Iowa State University

Courses and Programs Catalog 2017 - 2018

The Iowa State University Catalog

The Iowa State University Catalog is a one-year publication which lists all academic policies, and procedures.

The catalog also includes the following: information for fees; curriculum requirements; first-year courses of study for over 100 undergraduate majors; course descriptions for nearly 5000 undergraduate and graduate courses; and a listing of faculty members at Iowa State University.

New courses developed and offered since catalog publication can be found on the Web at http://www.registrar.iastate.edu/faculty-staff/courses/explistings.

Every effort has been made to make the catalog accurate as of the date of publication. However, all policies, procedures, fees, and charges are subject to change at any time by appropriate action of the faculty, the university administration, or the Board of Regents, State of Iowa.

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Accounting (ACCT)

Courses primarily for undergraduates:

ACCT 215: Legal Environment of Business
(3-0) Cr. 3. F.S.SS.
Prereq: Sophomore classification
General history, structure, and principles of the US legal system. The legal system, as an agency of social control and tool for resolving disputes. The court systems, Constitution, torts, crimes, intellectual property, contracts, property rights, employment law, basic business entity law, bankruptcy, administrative agencies, environmental law and agency law.

ACCT 284: Financial Accounting
(3-0) Cr. 3. F.S.SS.
Prereq: not open to first term freshmen
Introduction to the basic concepts and procedures of financial accounting from a user perspective. The course examines the accounting cycle, business terminology, basic control procedures, and the preparation and evaluation of financial reports, with an emphasis on financial statement analysis.

ACCT 285: Managerial Accounting
(3-0) Cr. 3. F.S.SS.
Prereq: ACCT 284
Understanding of fixed and variable costs and their role in planning, control and performance evaluation. Examination of alternative costing methods. Making decisions by identifying and developing relevant information. Development of spreadsheet skills.

ACCT 301: The Accounting Cycle
(1-0) Cr. 1. F.S.SS.
Prereq: ACCT 284
Interactive computer-based analysis of the accounting cycle including transactions and financial statements. Preparation of journal entries and adjusting entries and completion of the closing process.

ACCT 316: Business Law
(3-0) Cr. 3. F.S.
Prereq: ACCT 215
Continuation of 215. The Uniform Commercial Code as applied to sales contracts and negotiable instruments. Property law, wills and estates, insurance, secured transactions, corporation law, partnership law and antitrust law.

ACCT 383: Intermediate Managerial Accounting
(3-0) Cr. 3. F.S.
Prereq: ACCT 285 or ACCT 501; and ACCT 301
Generation, communication and use of information to assist management with planning, control, and decision making in manufacturing and service organizations. Includes cost concepts and relevance to decision situations, operational and capital budgeting, and performance evaluation. Emphasis on developing effective teamwork skills as well as spreadsheet capabilities.

ACCT 384: Accounting Information Systems
(3-0) Cr. 3.
Prereq: ACCT 285 or ACCT 501; ACCT 301 and MIS 301
Analysis of concepts and procedures underlying the automated accumulation and processing of accounting data. EDP internal control and audit techniques. Trends in accounting information systems.

ACCT 386: Intermediate Accounting I
(3-0) Cr. 3. F.S.
Prereq: ACCT 285 or ACCT 501 and ACCT 301
The conceptual framework of financial accounting. Communication of financial information on the income and retained earnings statements, statement of cash flows, and the balance sheet. Accounting concepts relating to current and operational assets of the firm.

ACCT 387: Intermediate Accounting II
(3-0) Cr. 3. F.S.
Prereq: ACCT 386
Financial accounting and reporting practices for business entities. Generally accepted accounting principles (GAAP) relative to firm liabilities, equity, income, taxes, employee benefits, leases, accounting changes and cash flows. Discussion of current issues in financial accounting. Focus on written communication.

ACCT 483: Advanced Managerial Accounting
(Dual-listed with ACCT 583). Cr. 3.
Prereq: ACCT 383 or ACCT 581
Business simulation focusing on generation and communication of information to assist management with financial decision-making. Emphasis on developing teamwork, written communication, and oral presentation skills.

ACCT 484: Advanced Accounting Information Systems
(Dual-listed with ACCT 584). (3-0) Cr. 3.
Prereq: ACCT 384
Advanced accounting information systems concepts; database design and information retrieval, internal controls within computerized accounting information systems, financial reporting in an electronic environment.

ACCT 485: Principles of Federal Income Tax
(3-0) Cr. 3. F.S.
Prereq: ACCT 386 or ACCT 501
Introduction to the fundamentals of federal income taxation and concepts applicable to all tax entities. Addresses issues related to the measurement and recognition of income, deductions, gains, and losses, taxation of property transactions, and basis / cost recovery concepts. Includes coverage of tax law policy objectives, tax implications of business and investment decisions, tax versus financial reporting treatment of common business transactions, and ethical issues related to tax compliance and planning.

ACCT 487: Volunteer Income Tax Assistance
(Dual-listed with ACCT 587). (0-2) Cr. 1. Repeatable, maximum of 3 credits. S.
Prereq: ACCT 285 or ACCT 501
Introduction to and field work in the preparation of individual income tax returns (state and federal). Basic coverage of filing and residency status, taxable income, exemptions, deductions, and credits. Tax software usage and online filing.

ACCT 488: Governmental and Non-profit Institution Accounting
(Dual-listed with ACCT 588). (3-0) Cr. 3.
Prereq: ACCT 387
Accounting and financial reporting principles of local and state governments, including universities, schools, and hospitals. In addition, accounting and financial reporting of non-profit organizations will be addressed. Financial statements of local governmental units and the university are explored.

ACCT 490: Independent Study
Cr. 1-3. Repeatable. F.S.SS.
Prereq: ACCT 285, senior classification, permission of instructor

ACCT 495: Advanced Accounting Problems
(Dual-listed with ACCT 595). (3-0) Cr. 3.
Prereq: ACCT 387
Accounting for business combinations and affiliated companies, intercompany transactions, and consolidated financial statements; Partnership accounting; Segment and Interim Reporting; Multinational accounting.

ACCT 496: International Accounting
(Dual-listed with ACCT 596). (3-0) Cr. 3.
Prereq: ACCT 386 or ACCT 501
Financial reporting issues in a global environment, including introduction to International Financial Reporting Standards (IFRS) and the potential for the use of IFRS in the U.S. Accounting and managerial issues faced by multinational corporations. Technical issues such as transfer pricing, inflation accounting and taxation will be discussed.

ACCT 497: Introduction to Auditing
(3-0) Cr. 3. F.S.
Prereq: ACCT 384, ACCT 387 and STAT 326
The conceptual framework of auditing. Professional ethics. External reporting concepts. Audit methodology including risk analysis, internal control, procedures for gathering evidence and the role of statistical sampling in auditing.

ACCT 498: Capstone in Accounting
(2-0) Cr. 2. F.
Prereq: ACCT 383, ACCT 384, ACCT 387, and ACCT 485.
Integrative studies in accounting. Development of critical thinking, ethical reasoning, professional research and teamwork skills. Written, visual, and oral communication with corporate stakeholders.

Courses primarily for graduate students, open to qualified undergraduates:

ACCT 501: Financial Accounting
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission
A general introduction to financial accounting information. Topics covered include the use and analysis of financial information, the regulatory environment, the role of International Financial Reporting Standards (IFRS), and the use of the internet and electronic spreadsheets as a means of accessing and analyzing financial data.

ACCT 581: Accounting for Decision Making
(3-0) Cr. 3.
Prereq: ACCT 501 or equivalent
Decision analysis applied to managerial accounting issues. Generation of information for management decision making and control. Responsibility accounting and non-recurring decisions.

ACCT 582: Corporate Governance and Top Management
(Cross-listed with MGMT). (3-0) Cr. 3.
Prereq: MGMT 503 or permission
Duties, structure, and functioning of top management teams and corporate boards of directors. CEO/board tenure and succession planning, top management compensation, board committee composition, assessment of CEO and board performance, theories of corporate governance, management of the corporate strategic agenda, governance codes, international governance, and chairman/CEO duality. Case studies and contemporary issues discussed.

ACCT 583: Advanced Managerial Accounting
(Dual-listed with ACCT 483). Cr. 3.
Prereq: ACCT 383 or ACCT 581
Business simulation focusing on generation and communication of information to assist management with financial decision-making. Emphasis on developing teamwork, written communication, and oral presentation skills.

ACCT 584: Advanced Accounting Information Systems
(Dual-listed with ACCT 484). (3-0) Cr. 3.
Prereq: ACCT 384
Advanced accounting information systems concepts; database design and information retrieval, internal controls within computerized accounting information systems, financial reporting in an electronic environment.

ACCT 585: Taxes and Business Strategy
(3-0) Cr. 3.
Prereq: ACCT 485
Integration of concepts from accounting, finance, and economics to determine how taxes affect business decisions. Provides students with a conceptual framework for thinking about business tax planning and applies it to various common business decisions.

ACCT 586: Advanced Federal Taxation
(3-0) Cr. 3.
Prereq: ACCT 485
Advanced coverage of federal taxation including issues related to the taxation of corporations, partnerships, estates and trusts, and their owners. Includes coverage of rules, concepts, background, and planning opportunities related to a number of common transactions involving these entities.

ACCT 587: Volunteer Income Tax Assistance
(Dual-listed with ACCT 487). (0-2) Cr. 1. Repeatable, maximum of 3 credits. S.
Prereq: ACCT 285 or ACCT 501
Introduction to and field work in the preparation of individual income tax returns (state and federal). Basic coverage of filing and residency status, taxable income, exemptions, deductions, and credits. Tax software usage and online filing.

ACCT 588: Governmental and Non-profit Institution Accounting
(Dual-listed with ACCT 488). (3-0) Cr. 3.
Prereq: ACCT 387
Accounting and financial reporting principles of local and state governments, including universities, schools, and hospitals. In addition, accounting and financial reporting of non-profit organizations will be addressed. Financial statements of local governmental units and the university are explored.

ACCT 589: Corporate Social Responsibility Reporting
(3-0) Cr. 3. S.
Prereq: ACCT 386 or ACCT 501
Theory and practice of social and environmental reporting, the role of the corporation in society, and the mechanisms by which society might hold corporations accountable for their actions.

ACCT 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
For students wishing to do individual research in a particular area of accounting.

ACCT 591: Fraud Examination and Prevention
(3-0) Cr. 3.
Prereq: ACCT 497 or ACCT 501
Principles and methodology of fraud detection and deterrence. Addresses the causes and elements of fraud, asset theft, corruption, financial statement mis-representation, internal controls for fraud prevention, investigative evidence gathering, and legal aspects of fraud.

ACCT 592: Financial Statement Analysis
(3-0) Cr. 3.
Prereq: ACCT 284 or ACCT 501
Presentation and analysis of financial statement information from the point of view of the primary users of such data: owners and creditors. Topics include the financial reporting system, the primary financial statements, effects of accounting method choice on reported financial data, and firm valuation.

ACCT 594: Business Valuation
(3-0) Cr. 3.
Prereq: ACCT 387 or ACCT 592
Using financial statement analysis to value the firm. Topics covered include assessing how well a firm's financial statements reflect the economic effects of its resource management strategies and constructing proforma financial information that will serve as inputs to valuation models.

ACCT 595: Advanced Accounting Problems
(Dual-listed with ACCT 495). (3-0) Cr. 3.
Prereq: ACCT 387
Accounting for business combinations and affiliated companies, intercompany transactions, and consolidated financial statements; Partnership accounting; Segment and Interim Reporting; Multinational accounting.

ACCT 596: International Accounting
(Dual-listed with ACCT 496). (3-0) Cr. 3.
Prereq: ACCT 386 or ACCT 501
Financial reporting issues in a global environment, including introduction to International Financial Reporting Standards (IFRS) and the potential for the use of IFRS in the U.S. Accounting and managerial issues faced by multinational corporations. Technical issues such as transfer pricing, inflation accounting and taxation will be discussed.

ACCT 597: Advanced Auditing and Assurance Services
(3-0) Cr. 3.
Prereq: ACCT 497
A study of advanced auditing and assurance issues. Topics include risk analysis, internal control, fraud detection, analytical procedures, evaluating operational and strategic objectives, and reporting and implementing audit findings.

ACCT 598: Financial Accounting: Theory and Contemporary Issues
(3-0) Cr. 3. F.
Prereq: ACCT 386 or ACCT 501
Theoretical discussion of the financial accounting and reporting environment. The usefulness of financial accounting information for decision making. Current financial accounting issues, the financial accounting standard setting process, FASB Standards Codification, and the role of the SEC in financial reporting.

ACCT 599: Creative Component
Cr. 2.
Prereq: Admission to the Master of Accounting Program
This course prepares students to complete their creative component project option in the Master of Accounting degree.

Advertising (ADVRT)

Courses primarily for undergraduates:

ADVRT 230: Advertising Principles
(3-0) Cr. 3.
Historical, social, economic and legal aspects of advertising. Evaluations of advertising research, media, strategy and appeals. Study of the creation of advertising.

ADVRT 301: Research and Strategic Planning for Advertising and Public Relations
(Cross-listed with P R). (3-0) Cr. 3.
Prereq: ADVRT 230 or P R 220
The use of primary and secondary research for situations, organizations and the public. Formation and development of strategic plans for public relations and advertising students.

ADVRT 334: Advertising Creativity
(2-2) Cr. 3.
Prereq: JL MC 110; Minimum of C+ in JL MC 201; ADVRT 301/P R 301
Development and execution of creative advertising materials. Copywriting, art direction and computer applications. Creative strategy development, execution and evaluation.

ADVRT 335: Advertising Media Planning
(3-0) Cr. 3.
Prereq: ADVRT/P R 301
Concepts of media planning and selection in the development, execution and evaluation of advertising campaigns. Characteristics and capabilities of the advertising media. Utilization of market segmentation, consumer buying and media audience databases.

ADVRT 336: Advertising Account Management
(3-0) Cr. 3.
Prereq: JL MC 110; Minimum of C+ in JL MC 201; ADVRT/P R 301
Fundamentals of account management with emphasis on leadership, sales techniques, relationship building, presentation skills, and strategic thinking. Includes aspects of agency communications, team building, client management, evaluating creative concepts and media plans, and developing strategic proposals and campaign recommendations.

ADVRT 390: Professional Skills Development
(Cross-listed with JL MC, P R). Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Minimum of C+ in JL MC 201; other vary by topic. Instructor permission for non-majors.
Check with Greenlee School for course availability.

ADVRT 434: Advertising Campaigns
(3-0) Cr. 3. F.S.
Prereq: Minimum of C+ in ADVRT 334 or ADVRT 336, and major status
Development of advertising campaigns for business and social institutions. Projects involve budgeting, media selection, market analysis, campaign strategy and creative execution.

ADVRT 435: Advertising Competition
Cr. 1-3. Repeatable, maximum of 3 credits. Alt. S., offered irregularly.
Prereq: Permission of instructor, Junior/senior standing strongly recommended
Preparation of materials for regional and national competitions.

ADVRT 436: Advertising Portfolio Practicum
(2-2) Cr. 3. S.
Prereq: Minimum of C+ in ADVRT 334, non-majors with instructor permission
Advanced advertising writing and design. Emphasis on creative strategy, problem solving and execution of creative materials in print, broadcast and online media for a variety of clients.

ADVRT 497: Special Topics in Communication
(Cross-listed with JL MC, P R). Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: Junior classification. See Schedule of Classes for possible pre-requisites.
Seminars or one-time classes on topics of relevance to students in communication.

ADVRT 499: Professional Media Internship
Cr. 1-3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, junior classification, formal faculty adviser approval.
Required of all Greenlee School majors. A 400-hour (for 3 credits) internship in the student's journalism and mass communication or advertising or public relations specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

ADVRT 499A: Professional Media Internship: Required
Cr. 3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, junior classification, formal faculty adviser approval.
Initial, required internship. A 400-hour (for 3 credits) internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

ADVRT 499B: Professional Media Internship: Optional
Cr. 1-3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, junior classification, formal faculty adviser approval.
Optional internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

Aerospace Engineering (AER E)

Courses primarily for undergraduates:

AER E 160: Aerospace Engineering Problems With Computer Applications Laboratory
(2-2) Cr. 3. F.S.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Solving aerospace engineering problems and presenting solutions through technical reports. Significant figures and estimation. SI units. Graphing and curve fitting. Introduction to aerospace engineering and engineering design. Spreadsheet programs. History of aerospace. Systems thinking. Team projects.

AER E 160H: Aerospace Engineering Problems With Computer Applications Laboratory: Honors
(2-2) Cr. 3. F.S.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Solving aerospace engineering problems and presenting solutions through technical reports. Significant figures. SI units and estimation. Graphing and curve fitting. Introduction to aerospace engineering and engineering design. Spreadsheet programs. History of aerospace. Systems thinking. Team projects.

AER E 161: Numerical, Graphical and Laboratory Techniques for Aerospace Engineering
(2-2) Cr. 3. F.S.
Prereq: AER E 160 or equivalent course
Computer-based problem solving using Matlab(R), with emphasis on numerical methods. Introduction to solid modeling and aerospace design using SolidWorks.

AER E 161H: Numerical, Graphical and Laboratory Techniques for Aerospace Engineering: Honors
(2-2) Cr. 3. F.S.
Prereq: AER E 160 or equivalent course
Computer-based problem solving using Matlab(R), with emphasis on numerical methods. Introduction to solid modeling and aerospace design using SolidWorks.

AER E 192: Aerospace Seminar
Cr. R. S.
Vectors, differentiation, integration, matrices, and systems of linear equations.

AER E 192H: Aerospace Seminar: Honors.
Cr. R. S.
Vectors, differentiation, integration, matrices, and systems of linear equations.

AER E 261: Introduction to Performance and Design
(3-0) Cr. 3. F.S.
Prereq: AER E 161, MATH 166, PHYS 221
Aerodynamics of the airplane, lift and drag, drag polar, propulsion characteristics of turbojets and piston props, level flight, range, endurance, climbing flight, turning flight, take-off and landing, design examples.

AER E 265: Scientific Balloon Engineering and Operations
(Cross-listed with MTEOR). (0-2) Cr. 1. Repeatable. F.
Engineering aspects of scientific balloon flights. Integration of science mission objectives with engineering requirements. Operations team certification. FAA and FCC regulations, communications, and command systems. Flight path prediction and control.

AER E 290: Aerospace Engineering Independent Study: Independent Study
Cr. 1-2. Repeatable.
Prereq: Sophomore classification, approval of the department

AER E 290A: Aerospace Engineering Independent Study: Flight ground instruction
Cr. 1-2. Repeatable.
Prereq: Sophomore classification, approval of the department

AER E 290B: Aerospace Engineering Independent Study: In-flight training
Cr. 1-2. Repeatable.
Prereq: AER E 301

AER E 290C: Aerospace Engineering Independent Study: Other
Cr. 1-2. Repeatable.
Prereq: AER E 301

AER E 301: Flight Experience
Cr. R. F.S.
Prereq: Credit or enrollment in AER E 355
Two hours of in-flight training and necessary ground instruction. Course content prescribed by the Aerospace Engineering Department. Ten hours of flight training certified in a pilot log book can be considered by the course instructor as evidence of satisfactory performance in the course. Offered on a satisfactory-fail basis only.

AER E 310: Aerodynamics I: Incompressible Flow
(3-0) Cr. 3. F.S.
Prereq: Grade of C- or better in AER E 261 and MATH 265
Introduction to fluid mechanics and aerodynamics. Fluid properties and kinematics. Conservation equations in differential and integral form. Bernoulli's equation. Basic potential flow concepts and solutions. Boundary layer concept. Incompressible flow over airfoils and wings. Examples of numerical methods. Applications of multi-variable calculus to fluid mechanics and aerodynamics.

AER E 311: Aerodynamics II: Compressible Flow
(3-0) Cr. 3. F.S.
Prereq: AER E 310, M E 231
Review of thermodynamics, energy equation, compressible flow, and isentropic flow. Normal and oblique shocks. Mach waves and expansion fans. Applications to ducts and nozzles. Compressible airfoil and wing theory. Introduction to advanced compressible flow topics.

AER E 321: Flight Structures Analysis
(3-0) Cr. 3. F.S.
Prereq: E M 324, Credit or enrollment in MATH 266 or 267
Introduction to elasticity, airworthiness, and flight loads. Introduction to fatigue. Materials selection for flight applications. Thin walled cross-sections under bending, torsion, and shear loads using classical methods. Shear center. Column buckling. Matrix methods of structural analysis.

AER E 322: Aerospace Structures Laboratory
(1-2) Cr. 2. F.S.
Prereq: Credit or enrollment in AER E 321
Design of experiments. Data analysis. Strain gage installation. Measurement of stiffness/strength of aluminum. Analysis/fabrication/testing of riveted joints. Shear/bending measurements inbeam sections. Analysis/measurement of strains in frames. Buckling of columns. Stress concentration. Vibration testing of beams and plates. Fabrication/testing of composites.

AER E 331: Flight Control Systems I
(3-0) Cr. 3. F.S.
Prereq: AER E 355
Linear system analysis. Control system designs using root-locus and frequency response methods. Applications in flight control systems.

AER E 344: Aerodynamics and Propulsion Laboratory
(2-2) Cr. 3. F.S.
Prereq: AER E 310; Coreq: AER E 311
Similitude and dimensional analysis. Measurement uncertainty analysis. Pressure and velocity measurement methods and instruments. Pressure distribution around a circular cylinder. Aerodynamic performance of low-speed airfoils. Airfoil wake flow; Boundary layer flow. Flow visualization techniques for supersonic flows and de Laval nozzles.

AER E 351: Astrodynamics I
(3-0) Cr. 3. F.S.
Prereq: E M 345, AER E 261, Credit or enrollment in AER E 310
Introduction to astrodynamics. Two-body motion. Geocentric, lunar and interplanetary trajectories and applications. Launch and atmospheric re-entry trajectories.

AER E 355: Aircraft Flight Dynamics and Control
(3-0) Cr. 3. F.S.
Prereq: AER E 261, MATH 267, E M 345
Aircraft rigid body equations of motion, linearization, and modal analysis. Longitudinal and lateral-directional static and dynamic stability analysis. Flight handling characteristics analysis. Longitudinal and lateral-directional open loop response to aircraft control inputs. Aircraft flight handling qualities.

AER E 361: Computational Techniques for Aerospace Design
(2-2) Cr. 3. F.S.
Prereq: AER E 310, MATH 267, E M 324, E M 345
Advanced programming, workstation environment, and development of computational tools for aerospace analysis and design. Technical report writing.

AER E 362: Aerospace Systems Integration
(3-0) Cr. 3. F.S.
Prereq: Junior standing in Aerospace Engineering or permission of instructor
Emphasis on impact of component interfaces in aerospace systems. Understand how changes in variables associated with individual components impact the performance of the aerospace system. Specific integration challenges include: capturing implicit disciplinary interactions (e.g. structures/aerodynamics, propulsion/aerodynamics, etc.), propagating tolerances through the system (i.e. uncertainty modeling), balancing component attributes in the system objective.

AER E 381: Introduction to Wind Energy
(3-0) Cr. 3. S.
Prereq: MATH 166, PHYS 221
Basic introduction to the fundamentals of Wind Energy and Wind Energy conversion systems. Topics include but not limited to various types of wind energy conversion systems and the aerodynamics, blade and tower structural loads, kinematics of the blades and meteorology.

AER E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

AER E 398: Cooperative Education
Cr. R. Repeatable. F.S.
Prereq: AER E 298, permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

AER E 411: Aerospace Vehicle Propulsion I
(3-0) Cr. 3. F.S.
Prereq: AER E 311, Aer E 344
Atmospheric propulsion system performance and cycle analysis. Momentum theorem, thrust and propulsive efficiency. Thermodynamics of compressible flow with heat and work addition. Components and principles of turbojets and turbofans. Rocket engines and ramjet principles.

AER E 412: Aerospace Vehicle Propulsion II
(3-0) Cr. 3. S.
Prereq: AER E 311
Electricity and magnetism. Plasma physics. Ion engine performance. Introduction to advanced electromagnetic propulsion systems. Energy sources and nuclear propulsion. Space mission requirements.

AER E 417: Experimental Mechanics
(Dual-listed with AER E 517). (Cross-listed with E M). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324; MAT E 273
Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments.

AER E 421: Advanced Flight Structures
(2-2) Cr. 3. F.S.
Prereq: AER E 321, MATH 266 or MATH 267
Analysis of indeterminate flight structures including finite element laboratory. Static analysis of complex structural components subject to thermal and aerodynamic loads. Analytical and finite element solutions for stresses and displacements of membrane, plane stress, plate structures. Buckling of beams, frames, and plate structures. Introduction to vibration of flight structures. Steady state and transient structural response using normal modal analysis.

AER E 422: Vibrations and Aeroelasticity
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E M 324 or AER E 321
Vibration theory. Steady and unsteady flows. Mathematical foundations of aeroelasticity, static and dynamic aeroelasticity. Linear unsteady aerodynamics, non-steady aerodynamics of lifting surfaces. Stall flutter. Aeroelastic problems in civil engineering structures. Aeroelastic problems of rotorcraft. Experimental aeroelasticity. Selected wind tunnel laboratory experiments.

AER E 423: Composite Flight Structures
(2-2) Cr. 3. S.
Prereq: E M 324; MAT E 273
Fabrication, testing and analysis of composite materials used in flight structures. Basic laminate theory of beams, plates and shells. Manufacturing and machining considerations of various types of composites. Testing of composites for material properties, strength and defects. Student projects required.

AER E 426: Design of Aerospace Structures
(2-2) Cr. 3. F.
Prereq: E M 324
Detailed design and analysis of aerospace vehicle structures. Material selection, strength, durability and damage tolerance, and validation analysis. Design for manufacturability.

AER E 432: Flight Control Systems II
(3-0) Cr. 3. F.
Prereq: AER E 331
Aircraft lateral directional stability augmentation. Launch vehicle pitch control system design. Control of flexible vehicles. Satellite attitude control. Flight control designs based on state-space methods. Introduction to sample-data systems.

AER E 433: Spacecraft Dynamics and Control
(3-0) Cr. 3. F.
Prereq: EM 345
Three-dimensional rotational kinematics and attitude dynamics of a rigid body in space. Stability analysis of a spinning spacecraft with or without energy dissipation. Attitude dynamics and stability of a satellite in circular orbit. Introduction to spacecraft attitude determination and control systems (ADCS). Simulation of spacecraft attitude-dynamics and control problems of practical interest using MATLAB.

AER E 442: V/STOL Aerodynamics and Performance
(3-0) Cr. 3. F.
Prereq: AER E 261
Introduction to the aerodynamics, performance, stability, control and critical maneuvering characteristics of V/STOL vehicles. Topics include hovercrafts, jet flaps, ducted fans and thrust vectored engines.

AER E 446: Computational Fluid Dynamics
(3-0) Cr. 3. F.
Prereq: AER E 311, AER E 361
Introduction to computational fluid dynamics. Discretization, consistency, and stability. Explicit and implicit methods for ordinary and partial differential equations. Linearization techniques. Iterative and direct solution algorithms. Numerical methods for parabolic, elliptic and hyperbolic equations. Curvilinear coordinates and numerical grid generation. Applications to Euler, boundary-layer and Navier-Stokes equations.

AER E 448: Fluid Dynamics of Turbomachinery
(Cross-listed with M E). (3-0) Cr. 3. S.
Prereq: AER E 311 or M E 335
Applications of principles of fluid mechanics and thermodynamics in performance analysis and design of turbomachines. Conceptual and preliminary design of axial and radial flow compressors and turbines using velocity triangles and through-flow approaches.

AER E 451: Astrodynamics II
(3-0) Cr. 3. F.S.
Prereq: AER E 351
Orbit determination and prediction using Gibb's and Gauss' methods. Advanced orbit maneuvers, triple-, and fixed-impulse; universal variables; Kepler's problem. Earth gravity field models and gravity harmonics, orbit perturbations, advanced dynamics, variational methods, relative orbital mechanics, and Clohessy-Wiltshire equations.

AER E 461: Modern Design Methodology with Aerospace Applications
(2-2) Cr. 3. F.S.
Prereq: AER E 361, AER E 311, AER E 321, AER E 351, AER E 355
Introduction to modern engineering design methodology. Computational constrained optimal design approach including selection of objective function, characterization of constraint system, materials and strength considerations, and sensitivity analyses.

AER E 462: Design of Aerospace Systems
(1-4) Cr. 3. F.S.
Prereq: AER E 461
Fundamental principles used in engineering design of aircraft, missile, and space systems. Preliminary design of aerospace vehicles. Engineering Ethics.

AER E 463: Introduction to Multidisciplinary Design Optimization
(Dual-listed with AER E 563). (3-0) Cr. 3. F.
Prereq: senior standing in College of Engineering or permission of instructor
Introduction to the theory and methods of Multidisciplinary Design Optimization (MDO), including system coupling, system sensitivity methods, decomposition methods, MDO formulations (such as multi-discipline feasible (MDF), individual discipline feasible (IDF) and all-at-once (AAO) approaches, and MDO search methods.

AER E 464: Spacecraft Systems
(3-0) Cr. 3. S.
Prereq: AER E 351
An examination of spacecraft systems including attitude determination and control, power, thermal control, communications, propulsion, guidance, navigation, command and data handling, and mechanisms. Explanation of space and operational environments as they impact spacecraft design. Includes discussion of safety, reliability, quality, maintainability, testing, cost, legal, and logistics issues.

AER E 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, B M E, CPR E, E E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

AER E 467: Multidisciplinary Engineering Design II
(Cross-listed with CPR E, E E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: Student must be within two semesters of graduation or receive permission of instructor.
Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

AER E 468: Large-Scale Complex Engineered Systems (LSCES)
(Dual-listed with AER E 568). (Cross-listed with I E). (3-0) Cr. 3. S.
Prereq: senior standing in College of Engineering or permission of AerE 468 instructor
Introduction to the theoretical foundation and methods associated with the design for large-scale complex engineered systems, including objective function formation, design reliability, value-driven design, product robustness, utility theory, economic factors for the formation of a value function and complexity science as a means of detecting unintended consequences in the product behavior.

AER E 480: Ultrasonic Nondestructive Evaluation
(Cross-listed with E M). (3-0) Cr. 3. S.
Prereq: E M 324, MATH 266 or MATH 267, PHYS 222
Introduction to stress/strain, Hooke's law, and elastic wave propagation in two dimensions in isotropic media. Ultrasonic plane-wave reflection and transmission; and simple straight-crested guided waves. Transducer construction, behavior, and performance. Simple signal analysis and discrete signal processing. The last few weeks of the course are devoted to case studies.

AER E 481: Advanced Wind Energy: Technology and Design
(3-0) Cr. 3. S.
Prereq: AER E 381 or senior classification in engineering or junior in engineering with a course in fluid mechanics
Advanced topics in wind energy, emphasis on current practices. Theoretical foundations for horizontal and vertical axis wind turbine. Design codes for energy conversion systems design, aerodynamic and structural load estimation, wind resource characterization wind farm design, optimization.

AER E 490: Aerospace Engineering Independent Study
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490A: Aerospace Engineering Independent Study: Aero and/or Gas Dynamics
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490B: Aerospace Engineering Independent Study: Propulsion
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490C: Aerospace Engineering Independent Study: Aerospace Structures
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490D: Aerospace Engineering Independent Study: Flight Dynamics
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490E: Aerospace Engineering Independent Study: Spacecraft Systems
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490F: Aerospace Engineering Independent Study: Flight Control Systems
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490G: Aerospace Engineering Independent Study: Aeroelasticity
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490H: Aerospace Engineering Independent Study: Independent Study, Honors
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490I: Aerospace Engineering Independent Study: Design
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490J: Aerospace Engineering Independent Study: Non-destructive Evaluation
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490K: Aerospace Engineering Independent Study: Wind Engineering
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490L: Aerospace Engineering Independent Study: Multi-functional Ultra-light Structures
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490O: Aerospace Engineering Independent Study: Other
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 499: Senior Project
Cr. 1-2. Repeatable. F.S.
Prereq: Senior classification, credit or enrollment in AER E 491
Development of aerospace principles and concepts through individual research and projects. Written report.

Courses primarily for graduate students, open to qualified undergraduates:

AER E 514: Advanced Mechanics of Materials
(Cross-listed with E M). (3-0) Cr. 3. F.
Prereq: E M 324
Theory of stress and strain, stress-strain relationships. Unsymmetrical bending, curved beams, shear center. Torsion of thin-walled noncircular sections. Equilibrium, compatibility equations. Airy stress functions. Membrane stresses in shells, thick-walled cylinders.

AER E 517: Experimental Mechanics
(Dual-listed with AER E 417). (Cross-listed with E M). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324; MAT E 273
Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments.

AER E 521: Airframe Analysis
(3-0) Cr. 3. F.
Prereq: AER E 421 or E M 424
Analysis of static stresses and deformation in continuous aircraft structures. Various analytical and approximate methods of analysis of isotropic and anisotropic plates and shells.

AER E 522: Design and Analysis of Composite Materials
(3-0) Cr. 3. F.
Prereq: E M 324
Composite constituent materials, micro-mechanics, laminate analysis, hygro-thermal analysis, composite failure, joining of composites, design of composite beams and plates, honeycomb core, manufacturing of composites, short fiber composites, and demonstration laboratory.

AER E 524: Numerical Mesh Generation
(3-0) Cr. 3. F.
Prereq: MATH 385, proficiency in programming
Introduction to modern mesh generation techniques. Structured and unstructured mesh methods, algebraic and PDE methods, elliptic and hyperbolic methods, variational methods, error analysis, Delaunay triangulation, data structures, geometric modeling with B-spline and NURBS surfaces, surface meshing.

AER E 525: Finite Element Analysis
(Cross-listed with E M). (3-0) Cr. 3. S.
Prereq: E M 425, MATH 385
Variational and weighted residual approach to finite element equations. Emphasis on two- and three-dimensional problems in solid mechanics. Isoparametric element formulation, higher order elements, numerical integration, imposition of constraints and penalty, convergence, and other more advanced topics. Use of two- and three-dimensional computer programs. Dynamic and vibrational problems, eigenvalues, and time integration. Introduction to geometric and material nonlinearities.

AER E 531: Automatic Control of Flight Vehicles
(3-0) Cr. 3. S.
Prereq: AER E 331
Applications of classical and modern linear control theory to automatic control of flight vehicles. Spacecraft attitude control. Control of flexible vehicles. Linear-quadratic regulator design applications.

AER E 532: Compressible Fluid Flow
(Cross-listed with M E). (3-0) Cr. 3. S.
Prereq: AER E 310, 311 or equivalent
Thermodynamics of compressible flow. Viscous and inviscid compressible flow equations. One dimensional steady flow; isentropic flow, shocks, expansions. Multidimensional compressible flow aspects. Linear and nonlinear wave analysis and method of characteristics. Subsonic, transonic, supersonic and hypersonic flows.

AER E 541: Incompressible Flow Aerodynamics
(3-0) Cr. 3. F.
Prereq: AER E 310 or M E 335 or equivalent
Kinematics and dynamics of fluid flow. Derivation of the Navier-Stokes, Euler and potential flow equations. Introduction to generalized curvilinear coordinates. Ideal fluids. Two-dimensional and three-dimensional potential flow. Complex variable methods.

AER E 545: Experimental Flow Mechanics and Heat Transfer
(3-0) Cr. 3. F.
Prereq: AER E 310 or M E 335 or E M 378
Similitude and dimensional analysis. Measurement uncertainty analysis; Fluid mechanical apparatus: wind tunnel and water tunnels. Various experimental techniques widely used for fluid mechanics, aerodynamics, heat transfer, and combustion studies: Pressure gauge and transducers; Pitot tube; hot wire anemometry; Shadowgraph and Schlieren Photography; laser Doppler velocimetry; particle image velocimetry (PIV); advanced PIV techniques (stereo PIV, 3-D PIV, Tomographic PIV, Holograph PIV and microscopic PIV); laser induced fluorescence; pressure sensitive painting, temperature sensitive painting; molecular tagging velocimetry; molecular tagging thermometry. Extensive applications and laboratory experiments will be included.

AER E 546: Computational Fluid Mechanics and Heat Transfer I
(Cross-listed with M E). (3-0) Cr. 3. F.
Prereq: AER E 310 or M E 335, and programming experience
Basic concepts of discretization, consistency, and stability. Explicit and implicit methods for ordinary differential equations. Methods for each type of partial differential equation. Iterative solution methods; curvilinear grids. Students will program basic algorithms.

AER E 547: Computational Fluid Mechanics and Heat Transfer II
(Cross-listed with M E). (3-0) Cr. 3. S.
Prereq: AER E 546 or equivalent
Application of computational methods to current problems in fluid mechanics and heat transfer. Methods for solving the Navier-Stokes and reduced equation sets such as the Euler, boundary layer, and parabolized forms of the conservation equations. Introduction to relevant aspects of grid generation and turbulence modeling.

AER E 551: Orbital Mechanics
(3-0) Cr. 3. F.
Prereq: AER E 351
Review of 2-body problem. Orbital maneuvers. Relative motion in orbit. Orbit perturbation analysis. Gravity field expansions and effects on orbiters. 3-body problem with applications.

AER E 556: Guidance and Navigation of Aerospace Vehicles
(3-0) Cr. 3. F.
Prereq: AER E 331
Principles of guidance systems for spacecraft, launch vehicles, homing and ballistic missiles. Optimal guidance. Interplanetary transfer guidance with low thrust. Principles of inertial navigation. Theory and applications of the Global Positioning System. Celestial navigation procedures. Application of Kalman filtering to recursive navigation theory.

AER E 563: Introduction to Multidisciplinary Design Optimization
(Dual-listed with AER E 463). (3-0) Cr. 3. F.
Prereq: senior standing in College of Engineering or permission of instructor
Introduction to the theory and methods of Multidisciplinary Design Optimization (MDO), including system coupling, system sensitivity methods, decomposition methods, MDO formulations (such as multi-discipline feasible (MDF), individual discipline feasible (IDF) and all-at-once (AAO) approaches, and MDO search methods.

AER E 564: Fracture and Fatigue
(Cross-listed with E M, M E, M S E). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324 and either MAT E 216 or MAT E 273 or MAT E 392. Undergraduates: Permission of instructor
Materials and mechanics approach to fracture and fatigue.
Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue.

AER E 565: Systems Engineering and Analysis
(Cross-listed with E E, I E). (3-0) Cr. 3.
Prereq: Coursework in basic statistics
Introduction to organized multidisciplinary approach to designing and developing systems. Concepts, principles, and practice of systems engineering as applied to large integrated systems. Life-cycle costing, scheduling, risk management, functional analysis, conceptual and detail design, test evaluation, and systems engineering planning and organization. Not available for degrees in industrial engineering

AER E 566: Avionics Systems Engineering
(Cross-listed with E E). (3-0) Cr. 3. S.
Prereq: E E 565
Avionics functions. Applications of systems engineering principles to avionics. Top-down design of avionics systems. Automated design tools.

AER E 568: Large-Scale Complex Engineered Systems (LSCES)
(Dual-listed with AER E 468). (Cross-listed with I E). (3-0) Cr. 3. S.
Prereq: senior standing in College of Engineering or permission of AerE 468 instructor
Introduction to the theoretical foundation and methods associated with the design for large-scale complex engineered systems, including objective function formation, design reliability, value-driven design, product robustness, utility theory, economic factors for the formation of a value function and complexity science as a means of detecting unintended consequences in the product behavior.

AER E 569: Mechanics of Composite and Combined Materials
(Cross-listed with E M, M S E). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E M 324
Mechanics of fiber-reinforced materials. Micromechanics of lamina. Macromechanical behavior of lamina and laminates. Strength and interlaminar stresses of laminates. Failure criteria. Stress analysis of laminates. Thermal moisture and residual stresses. Joints in composites.

AER E 570: Wind Engineering
(Cross-listed with E M). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: E M 378, E M 345
Atmospheric circulations, atmospheric boundary layer wind, bluff-body aerodynamics, aeroelastic phenomena, wind-tunnel and full-scale testing, wind-load code and standards, effect of tornado and thunderstorm winds, design applications.

AER E 572: Turbulence
(Cross-listed with CH E). (3-0) Cr. 3.
Prereq: AER E 541 or M E 538
Qualitative features of turbulence. Statistical representation of turbulent velocity fields: averages, moments, correlations, length and time scales and the energy cascade. Averaged equations of motion, closure requirements, Reynolds averaged models. Homogeneous shear flows, free shear flows, boundary layers. Numerical simulation of turbulence: DNS, LES, DES.

AER E 573: Random Signal Analysis and Kalman Filtering
(Cross-listed with E E, M E). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or M E 370 or M E 411 or MATH 341
Elementary notions of probability. Random processes. Autocorrelation and spectral functions. Estimation of spectrum from finite data. Response of linear systems to random inputs. Discrete and continuous Kalman filter theory and applications. Smoothing and prediction. Linearization of nonlinear dynamics.

AER E 574: Optimal Control
(Cross-listed with E E, M E). (3-0) Cr. 3. S.
Prereq: E E 577
The optimal control problem. Variational approach. Pontryagin's principle, Hamilton-Jacobi equation. Dynamic programming. Time-optimal, minimum fuel, minimum energy control systems. The regulator problem. Structures and properties of optimal controls.

AER E 575: Introduction to Robust Control
(Cross-listed with E E, M E). (3-0) Cr. 3.
Prereq: E E 577
Introduction to modern robust control. Model and signal uncertainty in control systems. Uncertainty description. Stability and performance robustness to uncertainty. Solutions to the H2, Hoo, and l1 control problems. Tools for robustness analysis and synthesis.

AER E 576: Digital Feedback Control Systems
(Cross-listed with E E, M E). (3-0) Cr. 3. F.
Prereq: E E 475 or AER E 432 or M E 411 or MATH 415; and MATH 267
Sampled data, discrete data, and the z-transform. Design of digital control systems using transform methods: root locus, frequency response and direct design methods. Design using state-space methods. Controllability, observability, pole placement, state estimators. Digital filters in control systems. Microcomputer implementation of digital filters. Finite wordlength effects. Linear quadratic optimal control in digital control systems. Simulation of digital control systems.

AER E 577: Linear Systems
(Cross-listed with E E, M E, MATH). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or MATH 415; and MATH 207
Linear algebra review. Least square method and singular value decomposition. State space modeling of linear continuous-time systems. Solution of linear systems. Controllability and observability. Canonical description of linear equations. Stability of linear systems. State feedback and pole placements. Observer design for linear systems.

AER E 578: Nonlinear Systems
(Cross-listed with E E, M E, MATH). (3-0) Cr. 3. S.
Prereq: E E 577
Linear vs nonlinear systems. Phase plane analysis. Bifurcation and center manifold theory. Lyapunov stability. Absolute stability of feedback systems. Input-output stability. Passivity theory and feedback linearization. Nonlinear control design techniques.

AER E 581: Perturbation Methods
(3-0) Cr. 3. F.
Prereq: MATH 267
Mathematical perturbation methods with applications to ordinary and partial differential equations. Perturbation expansions. Order of magnitude and gauge functions. Matched asymptotic expansions. Boundary layer problems. Multiple scales. Resonance and mode coupling. Solvability conditions for differential equations. Physical and engineering applications.

AER E 590: Aerospace Engineering Independent Study: Special Topics
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590A: Aerospace Engineering Independent Study: Aero and/or Gas Dynamics
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590B: Aerospace Engineering Independent Study: Propulsion
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590C: Aerospace Engineering Independent Study: Aerospace Structures
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590D: Aerospace Engineering Independent Study: Flight Dynamics
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590E: Aerospace Engineering Independent Study: Spacecraft Systems
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590F: Aerospace Engineering Independent Study: Flight Control Systems
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590G: Aerospace Engineering Independent Study: Aeroelasticity
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590H: Aerospace Engineering Independent Study: Viscous Aerodynamics
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590I: Aerospace Engineering Independent Study: Design
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590J: Aerospace Engineering Independent Study: Hypersonics
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590K: Aerospace Engineering Independent Study: Computational Aerodynamics
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590L: Aerospace Engineering Independent Study: Optimization
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590M: Aerospace Engineering Independent Study: Non Destructive Evaluation
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590N: Aerospace Engineering Independent Study: Wind Engineering
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 591: Graduate Student Seminar Series
Cr. R. Repeatable.
Presentation of professional topics by department graduate students. Development of presentation skills used in a professional conference setting involving question and answer format.

AER E 599: Creative Component
Cr. 1-5. Repeatable.

Courses for graduate students:

AER E 640: Stability of Fluid Flow
(3-0) Cr. 3.
Prereq: AerE 541
Theoretical methods of stability analysis; linear analysis of exchange of stability and over stability; bifurcation of equilibria; most dangerous modes and pattern formation; shear flow stability theorems. Physical mechanisms. Tollmein-Schlichting waves, disintegration of capillary jets, Benard convection, Taylor-Couette flow, centrifugal instability, double diffusion.

AER E 647: Advanced Computational Fluid Dynamics
(Cross-listed with M E). (3-0) Cr. 3. S.
Prereq: AER E 547
An examination of current methods in computational fluid dynamics. Differencing strategies. Advanced solution algorithms for unstructured meshes. Grid generation. Construction of higher-order CFD algorithms. Parallel computing. Current applications. Use of state of the art CFD codes.

AER E 690: Aerospace Engineering Independent Study: Advanced Topics
Cr. 1-5. Repeatable.

AER E 690A: Aerospace Engineering Independent Study: Aero and/or Gas Dynamics
Cr. 1-5. Repeatable.

AER E 690B: Aerospace Engineering Independent Study: Propulsion
Cr. 1-5. Repeatable.

AER E 690C: Aerospace Engineering Independent Study: Aerospace Structures
Cr. 1-5. Repeatable.

AER E 690D: Aerospace Engineering Independent Study: Flight Dynamics
Cr. 1-5. Repeatable.

AER E 690E: Aerospace Engineering Independent Study: Spacecraft Systems
Cr. 1-5. Repeatable.

AER E 690F: Aerospace Engineering Independent Study: Flight Control Systems
Cr. 1-5. Repeatable.

AER E 690G: Aerospace Engineering Independent Study: Aeroelasticity
Cr. 1-5. Repeatable.

AER E 690H: Aerospace Engineering Independent Study: Viscous Aerodynamics
Cr. 1-5. Repeatable.

AER E 690I: Aerospace Engineering Independent Study: Design
Cr. 1-5. Repeatable.

AER E 690J: Aerospace Engineering Independent Study: Hypersonics
Cr. 1-5. Repeatable.

AER E 690K: Aerospace Engineering Independent Study: Computational Aerodynamics
Cr. 1-5. Repeatable.

AER E 690L: Aerospace Engineering Independent Study: Non Destructive Evaluation
Cr. 1-5. Repeatable.

AER E 690M: Aerospace Engineering Independent Study: Wind Engineering
Cr. 1-5. Repeatable.

AER E 697: Engineering Internship
Cr. R. Repeatable.
Prereq: Permission of DOGE (Director of Graduate Education), graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

AER E 699: Research
Cr. arr. Repeatable.

African American Studies (AF AM)

Courses primarily for undergraduates:

AF AM 201: Introduction to African American Studies
(3-0) Cr. 3. F.S.
An interdisciplinary introduction to the study of African American culture. Includes history, the social sciences, literature, religion, and the arts, as well as conceptual frameworks for investigation and analysis of the African American experience.
Meets U.S. Diversity Requirement

AF AM 311: Africa under Colonial Rule
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: 3 credits of 200-level HIST at Iowa State, and sophomore classification.
Development of Africa from imposition of colonial rule to independence, including processes of European domination, African reaction and resistance, emergence of nationalism, and dismantling of colonialism.
Meets International Perspectives Requirement.

AF AM 325: Peoples and Cultures of Africa.
(Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: 201 or 306 recommended.
Survey of diverse African culture areas across the continent and globally; local level description and analysis of individuals as members of African communities; regional, national and global scales of identification.
Meets International Perspectives Requirement.

AF AM 330: Ethnic and Race Relations
(Cross-listed with SOC). (3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
Analysis of ethnic and race relations, particularly in America; emphasis on the sociology and psychology of race and ethnic relations.
Meets U.S. Diversity Requirement

AF AM 334: African American Religious Experience
(Cross-listed with RELIG). (3-0) Cr. 3. F.
Prereq: Prior course work in Religious Studies or African American Studies recommended
Examination of African-American experience from the perspective of black religion with attention to political, economic, social, theological and artistic expressions, including music, that serve the life of African-American communities.".
Meets U.S. Diversity Requirement

AF AM 347: Studies in African American Literature
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250
Literature by African Americans, which may include study of individual authors, movements, themes, genres.
Meets U.S. Diversity Requirement

AF AM 350: Women of Color in the U.S
(Cross-listed with W S). (3-0) Cr. 3. S.
Prereq: 3 credits in Womens' Studies or African American Studies
Economic, social, political and cultural roles of Women of Color in the U.S. Includes literary, philosophical, and artistic expressions. Myths and realities explored.
Meets U.S. Diversity Requirement

AF AM 353: History of African Americans I
(Cross-listed with HIST). (3-0) Cr. 3. S.
Prereq: Sophomore classification
Examines African roots of black culture and the African American experience in the United States from the colonial period through the Civil War. Topics include Atlantic Slave Trade, slavery and American identity, abolition, the emergence of Black Nationalism, and black participation in the Civil War.
Meets U.S. Diversity Requirement

AF AM 354: History of African Americans II
(Cross-listed with HIST). (3-0) Cr. 3. S.
Prereq: Sophomore classification
Explores African American political thought and political action from Reconstruction to the present. Topics include rise of Jim Crow segregation, urban migration, Garvey movement, Harlem Renaissance, Depression and world wars, Pan-Africanism, civil rights, Black Power, and black feminism.
Meets U.S. Diversity Requirement

AF AM 460: Seminar in African American Culture
(3-0) Cr. 3. S.
Intensive study of a selected topic in African-American Studies in one or more disciplines. Selected readings of various authors, movements, eras, or genres. Primary and secondary source materials.
Meets U.S. Diversity Requirement

AF AM 473: Civil Rights and Ethnic Power
(Cross-listed with HIST, US LS). (3-0) Cr. 3.
Prereq: Sophomore classification
Comparative history of the civil rights and ethnic power movements (African American, Chicano, American Indian, Puerto Rican, among others) in the U.S. from World War II to the present. Topics include institutional foundations, leadership, gender and racial dynamics, and the convergences and divergences of these differing ethnic struggles for rights.
Meets U.S. Diversity Requirement

AF AM 490: Independent Study
Cr. 1-3. Repeatable, maximum of 3 times.

Agricultural Education and Studies (AGEDS)

Courses primarily for undergraduates:

AGEDS 110: Orientation
(1-0) Cr. 1. F.S.
Orientation to the department. Careers in agriculture.

AGEDS 110A: Agriculture and Life Sciences Education (Fall only)
(1-0) Cr. 1. F.S.
Orientation to the department. Careers in agriculture.

AGEDS 110B: Agricultural Studies (Fall only)
(1-0) Cr. 1. F.S.
Orientation to the department. Careers in agriculture.

AGEDS 110C: Agricultural and Life Sciences exploration
(1-0) Cr. 1. F.S.
Orientation to the department. Careers in agriculture.

AGEDS 111: Dean s Leadership Seminar
(1-0) Cr. 1. F.
Prereq: Permission of the Associate Dean for Academic Programs, College of Agriculture and Life Sciences
Introduction to leadership in agriculture and the life sciences, problem solving applied to current case studies, global perspective required by leaders, and designing programs to respond to societal needs in the agricultural and life sciences.

AGEDS 112: Agriculture Biotechnology Colloquium
(1-0) Cr. 1. S.
Prereq: Enrollment as an agricultural excellence scholar
The scientific basis of biological and social sciences in agriculture.

AGEDS 113: Access to Success Seminar I
(1-0) Cr. 1. Repeatable. F.S.
Course provides career skills, learning strategies and social and academic integration techniques to student members of Step Forward Learning Community. Utilization of campus resources, encouragement of self-exploration, and development of academic skills. Offered on a satisfactory-fail basis only.

AGEDS 116: Initial Field Experience in Agricultural Education
(1-2) Cr. 1. F.
Prereq: AGEDS majors only.
Field experience in a formal education setting designed to explore teaching as a career through guided observation and interviews, reflection, and on-campus dialogue.

AGEDS 211: Early Field Based Experience
(1-0) Cr. 1. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: AGEDS 110
Forty hours on-site in an agricultural setting. Students will have an opportunity outside the classroom for career guidance, role modeling, and reflection on their observations that they can apply to their courses and other educational experiences.

AGEDS 211A: High School Agriculture Programs
(1-0) Cr. 1. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: AGEDS 110
Forty hours on-site in an agricultural setting. Students will have an opportunity outside the classroom for career guidance, role modeling, and reflection on their observations that they can apply to their courses and other educational experiences.

AGEDS 211C: Agricultural Industries and Agencies
(1-0) Cr. 1. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: AGEDS 110
Forty hours on-site in an agricultural setting. Students will have an opportunity outside the classroom for career guidance, role modeling, and reflection on their observations that they can apply to their courses and other educational experiences.

AGEDS 215: Career Seminar
(1-0) Cr. 1. F.S.
Prereq: Sophomore classification
Overview of career opportunities. Evaluation of interests and accomplishments and setting career goals. Development of job search and interviewing skills. Establishing networks of job contacts.

AGEDS 310: Foundations of Agricultural Education Programs
(3-0) Cr. 3. F.S.
Historical development of agricultural education programs. Philosophic premises, program goals and objectives. Educational and social issues impacting the implementation of agricultural education programs.

AGEDS 311: Presentation and Sales Strategies for Agricultural Audiences
(3-0) Cr. 3. F.S.
Utilizing instructional methods, techniques, and problem solving, presentation and sales strategies with agricultural audiences.

AGEDS 312: Science With Practice
(1-6) Cr. 3. Repeatable. F.S.
Prereq: College of Agriculture and Life Sciences majors only
A planned learning experience wherein each student and faculty mentor develops a learning agreement that encompasses specific activities and expectations. Students are engaged in reflective activities that include journals, micro-reflections, formal presentations, and a comprehensive portfolio.

AGEDS 315: Personal, Professional, and Entrepreneurial Leadership in Agriculture
(3-0) Cr. 3. F.S.
Leadership principles and strategies to influence and motivate team members to achieve personal, professional, and entrepreneurial goals in production agriculture, agricultural education, and agricultural organizations.

AGEDS 327: Advanced Communications for Agriculture and Life Sciences
(2-2) Cr. 3. F.S.
Prereq: ENGL 250 or equivalent.
Development of written, oral, visual and electronic communications relevant to agriculture and life sciences. Students develop skills and perspectives consistent ethical and democratic principles applicable to agriculture, natural resource, and life science issues. Provide explanations of scientific and technical concepts to rural, industry, and urban audiences. Field trips.

AGEDS 388: Agricultural Mechanics Applications
(2-3) Cr. 3. Repeatable, maximum of 2 times. F.S.SS.
Introduction to SMAW (Arc), GMAW (Mig), GTAW (Tig), Oxy-Fuel welding, Oxy-Fuel cutting, and Plasma cutting theories and applications. Emphasis will be on theoretical foundation of welding, safety, welding skill development, and management of equipment, and materials. Introduction to small engines and applications. Emphasis will be on theory of operating systems, maintenance, troubleshooting, failure analysis, and safety.

AGEDS 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

AGEDS 401: Planning Agriculture and Life Sciences Education Programs
(Dual-listed with AGEDS 501). (3-0) Cr. 3. F.
Prereq: AGEDS 310
Responsibilities of an agricultural education teacher, curriculum development, experiential learning opportunities including FFA and SAE, and assessment and maintenance of program quality.

AGEDS 402: Methods of Teaching in Agriculture and Life Sciences
(Dual-listed with AGEDS 502). (3-0) Cr. 3. F.
Prereq: Concurrent enrollment in AGEDS 401
Topics include: principles of teaching and learning, individualized and group methods, application of learning, instructional management, special populations, and evaluation.

AGEDS 412: Internship in Agricultural Education and Studies
Cr. 2-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior classification in AGEDS and permission of instructor
A supervised two to twelve week learning experience in an approved learning setting with application to educational, agricultural, communications and/or environmental practices and principles.

AGEDS 414: Developing Agricultural Education Programs in Non-Formal Settings
(2-0) Cr. 2. S.
Basic concepts in planning, conducting, and evaluating educational programs in non-formal settings. Includes programming for youth and adults in Extension, agricultural industry, and related agencies.

AGEDS 416: Pre-Student Teaching Experience in Agricultural Education
Cr. 1. F.S.
Prereq: AGEDS 211, AGEDS 402 and admission to teacher education program
A forty hour field-based experience in an approved secondary agricultural education program. Concurrent enrollment in 417 is required.

AGEDS 417: Supervised Teaching in Agriculture and Life Sciences
Cr. 1-16. Repeatable. F.S.
Prereq: AGEDS 211, AGEDS 402 and admission to teacher education program
Supervised teaching in public schools.

AGEDS 450: Farm Management and Operation
(2-4) Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Econ 235, Econ 230, junior classification
Participation in the management and operation of a diversified Iowa farm. The class is responsible for the plans, records, and decisions for buying and selling the farm's livestock, crops, and equipment. Special speakers on current topics. May be taken for credit 3 times at different times of the year with permission of the instructor.

AGEDS 451: Agricultural Law
(3-2) Cr. 4. S.
Prereq: Senior classification
The legal framework impinging upon decision-making by firms, families, and individuals, real and personal property, contracts, secured transactions, negotiable instruments, debtor-creditor relations, bankruptcy, farm income tax organization of firms, intergenerational property transfers, trusts and farm estate planning, civil and criminal liabilities, environmental law, federal and state regulatory powers.

AGEDS 461: Technology Transfer and the Role of Agricultural and Extension Education
(Dual-listed with AGEDS 561). (3-0) Cr. 3. S.
Impact of agricultural and extension education processes on development and their role in the transfer of agricultural technology. Utilizing situational analysis techniques to analyze and solve problems in international agricultural education programs.
Meets International Perspectives Requirement.

AGEDS 475: Agri-Marketing and Communications Competition
(2-0) Cr. 1-2. Repeatable, maximum of 6 credits. F.S.
Prereq: Admission by invitation.
Specialized training in communication and agricultural marketing knowledge and skills in preparation for intercollegiate competition. Maximum of 6 credits can be applied toward graduation.

AGEDS 488: Methods of Teaching Agricultural Mechanics
(2-3) Cr. 3. F.S.
Methods and management techniques in agricultural mechanics laboratories. Emphasis will be on safety, mechanical skills development and management of students, facilities, equipment, and materials.

AGEDS 490: Independent Study in Agricultural Education and Studies
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490A: Philosophy, Curriculum, and Methods
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490B: Leadership, Evaluation, and Administration
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490C: Business, Industry, and Production Agriculture
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490D: Extension and International Agriculture
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490E: Instructional Technology
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490F: Environmental Issues
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490G: Entrepreneurship
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490H: Independent Study in Agricultural Education and Studies, Honors
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490I: Communications
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 496: Agricultural Travel Course
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study agriculture and education related topics. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

AGEDS 496A: International
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study agriculture and education related topics. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.
Meets International Perspectives Requirement.

AGEDS 496B: Domestic
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study agriculture and education related topics. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

AGEDS 499: Undergraduate Research
Cr. arr. F.S.SS.
Prereq: Permission of instructor, adviser, and departmental chair
Research experience in agricultural education and studies with application to selected problems.

Courses primarily for graduate students, open to qualified undergraduates:

AGEDS 501: Planning Agriculture and Life Sciences Education Programs
(Dual-listed with AGEDS 401). (3-0) Cr. 3. F.
Prereq: AGEDS 310
Responsibilities of an agricultural education teacher, curriculum development, experiential learning opportunities including FFA and SAE, and assessment and maintenance of program quality.

AGEDS 502: Methods of Teaching in Agriculture and Life Sciences
(Dual-listed with AGEDS 402). (3-0) Cr. 3. F.
Prereq: Concurrent enrollment in AGEDS 401
Topics include: principles of teaching and learning, individualized and group methods, application of learning, instructional management, special populations, and evaluation.

AGEDS 510: Introduction to Research in Agricultural Education
(3-0) Cr. 3. S.
Prereq: Graduate classification
Determining your research focus; developing research problems and objectives; reviewing the literature and establishing a theoretical framework; establishing procedures for data collection and analysis; ethical issues.

AGEDS 511: Professional Agricultural Presentation Practices
(3-0) Cr. 3. F.SS.
Prereq: Graduate Classification
The identification and use of key planning, delivery and evaluation of presentations using audience engagement techniques focused on research-based principles and field-based practices of professional presenters in agriculture and the life sciences.

AGEDS 520: Instructional Methods for Adult and Higher Education in Agriculture and Natural Resources
(3-0) Cr. 3. S.
Prereq: Graduate classification
Theory and practice of adult education. Teaching and learning in formal and non-formal instructional programs for adult learners.

AGEDS 524: Program Development and Evaluation in Agricultural and Extension Education
(3-0) Cr. 3. F.
Prereq: Graduate classification
Theories and practice of program planning for nonformal education. Addresses use of program logic modeling and considers critical theories of planning to address power and interests in program development, needs assessment, and evaluation.

AGEDS 533: Introduction to Learning Theory in Agricultural Education
(3-0) Cr. 3. S.
Prereq: Graduate classification
Introduction to a variety of theoretical perspectives of learning and how they may be used within the context of agricultural education. Emphasis will be on the major domains of learning, developmental considerations, basic assumptions, concepts, and principles of various learning theories; understanding how each theoretical perspective may be used in both formal and non-formal educational settings.

AGEDS 550: Foundations of Agricultural Education
(3-0) Cr. 3. F.
Prereq: Graduate classification
Philosophical premises, ethical principles, historical development, contextual applications, and knowledge bases for agricultural education.

AGEDS 561: Technology Transfer and the Role of Agricultural and Extension Education
(Dual-listed with AGEDS 461). (3-0) Cr. 3. S.
Impact of agricultural and extension education processes on development and their role in the transfer of agricultural technology. Utilizing situational analysis techniques to analyze and solve problems in international agricultural education programs.
Meets International Perspectives Requirement.

AGEDS 590: Special Topics in Agricultural Education
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590A: Curriculum
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590B: Methods
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590C: Philosophy
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590D: Evaluation
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590E: Administration
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590F: Leadership
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590G: Guidance
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590I: Instructional Technology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590J: Extension
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590K: International Agriculture
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590L: Program Planning
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593: Workshop in Agricultural Education
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593A: Curriculum
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593B: Methods
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593C: Evaluation
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593D: Administration
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593E: Leadership
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593F: Extension
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593G: Program Planning
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593H: Instructional Technology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593M: Biotechnology Workshop
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 599: Creative Component
Cr. arr. Repeatable. F.S.SS.
For nonthesis masters degree programs.

Courses for graduate students:

AGEDS 615: Seminar in Agricultural Education
(1-0) Cr. 1. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

AGEDS 615A: Writing for publication
(1-0) Cr. 1. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

AGEDS 615B: Ethics
(1-0) Cr. 1. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

AGEDS 615C: Grant writing
(1-0) Cr. 1. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

AGEDS 615D: Career planning
(1-0) Cr. 1. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

AGEDS 615E: Contemporary issues
(1-0) Cr. 1. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

AGEDS 617: Professional Internship for Agricultural Educators
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Analysis of the roles and activities of professionals in agricultural education. Supervised professional field-based experience in public and private settings. Offered on a satisfactory-fail basis only.

AGEDS 625: Leadership, Administration, Supervision and Management of Agricultural Education Programs
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Graduate classification
Principles and best practices for leading, administering, supervising, and managing agricultural education programs. Analyzing selected case studies that apply theory to practice in agricultural situations.

AGEDS 699: Research
Cr. arr. Repeatable.

Agricultural and Biosystems Engineering (A B E)

Courses primarily for undergraduates:

A B E 110: Experiencing Agricultural and Biosystems Engineering
(0-2) Cr. 1. S.
Laboratory-based, team-oriented experiences in a spectrum of topics common to the practice of agricultural and biosystems engineering. Report writing, co-ops, internships, careers, registration planning.

A B E 160: Systematic Problem Solving and Computer Programming
(2-2) Cr. 3. S.
Prereq: Credit or enrollment in MATH 143 or MATH 165
Engineering approach to problem solution and presentation in the context of real world problems. Introduction to basic principles from statics, projectile motion, conservation of mass and energy and electricity and magnetism. Use of spreadsheet programs and computer programming language(s) to solve and present engineering problems. Introduction to interfacing computers to sensor systems for data collection.

A B E 170: Engineering Graphics and Introductory Design
(2-2) Cr. 3.
Prereq: Satisfactory scores in math placement assessments; credit or enrollment in MATH 142.
Applications of multi-view drawings and dimensioning. Techniques for visualizing, analyzing, and communicating 3-D geometries. Application of the design process including written and oral reports.

A B E 201: Preparing for Workplace Seminar
(Cross-listed with TSM). (1-0) Cr. 1. F.S.
Prereq: Prereq: Sophomore classification in AE, AST, BSE, or I TEC
8 week course. Professionalism in the context of the engineering/technical workplace. Development and demonstration of key workplace competencies: teamwork, initiative, communication, and engineering/technical knowledge. Resumes; Cover Letters; Behavioral Based Interviewing; Industry Speakers; Preparation for internships experiences.

A B E 216: Fundamentals of Agricultural and Biosystems Engineering
(2-2) Cr. 3. F.
Prereq: A B E 160 or permission of the instructor
Application of mathematics and engineering sciences to mass and energy balances in agricultural and biological systems. Emphasis is on solving engineering problems in the areas of heat and mass transfer, air and water vapor systems; animal production systems, grain systems; food systems, hydrologic systems, and bioprocessing.

A B E 218: Project Management & Design in Agricultural and Biosystems Engineering
(1-2) Cr. 2. S.
Prereq: A B E 216
Project management - critical path, Gantt charts, resource allocations, basic project budgeting, and project management software. Engineering design approaches. Open-ended design projects to demonstrate the preceding principles through application of technical concepts taught in prerequisite coursework.

A B E 271: Engineering Applications of Parametric Solid Modeling
(1-2) Cr. 1. F.S.
Prereq: A B E 170 or TSM 116 or equivalent
8 week-course. Creating, editing, and documenting part and assembly models using Solidworks.

A B E 272: Parametric Solid Models, Drawings, and Assemblies Using Pro/ENGINEER
(1-2) Cr. 1. F.S.
Prereq: A B E 170 or TSM 116 or equivalent
8 week-course. Applications of Creo Parametric software. Create solid models of parts and assemblies. Utilize the solid models to create design documentation (standard drawing views, dimensions, and notes) and for the geometric analysis of parts and assemblies.

A B E 273: CAD for Process Facilities and Land Use Planning
(1-2) Cr. 1. F.S.
Prereq: ENGR 170 or TSM 116 or equivalent. 8-week course.
8-week course. Application of 2-D AutoCAD software to create and interpret 2-D drawings and 3-D models of facilities. Topics include geometric construction, design documentation: (using views, dimension, notes), and AutoCAD specific features (i.e. Layers, Blocks, Standards, Styles).

A B E 316: Applied Numerical Methods for Agricultural and Biosystems Engineering
(2-2) Cr. 3. F.S.
Prereq: A B E 160, A B E 218; MATH 266 or MATH 267
Computer aided solution of agricultural engineering problems by use of numerical techniques and mathematical models. Systems analysis and optimization applicable to agricultural and biological systems.

A B E 325: Biorenewable Systems
(Cross-listed with TSM). (3-0) Cr. 3. F.
Prereq: ECON 101; CHEM 163 or higher; and MATH 140 or higher
Converting biorenewable resources into bioenergy and biobased products. Biorenewable concepts as they relate to drivers of change, feedstock production, processes, products, co-products, economics, and transportation/logistics.

A B E 340: Functional Analysis and Design of Agricultural Field Machinery
(2-2) Cr. 3. F.
Prereq: A B E 110, A B E 216
Principles of operation, design, selection, testing and evaluation of agricultural field machinery and systems. Functional and mechanical performances. Crop and soil interaction with machines. Machine systems, including land preparation, crop establishment, crop protection, harvesting and post-harvest, materials handling systems.

A B E 342: Agricultural Tractor Power
(2-3) Cr. 3. S.
Prereq: Ch E 381 or M E 231
Thermodynamic principles and construction of tractor engines. Fuels, combustion, and lubrication. Kinematics and dynamics of tractor power applications; drawbar, power take-off and traction mechanisms.

A B E 363: Agri-Industrial Applications of Electric Power and Electronics
(3-2) Cr. 4. F.S.
Prereq: A B E 218
Single phase and three phase circuit design. Electrical safety. Electric motors and controls. Programmable logic controllers. Digital logic, instrumentation and sensors.

A B E 380: Principles of Biological Systems Engineering
(2-2) Cr. 3. S.
Prereq: A B E 316
Unit-operation analysis of biological systems, through the study of mass, energy, and information transport in bioresource production and conversion systems. Quantification and modeling of biomass production, ecological interactions, and bioreactor operations.

A B E 388: Sustainable Engineering and International Development
(Cross-listed with C E, E E). (2-2) Cr. 3. F.
Prereq: Junior classification in engineering
Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report.
Meets International Perspectives Requirement.

A B E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

A B E 398: Cooperative Education
Cr. R. Repeatable. F.S.
Prereq: A B E 218 and permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

A B E 403: Modeling, Simulation, and Controls for Agricultural and Biological Systems
(Dual-listed with A B E 503). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 316, and A B E 363, and MATH 266 or MATH 267
Modeling dynamic systems with ordinary differential equations. Introduction to state variable methods of system analysis. Analysis of mechanical, electrical, and fluid power systems. Analytical and numerical solutions of differential equations. Introduction to classical control theory. Feedback and stability examined in the s domain. Frequency response as an analytical and experimental tool. MATLAB will be used throughout the course for modeling. Individual and/or group projects required for graduate credit.

A B E 404: Instrumentation for Agricultural and Biosystems Engineering
(Dual-listed with A B E 504). (2-2) Cr. 3. F.
Prereq: A B E 316 and A B E 363 or CPR E 281
Interfacing techniques for computer-based data acquisition and control systems. Basic interfacing components including A/D and D/A conversion, signal filtering, multiplexing, and process control. Sensors and theory of operation applied to practical monitoring and control problems. Individual and group projects required for graduate credit.

A B E 408: GIS and Natural Resources Management
(Dual-listed with A B E 508). (Cross-listed with ENSCI). (2-2) Cr. 3. F.
Prereq: Working knowledge of computers and Windows environment
Introduction to fundamental concepts and applications of GIS in natural resources management with specific focus on watersheds. Topics include: basic GIS technology, data structures, database management, spatial analysis, and modeling; visualization and display of natural resource data. Case studies in watershed and natural resource management using ArcView GIS.

A B E 410: Electronic Systems Integration for Agricultural Machinery & Production Systems
(Dual-listed with A B E 510). Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 363
System architecture and design of electronics used in agricultural machinery and production systems. Emphasis on information technology and systems integration for automated agriculture processes. Design of Controller Area Network (CAN BUS) communication systems and discussion of relevant standards (ISO 11783 and SAE J1939). Application of technologies for sensing, distribution control, and automation of agricultural machinery will be emphasized.

A B E 413: Fluid Power Engineering
(Cross-listed with M E). (2-2) Cr. 3. F.
Prereq: Credit or enrollment in E M 378 or M E 335, A B E 216 or M E 270
Properties of hydraulic fluids. Performance parameters of fixed and variable displacement pumps and motors. Hydraulic circuits and systems. Hydrostatic transmissions. Characteristics of control valves. Analysis and design of hydraulic systems for power and control functions.

A B E 415: Agricultural & Biosystems Engineering Design I
(1-2) Cr. 2. F.S.
Prereq: A B E 316 (majors only)
Identification of current design problems in ag & biosystems engineering. Development of alternate solutions using creativity and engineering analysis and synthesis techniques.

A B E 416: Agricultural & Biosystems Engineering Design II
(1-2) Cr. 2. F.S.
Prereq: A B E 415 (majors only)
Selection of promising solutions to design problems identified in 415 for development by design teams. Presentation of designs through oral and written reports and prototypes.

A B E 418: Fundamentals of Engineering Review
(1-0) Cr. 1.
Prereq: senior classification.
8 week course. Review of core concepts covered in the Fundamentals of Engineering examination with emphasis on statics, dynamics, fluid mechanics, heat transfer, electric circuits, and engineering economics. Open to all College of Engineering seniors, however focus is on the general exam, not discipline specific exams.

A B E 424: Air Pollution
(Dual-listed with A B E 524). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 424A: Air Polution: Air quality and effects of pollutants
(Dual-listed with A B E 524A). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 424B: Air Pollution: Climate change and causes
(Dual-listed with A B E 524B). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 424C: Air Pollution: Transportation Air Quality
(Dual-listed with A B E 524C). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

A B E 424D: Air Pollution: Off-gas treatment technology
(Dual-listed with A B E 524D). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

A B E 424E: Air Pollution: Agricultural sources of pollution
(Dual-listed with A B E 524E). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 431: Design and Evaluation of Soil and Water Conservation Systems
(Dual-listed with A B E 531). (2-3) Cr. 3. F.
Prereq: E M 378 or CH E 356
Hydrology and hydraulics in agricultural and urbanizing watersheds. Design and evaluation of systems for the conservation and quality preservation of soil and water resources. Use and analysis of hydrologic data in engineering design; relationship of topography, soils, crops, climate, and cultural practices in conservation and quality preservation of soil and water for agriculture. Small watershed hydrology, water movement and utilization in the soil-plant-atmosphere system, agricultural water management, best management practices, and agricultural water quality. Graduate students will prepare several research literature reviews on topics covered in the class in addition to the other assignments.

A B E 432: Nonpoint Source Pollution and Control
(Dual-listed with A B E 532). (3-0) Cr. 3.
Prereq: A B E 431 or C E 372 or instructor permission
Characteristics and courses of non-point source (NPS) pollution in agricultural and urban watersheds, computer modeling and NPS pollution for terrestrial and aquatic systems, strategies to control and manage NPS pollution of water bodies, total maximum daily loads (TMDLs) and integrated watershed management. Graduate students are required to review research papers and develop/deliver lecture models on assigned topics.

A B E 436: Design and Evaluation of Soil and Water Monitoring Systems
(Dual-listed with A B E 536). (2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 431/A B E 531
Development of monitoring systems that support effective planning, performance evaluation, modeling, or environmental impact assessment of soil-, water-, and waste-management systems. Typical soil and water pollutants and physical, chemical, and biological characteristics that affect sample location and timing. Sample collection, documentation, chain-of-custody, and quality assurance procedures. In addition to other assignments, graduate students will prepare several research literature reviews on topics covered in the class and develop monitoring plans.

A B E 437: Watershed Modeling and Policy
(Dual-listed with A B E 537). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CE 372 or equivalent
A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools.

A B E 451: Food and Bioprocess Engineering
(Dual-listed with A B E 551). (3-0) Cr. 3. S.
Prereq: A B E 216 and credit or enrollment in M E 436 or CH E 357; or FS HN 351 and MATH 266 or MATH 267
Application of engineering principles and mathematical modeling to the quantitative analysis of food and bioprocessing systems. Physical/chemical characteristics of foods and biological systems, flow processes, thermal processes and separation processes. Term paper required for graduate credit.

A B E 466: Multidisciplinary Engineering Design
(Cross-listed with AER E, B M E, CPR E, E E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

A B E 469: Grain Processing and Handling
(Dual-listed with A B E 569). (Cross-listed with BSE). (2-3) Cr. 3. S.
Prereq: A B E 216
Cereal grain and oilseed properties, quality measurement, processing, and end-use value. Design of drying systems using computer simulation. Corn wet and dry milling. Soybean oil extraction. Grain handling systems.

A B E 472: Design of Environmental Modification Systems for Animal Housing
(Dual-listed with A B E 572). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 216, M E 231
Principles and design of animal environmental control systems. Insulation, heat and mass transfer, fans, ventilation, air distribution, heating and cooling equipment, and controls. Individual and group projects required for graduate credit.

A B E 475: Design in Animal Production Systems Engineering
(2-0) Cr. 2. F.S.
Prereq: A B E 271 or A B E 272, E M 324 and enrollment in APSE option of AE program.
Application of engineering fundamentals to the independent solution of an animal production systems engineering problem with well defined criteria and constraints in either environmental control, structural design, manure management, or air quality/mitigation.

A B E 478: Wood Frame Structural Design
(Dual-listed with A B E 578). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 216, E M 324
Design of light-framed wood structures using LRFD and ASD design procedures. Includes analysis of wind, snow, dead, and live loads. Applications include animal housing and machine storage. Fasteners, laminated posts, truss design and use of National Design Specifications.

A B E 480: Engineering Analysis of Biological Systems
(Cross-listed with ENSCI). (2-2) Cr. 3. F.
Prereq: A B E 380 or permission of the instructor
Systems-level quantitative analysis of biological systems, including applications in foods, feeds, biofuels, bioenergy, and other biological systems. Introduction to economic analysis and life-cycle assessment of these systems at multiple production scales. Applying these tools to evaluate and improve cost and sustainability performance of these biological systems.

A B E 490: A B E Independent Study
Cr. 1-5. Repeatable.
Independent Study.

A B E 490A: A B E Independent Study: Animal Production Systems Engineering
Cr. 1-5. Repeatable.
Independent Study.

A B E 490B: A B E Independent Study: Biorenewable Resources
Cr. 1-5. Repeatable. F.S.SS.
Independent study.

A B E 490E: A B E Independent Study: Environmental Bioprocessing Engineering
Cr. 1-5. Repeatable. F.S.SS.
Independent study in environmental bioprocessing engineering.

A B E 490F: A B E Independent Study: Food Engineering
Cr. 1-5. Repeatable. F.S.SS.
Independent study in food engineering.

A B E 490G: A B E Independent Study: General Topics in A B E
Cr. 1-5. Repeatable. F.S.SS.
Independent study in general A B E topics.

A B E 490H: A B E Independent Study: Honors
Cr. 1-5. Repeatable.
Guided instructing in agricultural and biosystems engineering for honors students.

A B E 490L: A B E Independent Study: Land & Water Resources Engineering
Cr. 1-5. Repeatable.
Guided instruction in land and water resources engineering.

A B E 490M: A B E Independent Study: Advanced Machinery Systems Engineering
Cr. 1-5. Repeatable.
Guided instruction in advance machinery systems engineering.

A B E 495: Agricultural and Biosystems Engineering Department Study Abroad Preparation or Follow-up
(Cross-listed with TSM). Cr. 1-2. Repeatable. F.S.SS.
Prereq: Permission of instructor
Preparation for, or follow-up of, study abroad experience (496). For preparation, course focuses on understanding the tour destination through readings, discussions, and research on topics such as the regional industries, climate, crops, culture, economics, food, geography, government, history, natural resources, and public policies. For follow-up, course focuses on presentations by students, report writing, and reflection. Students enrolled in this course intend to register for 496 the following term or have had taken 496 the previous term.
Meets International Perspectives Requirement.

A B E 496: Agricultural and Biosystems Engineering Department Study Abroad
(Cross-listed with TSM). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
Tour and study at international sites relevant to disciplines of industrial technology, biological systems engineering, agricultural systems technology, and agricultural engineering. Location and duration of tours will vary. Trip expenses paid by students. Pre-trip preparation and/or post-trip reflection and reports arranged through 495.
Meets International Perspectives Requirement.

Courses primarily for graduate students, open to qualified undergraduates:

A B E 503: Modeling, Simulation, and Controls for Agricultural and Biological Systems
(Dual-listed with A B E 403). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 316, and A B E 363, and MATH 266 or MATH 267
Modeling dynamic systems with ordinary differential equations. Introduction to state variable methods of system analysis. Analysis of mechanical, electrical, and fluid power systems. Analytical and numerical solutions of differential equations. Introduction to classical control theory. Feedback and stability examined in the s domain. Frequency response as an analytical and experimental tool. MATLAB will be used throughout the course for modeling. Individual and/or group projects required for graduate credit.

A B E 504: Instrumentation for Agricultural and Biosystems Engineering
(Dual-listed with A B E 404). (2-2) Cr. 3. F.
Prereq: A B E 316 and A B E 363 or CPR E 281
Interfacing techniques for computer-based data acquisition and control systems. Basic interfacing components including A/D and D/A conversion, signal filtering, multiplexing, and process control. Sensors and theory of operation applied to practical monitoring and control problems. Individual and group projects required for graduate credit.

A B E 506: Applied Computational Intelligence
(2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A B E 316 or equivalent, MATH 166, STAT 305
Applications of biologically inspired computational intelligence tools for data mining, system modeling, and optimization for agricultural, biological and other engineered systems. Introduction to Artificial Neural Networks, Support Vector Machines, Fuzzy Logic, Genetic Algorithms, Bayesian and Decision Tree learning. Fundamental Machine Vision techniques will be introduced in the first part of course and be integrated into the lab exercises for learning different computational intelligence techniques. MATLAB will be used throughout the course for algorithm implementation.

A B E 508: GIS and Natural Resources Management
(Dual-listed with A B E 408). (Cross-listed with ENSCI). (2-2) Cr. 3. F.
Prereq: Working knowledge of computers and Windows environment
Introduction to fundamental concepts and applications of GIS in natural resources management with specific focus on watersheds. Topics include: basic GIS technology, data structures, database management, spatial analysis, and modeling; visualization and display of natural resource data. Case studies in watershed and natural resource management using ArcView GIS.

A B E 510: Electronic Systems Integration for Agricultural Machinery & Production Systems
(Dual-listed with A B E 410). Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 363
System architecture and design of electronics used in agricultural machinery and production systems. Emphasis on information technology and systems integration for automated agriculture processes. Design of Controller Area Network (CAN BUS) communication systems and discussion of relevant standards (ISO 11783 and SAE J1939). Application of technologies for sensing, distribution control, and automation of agricultural machinery will be emphasized.

A B E 515: Integrated Crop and Livestock Production Systems
(Cross-listed with AGRON, AN S, SUSAG). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: SUSAG 509
Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms.

A B E 524: Air Pollution
(Dual-listed with A B E 424). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 524A: Air Polution: Air quality and effects of pollutants
(Dual-listed with A B E 424A). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 524B: Air Pollution: Climate change and causes
(Dual-listed with A B E 424B). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 524C: Air Pollution: Transportation Air Quality
(Dual-listed with A B E 424C). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

A B E 524D: Air Pollution: Off-gas treatment technology
(Dual-listed with A B E 424D). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

A B E 524E: Air Pollution: Agricultural sources of pollution
(Dual-listed with A B E 424E). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 531: Design and Evaluation of Soil and Water Conservation Systems
(Dual-listed with A B E 431). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: E M 378 or CH E 356
Hydrology and hydraulics in agricultural and urbanizing watersheds. Design and evaluation of systems for the conservation and quality preservation of soil and water resources. Use and analysis of hydrologic data in engineering design; relationship of topography, soils, crops, climate, and cultural practices in conservation and quality preservation of soil and water for agriculture. Small watershed hydrology, water movement and utilization in the soil-plant-atmosphere system, agricultural water management, best management practices, and agricultural water quality. Graduate students will prepare several research literature reviews on topics covered in the class in addition to the other assignments.

A B E 532: Nonpoint Source Pollution and Control
(Dual-listed with A B E 432). (Cross-listed with ENSCI). (3-0) Cr. 3.
Prereq: A B E 431 or C E 372 or instructor permission
Characteristics and courses of non-point source (NPS) pollution in agricultural and urban watersheds, computer modeling and NPS pollution for terrestrial and aquatic systems, strategies to control and manage NPS pollution of water bodies, total maximum daily loads (TMDLs) and integrated watershed management. Graduate students are required to review research papers and develop/deliver lecture models on assigned topics.

A B E 533: Erosion and Sediment Transport
(Cross-listed with ENSCI, NREM). (2-3) Cr. 3. F.
Prereq: C E 372 or GEOL/ENSCI/MTEOR 402, MATH 166 or equivalent
Soil erosion processes, soil loss equations and their application to conservation planning, sediment properties, initiation of sediment motion and over land flow, flow in alluvial channels and theory of sediment transport, channel stability, reservoir sedimentation, wind erosion, BMPs for controlling erosion.

A B E 536: Design and Evaluation of Soil and Water Monitoring Systems
(Dual-listed with A B E 436). (Cross-listed with ENSCI). (2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 431/A B E 531
Development of monitoring systems that support effective planning, performance evaluation, modeling, or environmental impact assessment of soil-, water-, and waste-management systems. Typical soil and water pollutants and physical, chemical, and biological characteristics that affect sample location and timing. Sample collection, documentation, chain-of-custody, and quality assurance procedures. In addition to other assignments, graduate students will prepare several research literature reviews on topics covered in the class and develop monitoring plans.

A B E 537: Watershed Modeling and Policy
(Dual-listed with A B E 437). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CE 372 or equivalent
A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools.

A B E 551: Food and Bioprocess Engineering
(Dual-listed with A B E 451). (3-0) Cr. 3. S.
Prereq: A B E 216 and credit or enrollment in M E 436 or CH E 357; or FS HN 351 and MATH 266 or MATH 267
Application of engineering principles and mathematical modeling to the quantitative analysis of food and bioprocessing systems. Physical/chemical characteristics of foods and biological systems, flow processes, thermal processes and separation processes. Term paper required for graduate credit.

A B E 569: Grain Processing and Handling
(Dual-listed with A B E 469). (2-3) Cr. 3. S.
Prereq: A B E 216
Cereal grain and oilseed preservation, quality measurement, and end-use value. Design of drying systems using computer simulation. Corn wet and dry milling. Soybean oil extraction. Grain handling systems. Individual and group projects required for graduate credit.

A B E 572: Design of Environmental Modification Systems for Animal Housing
(Dual-listed with A B E 472). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 216, M E 231
Principles and design of animal environmental control systems. Insulation, heat and mass transfer, fans, ventilation, air distribution, heating and cooling equipment, and controls. Individual and group projects required for graduate credit.

A B E 578: Wood Frame Structural Design
(Dual-listed with A B E 478). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 216, E M 324
Design of light-framed wood structures using LRFD and ASD design procedures. Includes analysis of wind, snow, dead, and live loads. Applications include animal housing and machine storage. Fasteners, laminated posts, truss design and use of National Design Specifications.

A B E 580: Engineering Analysis of Biological Systems
(2-2) Cr. 3. F.
Prereq: A B E 216; MATH 266; BIOL 211 or BIOL 212; M E 231
Systems-level engineering analysis of biological systems. Economic and life-cycle analysis of bioresource production and conversion systems. Global energy and resource issues and the role of biologically derived materials in addressing these issues. Students enrolled in ABE 580 will be required to answer additional exam questions and report on two journal articles.

A B E 590: Special Topics in Agricultural & Biosystems Engineering
Cr. 1-3. Repeatable.
Guided instruction and self-study on special topics relevant to agricultural and biosystems engineering.

A B E 598: Technical Communications for a Master's Degree
(Cross-listed with TSM). Cr. 1. F.S.SS.
A technical paper draft based on the M.S. thesis or creative component is required of all master's students. This paper must be in a form that satisfies the requirements of some specific journal and be ready for submission. A technical presentation based on M.S. thesis or creative component is required of all master's students. This presentation must be in a form that satisfies the normal presentation requirements of a professional society. The presentation itself (oral or poster) may be made at a professional society meeting or at any international, regional, state, or university conference/event as long as the presentation content and form conforms to normal expectations. Offered on a satisfactory-fail basis only.

A B E 599: Creative Component
Cr. arr. Repeatable.
Creative Component.

Courses for graduate students:

A B E 601: Graduate Seminar
(Cross-listed with TSM). (1-0) Cr. 1. F.
Keys to starting a good MS thesis or PhD dissertation project. Learning how to begin formulating research questions. Review of literature, research hypotheses, objectives, methods, making figures and tables, and discussing results. Discussion of appropriate outlets including peer-reviewed journals, patents and intellectual property rights, responsible conduct, plagiarism, authorship, and reproducible research. Using peer review, conducting a peer review, and responding to feedback. Other topics may include on-campus library resources, data management, and time management.

A B E 610: Foundations of Sustainable Agriculture
(Cross-listed with AGRON, ANTHR, SOC, SUSAG). (3-0) Cr. 3. F.
Prereq: Graduate classification, permission of instructor
Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts.

A B E 690: Advanced Topics
Cr. arr. Repeatable.
Advanced topics.

A B E 694: Teaching Practicum
(Cross-listed with TSM). Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and permission of instructor
Graduate student experience in the agricultural and biosystems engineering departmental teaching program.

A B E 697: Engineering Internship
Cr. R. Repeatable.
Prereq: Permission of department chair, graduate classification
One semester and one summer maximum per academic year professional work period.

A B E 698: Technical Communications for a Doctoral Degree
(Cross-listed with TSM). Cr. 1. F.S.SS.
A technical paper draft based on the dissertation is required of all Ph.D. students. This paper must be in a form that satisfies the requirements of some specific journal and be ready for submission. A technical presentation based on the dissertation is required of all Ph.D. students. This presentation must be in a form that satisfies the normal presentation requirements of a professional society. The presentation itself (oral or poster) may be made at a professional society meeting or at any international, regional, state, or university conference/event as long as the presentation content and form conforms to normal expectations. Offered on a satisfactory-fail basis only.

A B E 699: Research
Cr. arr. Repeatable.
Research.

A B E 699B: Research: Biosystems Engineering
Cr. arr. Repeatable.
Guided graduate research in biosystems engineering.

A B E 699C: Research: Computer Aided Design
Cr. arr. Repeatable.
Guided graduate research in computer-aided design.

A B E 699E: Research: Environmental Systems
Cr. arr. Repeatable.
Guided graduate research in environmental systems.

A B E 699F: Research: Food Engineering
Cr. arr. Repeatable.
Guided graduate research in food engineering.

A B E 699O: Research: Occupational Safety
Cr. arr. Repeatable.
Guided graduate research in occupational safety.

A B E 699P: Research: Power and Machinery Engineering
Cr. arr. Repeatable.
Guided graduate research in power and machinery engineering.

A B E 699Q: Research: Structures
Cr. arr. Repeatable.
Guided graduate research in structures.

A B E 699R: Research: Process Engineering
Cr. arr. Repeatable.
Guided graduate research in process engineering.

A B E 699S: Research: Environment and Natural Resources
Cr. arr. Repeatable.
Guided graduate research in environment and natural resources.

A B E 699U: Research: Waste Management
Cr. arr. Repeatable.
Guided graduate research in waste management.

Agronomy (AGRON)

Courses primarily for undergraduates:

AGRON 105: Leadership Experience
Cr. R. F.S.SS.
A participatory experience in activities or completion of a course that enhances the development of leadership and group-dynamic skills. See adviser for departmental requirements.

AGRON 110: Professional Development in Agronomy: Orientation
Cr. 1. F.
Orientation to college life, the profession of agronomy, and the agronomy curriculum.

AGRON 120: Introduction to Renewable Resources
(Cross-listed with ENV S, NREM). (3-0) Cr. 3. F.S.
Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management.

AGRON 160: Water Resources of the World
(Cross-listed with ENV S, GEOL, MTEOR). (3-0) Cr. 3. S.
Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement.

AGRON 180: Global Agriculture in a Changing World
(3-0) Cr. 3. F.
The global distribution of climate and soils and the physical processes that connect natural resources to agriculture and the environment. How agricultural production is distributed among food, feed, fiber, and energy. The impact of global change on the increasing demand for agricultural production. Meets International Perspectives requirement.
Meets International Perspectives Requirement.

AGRON 181: Introduction to Crop Science
(3-0) Cr. 3. F.S.
Basic structure and function of plants, origin and classification, growth and development. Fundamentals of photosynthesis, plant water use, plant nutrition and genetics that regulate plant growth, development and responses to the environment.

AGRON 182: Introduction to Soil Science
(3-0) Cr. 3. F.S.
Prereq: Chem 163
Introduction to physical, chemical, and biological properties of soils; soil formation, classification and global distribution; soil health, soils and humanity and sustainable land management.

AGRON 183: Basic Skills for Agronomists
(0-3) Cr. 1. F.
Developing the skills that agronomists employ in their work with crops, soil, and the environment through activities involving tools and methodologies used by agronomists. Enrollment is restricted to first-year students majoring in agronomy.

AGRON 206: Introduction to Weather and Climate
(Cross-listed with MTEOR). (3-0) Cr. 3. F.S.
Basic concepts in weather and climate, including atmospheric measurements, radiation, stability, precipitation, winds, fronts, forecasting, and severe weather. Applied topics include global warming, ozone depletion, world climates and weather safety.

AGRON 210: Professional Development in Agronomy: Career Planning
(1-0) Cr. 1. F.
Prereq: Sophomore classification
Career planning, résumé and cover letter preparation, and interviewing techniques. Career orientation through invited speakers.

AGRON 217: Weed Identification
(1-2) Cr. 1. F.S.
Prereq: BIOL 101 or equivalent
Half-semester course. Identification of important weeds of agricultural, horticultural and native ecosystems. Principles of plant taxonomy and classification. Field trips.

AGRON 259: Organic Compounds in Plants and Soils
(3-0) Cr. 3. S.
Prereq: CHEM 163, BIOL 212, MATH 140; AGRON 182 (or equivalent) or AGRON 282 or equivalent
Structure, function, and transformations of organic compounds significant in plant and soil environments.

AGRON 279: Field Exploration of Agronomy
(2-3) Cr. 3. F.
Prereq: AGRON 181 or equivalent and AGRON 182 or equivalent
Field-based investigation of Iowa's agronomic systems. Application of principles learned in introductory soils, crops and agronomy courses. For students majoring in Agronomy.

AGRON 280: Crop Development, Production and Management
(3-0) Cr. 3. F.S.
Prereq: AGRON 181 or equivalent and AGRON 182 or equivalent
Overview of crops and cropping systems in the context of global and US agriculture. Focus on agronomic principles, constraints and opportunities as they apply to various locations in Iowa, the USA and the world.

AGRON 281: Crop Physiology
(3-0) Cr. 3. S.
Prereq: Agron 181 or equivalent
Science governing plant growth and development in the context of cropping and genetic improvements.

AGRON 282: Soil Conservation and Land Use
(3-0) Cr. 3. F.S.
Prereq: Agron 182 or equivalent
Principles of soil conservation and land use with emphasis on best management practices and use of soil maps and databases such as Web Soil Survey. Only Agron 260 or Agron 282 can be used to meet graduation requirements.

AGRON 283: Pesticide Application Certification
(Cross-listed with ENT, FOR, HORT). (2-0) Cr. 2. S.
Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized.

AGRON 298: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department cooperative education coordinator, sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

AGRON 310: Professional Development in Agronomy: Work Experience
Cr. R. F.S.SS.
Professional work experience in agronomy. See adviser for departmental requirements. Offered on a satisfactory-fail basis only.

AGRON 311: Professional Internship in Agronomy
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor before internship begins
A supervised learning experience in a professional setting related to crop production, plant breeding, soil science or environmental science. For students majoring in Agronomy.

AGRON 316: Crop Structure-Function Relationships
(3-0) Cr. 3. F.S.
Prereq: BIOL 212 recommended
Basic principles concerning the growth, development, and production of crop communities in relation to their environment.

AGRON 317: Principles of Weed Science
(3-0) Cr. 3. F.
Biology and ecology of weeds. Interactions between weeds and crops. Principles and practices of integrated weed management systems. Herbicide mechanisms, classification, and fate in plants and soils.

AGRON 320: Genetics, Agriculture and Biotechnology
(Cross-listed with GEN). (3-0) Cr. 3. F.S.
Prereq: BIOL 212
Transmission genetics with an emphasis on applications in agriculture, the structure and expression of the gene, how genes behave in populations and how recombinant DNA technology can be used to improve agriculture. Credit for graduation will not be allowed for more than one of the following: Gen 260, 313, 320 and Biol 313 and 313L.

AGRON 330: Crop and Seed Identification Laboratory
(0-4) Cr. 2. S.
Prereq: AGRON 181 or equivalent.
Identification, agronomic and binomial classification of crops, weeds, and diseases. Analysis of crop seed samples for contaminants of weed and other crop seeds.

AGRON 331: Intercollegiate Crops Team
(0-6) Cr. 2. Repeatable. F.S.
Prereq: Permission of instructor. AGRON 330 recommended
Intensive training in preparation for intercollegiate competition in national crops contests.

AGRON 334: Forage Crop Management
(3-0) Cr. 3. S.
Prereq: AGRON 181 or equivalent
Production and management of forage crops; concepts applied to yield, quality, and stand persistence; systems of forage utilization including grazing, hay, and silage. Students enrolling for graduate credit will be expected to complete an additional class project.

AGRON 338: Seed Science and Technology
(Cross-listed with HORT). (2-3) Cr. 3. F.
Prereq: AGRON 181 (or equivalent) or HORT 221; BIOL 212
Seed production, maturation, dormancy, vigor, deterioration, and related aspects of enhancement, conditioning, storage, and quality evaluation. Aspects of the seed industry and regulation of seed marketing.

AGRON 342: World Food Issues: Past and Present
(Cross-listed with ENV S, FS HN, T SC). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

AGRON 342H: World Food Issues: Past and Present, Honors
(Cross-listed with ENV S, T SC). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

AGRON 351: Turfgrass Establishment and Management
(Cross-listed with HORT). (3-0) Cr. 3. F.
Prereq: HORT 221 or AGRON 181 (or equivalent) or BIOL 211
Principles and practices of turfgrass propagation, establishment, and management. Specialized practices relative to professional lawn care, golf courses, athletic fields, highway roadsides, and seed and sod production. The biology and control of turfgrass pests.

AGRON 351L: Turfgrass Establishment and Management Laboratory
(Cross-listed with HORT). (0-3) Cr. 1. F.
Prereq: Credit or enrollment in HORT 351
Those enrolled in the horticulture curriculum are required to take 351L in conjunction with 351 except by permission of the instructor.

AGRON 354: Soils and Plant Growth
(Cross-listed with HORT). (3-0) Cr. 3. F.S.
Prereq: AGRON 182 or equivalent and BIOL 101
Effects of chemical, physical, and biological properties of soils on plant growth, with emphasis on nutritive elements, pH, organic matter maintenance, and rooting development.

AGRON 354L: Soils and Plant Growth Laboratory
(Cross-listed with HORT). (0-3) Cr. 1. F.S.
Prereq: Agron or Hort major with credit or enrollment in AGRON 354
Laboratory exercises in soil testing that assess a soil's ability to support nutritive requirements for plant growth.

AGRON 360: Environmental Soil Science
(Cross-listed with ENSCI). (2-2) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or ENSCI 250 or GEOL 201
Application of soil science to contemporary environmental problems; comparison of the impacts that different management strategies have on short- and long-term environmental quality and land development. Emphasis on participatory learning activities.

AGRON 370: Field Experience in Soil Description and Interpretation
(0-3) Cr. 1. Repeatable, maximum of 4 times. F.S.
Prereq: AGRON 182 or equivalent and permission of instructor
Description and interpretation of soils in the field and laboratory, emphasizing hands-on experience. Evaluation of soil information for land use. Students may participate in intercollegiate judging contests.

AGRON 388: Agronomic Sciences in Theory and Practice
(1-0) Cr. 1. F.
Prereq: Junior or senior classification
How science works: Hypotheses, data integrity, classification, interpretations, ethics, and communications.

AGRON 392: Systems Analysis in Crop and Soil Management
(2-3) Cr. 3. F.S.
Prereq: AGRON 316 and AGRON 354
Management strategies at the level of the farm field. Emphasis will be on participatory learning activities.

AGRON 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

AGRON 402I: Watershed Hydrology and Surficial Processes
(Cross-listed with ENSCI, IA LL). Cr. 4. SS.
Prereq: Four courses in physical or biological sciences or engineering
Effects of geomorphology, soils, and land use on transport of water and materials (nutrients, contaminates) in watersheds. Fieldwork will emphasize investigations of the Iowa Great Lakes watershed.

AGRON 404: Global Change
(Dual-listed with AGRON 504). (Cross-listed with ENSCI, ENV S, MTEOR). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

AGRON 405: Environmental Biophysics
(Dual-listed with AGRON 505). (Cross-listed with ENSCI, MTEOR). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)
Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

AGRON 406: World Climates
(Cross-listed with ENSCI, MTEOR). (3-0) Cr. 3. S.
Prereq: AGRON 206/MTEOR 206
Distribution and causes of different climates around the world. Effects of climate and climate variations on human activities including society, economy and agriculture. Current issues such as climate change and international efforts to assess and mitigate the consequences of a changing climate. Semester project and in-class presentation required. Meets International Perspectives Requirement.

AGRON 407: Mesoscale Meteorology
(Dual-listed with AGRON 507). (Cross-listed with MTEOR). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Math 166 and Mteor 443
Arritt, Gallus. Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure.

AGRON 410: Professional Development in Agronomy: Senior Forum
(1-0) Cr. 1. F.S.
Prereq: Senior classification
Development of an appropriate content for professionalism. Topics include professional certification, ethics, and maintaining an active network of information sources and professional contacts in support of lifelong learning. Student interpretation, writings, presentations, and discussions.

AGRON 421: Introduction to Plant Breeding
(Cross-listed with HORT). (3-0) Cr. 3. F.
Prereq: GEN 320 or BIOL 313
Breeding methods used in the genetic improvement of self-pollinated, cross-pollinated and asexually reproducing agronomic and horticultural crops. Applications of biotechnology techniques in the development of improved cultivars.

AGRON 446: International Issues and Challenges in Sustainable Development
(Cross-listed with GLOBE, INTST). Cr. 3. F.S.
Prereq: 3-credit biology course, Sophomore or higher classification, permission of Instructor
Interdisciplinary study and analysis of agricultural systems, sustainable management, and impact on plants and animal biodiversity. International field experience in evaluating different agricultural systems and impact on biodiversity may be required. A program fee is charged to students for international study abroad.
Meets International Perspectives Requirement.

AGRON 450: Issues in Sustainable Agriculture
(Cross-listed with ENV S). (3-0) Cr. 3. F.
Agricultural science as a human activity; contemporary agricultural issues from agroecological perspective. Comparative analysis of intended and actual consequences of development of industrial agricultural practices.

AGRON 452: GIS for Geoscientists
(Dual-listed with AGRON 552). (Cross-listed with ENSCI, GEOL). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

AGRON 459: Environmental Soil and Water Chemistry
(Dual-listed with AGRON 559). (Cross-listed with ENSCI). (3-3) Cr. 4. F.
Prereq: Two semesters of college-level chemistry, MATH 140, AGRON 182 (or equivalent) or AGRON 360; GEOL 100 and AGRON 354 recommended
An introduction to the chemical properties of soils, chemical reactions and transformations in soils and surface waters, and their impact on the environment. Topics include solution chemistry in soils and surface waters, solid-phase composition of soils, reactions at the solid-solution interface, and applications to contemporary environmental issues.

AGRON 463: Soil Formation and Landscape Relationships
(Dual-listed with AGRON 563). (Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. Credit for one of AGRON 463 or AGRON 463I may be applied for graduation.

AGRON 463I: Soil Formation and Landscape Relationships
(Dual-listed with AGRON 563I). (Cross-listed with ENSCI, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

AGRON 463L: Soil Formation and Landscape Relationships Laboratory
(0-3) Cr. 1. S.
Prereq: Credit or enrollment in Agron 463
Laboratory exercise in soil formation with landscape relationships including pedon description with soil mapping.

AGRON 477: Soil Physics
(Dual-listed with AGRON 577). (Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: AGRON 182 or equivalent and MATH 166 recommended
The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

AGRON 484: Organic Agricultural Theory and Practice
(Dual-listed with AGRON 584). (Cross-listed with HORT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 9 cr. in biological or physical sciences
Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives.

AGRON 485: Soil and Environmental Microbiology
(Dual-listed with AGRON 585). (Cross-listed with ENSCI, MICRO). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

AGRON 488: GIS for Geoscientists II
(Dual-listed with AGRON 588). (Cross-listed with ENSCI, GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

AGRON 490: Independent Study
Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation
Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 490E: Independent Study: Entrepreneurship
Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation
Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 490G: Independent Study: General
Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation
Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 490H: Independent Study: Honors
Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation
Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 490Z: Independent Study: Service Learning
Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation
Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 491: Seed Science Internship Experience
(Cross-listed with HORT). Cr. 1-2. Repeatable, maximum of 1 times. F.S.SS.
Prereq: Agron 338, advanced approval and participation of employer and instructor
A professional work experience and creative project for seed science secondary majors. The project requires the prior approval and participation of the employer and instructor. The student must submit a written report.

AGRON 493: Workshop in Agronomy
Cr. arr. Repeatable, maximum of 4 times.
Prereq: Permission of instructor
Workshop experience in crops, soils, or agricultural meteorology.

AGRON 496: Agricultural Travel Course
Cr. arr. Repeatable.
Prereq: Permission of instructor
Limited enrollment. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on crop and livestock production. Location and duration of tours will vary. Tour expenses paid by students. Check with department for current offerings.

AGRON 496A: International Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Limited enrollment. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on crop and livestock production. Location and duration of tours will vary. Tour expenses paid by students. Check with department for current offerings. Meets International Perspectives Requirement.

AGRON 496B: Domestic Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Limited enrollment. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on crop and livestock production. Location and duration of tours will vary. Tour expenses paid by students. Check with department for current offerings.

AGRON 497: Agroecology Field Course
(3-0) Cr. 3. F.
Prereq: Jr. or Sr. classification with at least 8 credits in Agronomy
A one-week intensive class, offered off-campus. Student will visit farms within the Midwest and analyze the sustainability of each farm.

AGRON 498: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

AGRON 500: Orientation Seminar
(2-0) Cr. 1. F.
Prereq: International agronomy graduate students only
An introduction to Iowa and U.S. agriculture for international scholars in agronomic majors. Field trips when possible. Departmental role in the functioning of research, teaching, and extension in fulfilling the charge given the land-grant university.

AGRON 501: Crop Growth and Development
(3-0) Cr. 3. F.S.
Prereq: AGRON 181 or equivalent, MATH 140, CHEM 163, BIOL 101
Physiological processes in crop growth, development and yield: photosynthesis, respiration, water relations, mineral nutrition, assimilate partitioning, seedling vigor, light interception and canopy growth, root growth, reproduction and yield. Required course for the Master of Science in Agronomy degree program and Agronomy Graduate Certificate program.

AGRON 502: Chemistry, Physics, and Biology of Soils
(3-0) Cr. 3. F.
Prereq: AGRON 181 or equivalent, AGRON 182 or equivalent, BIOL 101, CHEM 163, MATH 140
Soil chemical, physical, and biological properties that control processes within the soil, their influence on plant/soil interactions, and soil classification. Basic concepts in soil science and their applications. Required course for the Master of Science in Agronomy degree program and Agronomy Graduate Certificate program.

AGRON 503: Climate and Crop Growth
(3-0) Cr. 3. F.S.SS.
Prereq: AGRON 181 or equivalent and MATH 140
Applied concepts in climate and agricultural meteorology with emphasis on the climate-agriculture relationship and the microclimate-agriculture interaction and crop risk management. Basic meteorological principles are also presented to support these applied concepts. Required course for the Master of Science in Agronomy degree program and Agronomy Graduate Certificate program.

AGRON 504: Global Change

(Dual-listed with AGRON 404). (Cross-listed with ENSCI, MTEOR). (3-0) Cr. 3. S.

Prereq: Four courses in physical or biological sciences or engineering; junior standing

Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

AGRON 505: Environmental Biophysics

(Dual-listed with AGRON 405). (Cross-listed with ENSCI, MTEOR). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)

Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

AGRON 506: Crop Genetics

(Cross-listed with HORT). Cr. 3. F.

Introduction to genetics of reproductive systems, recombination, segregation and linkage analysis, inbreeding, quantitative inheritance, fertility regulation, and polyploidy to prepare students for subsequent courses in crop improvement. Enrollment is restricted to off-campus MS in Plant Breeding students.

AGRON 507: Mesoscale Meteorology

(Dual-listed with AGRON 407). (Cross-listed with MTEOR). (3-0) Cr. 3. Alt. S., offered even-numbered years.

Prereq: Math 166 and Mteor 454

The physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Semester project and in-class presentation required.

AGRON 508: Biophysical Crop Ecology

(3-0) Cr. 3. Alt. S., offered even-numbered years.

Prereq: AGRON 505

Physical modeling of bio-response and crop adaptation to climate. Principles of resource capture (light and water) applied to growth and development. Ecological implications of radiation, temperature, moisture, and the biological properties of size, shape, resistance to water vapor loss, and absorptivity to solar and thermal radiation. Physiological stress in the soil, plant, atmosphere continuum.

AGRON 509: Agroecosystems Analysis

(Cross-listed with SOC, SUSAG). (3-4) Cr. 4. F.

Prereq: Senior or above classification

Experiential, interdisciplinary examination of Midwestern agricultural and food systems, emphasizing field visits, with some classroom activities. Focus on understanding multiple elements, perspectives (agronomic, economic, ecological, social, etc), and scales of operation.

AGRON 510: Crop Improvement

(Cross-listed with STB). (3-0) Cr. 3. F.

Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor

A study of the basic principles and methods in the genetic improvement of crop plants. Methods used in manipulating genomes through the use of biotechnology. Methods of cultivar development. Quantitative procedures for describing response to selection. Analysis of the relationship of reproductive characters and growth characteristics to response to selection.

AGRON 511: Crop Improvement

(3-0) Cr. 3. S.

Prereq: AGRON 181 or equivalent, MATH 140, CHEM 163, BIOL 101

Basic principles in the genetic improvement of crop plants. Methods of cultivar development in self-pollinated and cross-pollinated crop species. Required course for the Master of Science in agronomy degree program and agronomy graduate certificate program.

AGRON 512: Soil-Plant Environment

(3-0) Cr. 3. S.

Prereq: AGRON 502. Recommended AGRON 501

Soil properties and their impact on soil/plant relationships. Soil structure, aeration, moisture, and nutrients will be discussed in the context of soil fertility and environmental quality management. Required course for the Master of Science in agronomy degree program and agronomy graduate certificate program.

AGRON 513: Quantitative Methods for Agronomy

(3-0) Cr. 3. F.S.

Prereq: AGRON 181 or equivalent, MATH 140, STAT 104

Quantitative methods for analyzing and interpreting agronomic information. Principles of experimental design, hypothesis testing, analysis of variance, regression, correlation, and graphical representation of data. Use of SAS and Excel for organization, analyzing, and presenting data. Required course for the Master of Science in Agronomy degree program.

AGRON 514: Integrated Pest Management
(3-0) Cr. 3. SS.
Prereq: AGRON 181 or equivalent, AGRON 501, MATH 140, CHEM 163, BIOL 101; AGRON 502 and AGRON 503 recommended
Principles and practices of weed science, entomology, and plant pathology applied to crop production systems. Biology, ecology and principles of integrated crop pest management. Required course for the Master of Science in Agronomy degree program and Agronomy Graduate Certificate program.

AGRON 515: Integrated Crop and Livestock Production Systems
(Cross-listed with A B E, AN S, SUSAG). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: SUSAG 509
Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms.

AGRON 516: Crop Physiology
(3-0) Cr. 3. S.
Investigation of Molecular, whole plant, and plant community processes essential to biomass production and seed formation, and analysis of molecular approaches to overcome the limitations imposed on these processes by the environment.

AGRON 518: Microwave Remote Sensing
(Cross-listed with E E, MTEOR). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Math 265 or equivalent
Microwave remote sensing of Earth's surface and atmosphere using satellite-based or ground-based instruments. Specific examples include remote sensing of atmospheric temperature and water vapor, precipitation, ocean salinity, and soil moisture.

AGRON 519: Herbicide Physiology and Biochemistry
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: AGRON 316 (or equivalent) and AGRON 317
Herbicide mechanisms of action, selectivity, uptake, and translocation. Specific sites of herbicide action as they affect plant physiology. Herbicide resistance in weeds and crops. Implications of herbicides on weed management.

AGRON 520: Plant Breeding Methods
Cr. 3. S.
Prereq: AGRON 506
Breeding methods used in the genetic improvement of self-pollinated, cross-pollinated and asexually reproducing agronomic and horticultural crops. Application of biotechnology techniques in the development of improved cultivars.

AGRON 521: Principles of Cultivar Development
(3-0) Cr. 3. F.
Prereq: AGRON 421 and STAT 401
Theoretical and practical exploration of breeding methods to develop clonal, pureline, inbred and hybrid cultivars. Principles and strategies to set breeding objectives, parental selection and germplasm management, population development, generation advancements, multiple trait selection, experimental designs in breeding programs; seed production and certification. Introduce tools available to a breeder.

AGRON 522: Field Methods in Plant Breeding
(0-6) Cr. 1-2. Alt. SS., offered odd-numbered years.
Prereq: AGRON 521
Field experience in planning and conducting plant breeding research for germplasm and cultivar development. Offered on a satisfactory-fail basis only.

AGRON 523: Molecular Plant Breeding
(2-2) Cr. 3. S.
Prereq: AGRON 421 or AGRON 521, GDCB 542A
Plant breeding in the era of sequenced genomes and transformation. High throughout genomic technologies will be presented in relation to various applications in plant breeding.

AGRON 524: Applied Plant Molecular Genetics & Biotechnology
Cr. 3. F.
Prereq: AGRON 506
Basic principles and applied techniques used in the genetic improvement of crop plants. Discussion of structure and function of genes that control traits of value. Types of molecular markers, analysis of quantitatively inherited traits, genome mapping, analyses of databases.

AGRON 525: Crop and Soil Modeling
(3-0) Cr. 3. F.
Prereq: MATH 165 or Math 181 or equivalent; AGRON 316 or Agron 354 or equivalent.
Understanding basic crop physiology and soil processes through the use of mathematical and statistical approaches. Structure of crop models, dynamics and relationship among components such as leaf-level photosynthesis, canopy architecture, root dynamics and soil carbon and nitrogen pools.

AGRON 526: Field Plot Technique
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 401
Planning experiments for agricultural research, analysis of data, and concepts in data interpretation.

AGRON 528: Quantitative Genetics for Plant Breeding
(3-0) Cr. 3. S.
Prereq: AGRON 506 or AGRON 513
An introduction to the application of quantitative genetics to plant breeding programs.

AGRON 530: Ecologically Based Pest Management Strategies
(Cross-listed with ENT, PL P, SUSAG). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes.

AGRON 531: Crop Ecology and Management
(3-0) Cr. 3. F.
Prereq: AGRON 501, AGRON 502, AGRON 503; AGRON 512 and AGRON 514 recommended
Ecological principles underlying crop production systems. Crop production in the context of management approaches, system resources and constraints, and interactions. Emphasis on the ecology of row and forage crops common to the Midwest. Required course for the Master of Science in Agronomy degree program.

AGRON 532: Soil Management
(3-0) Cr. 3. F.
Prereq: AGRON 501, AGRON 503, AGRON 512. Recommended AGRON 513
Evaluates the impact of various soil management practices on soil and water resources. Combines and applies basic information gained in Agron 502 and Agron 512. Emphasizes the agronomic, economic, and environmental effects of soil management strategies. Required course for the Master of Science in Agronomy degree program.

AGRON 533: Crop Protection
(3-0) Cr. 3. F.
Prereq: AGRON 514
Integrated management systems for important crop pests. Cultural, biological and chemical management strategies applicable to major crops grown in the Midwest. Required course for the Master of Science in Agronomy degree program.

AGRON 534: Seed and Variety, Testing and Technology
(Cross-listed with STB). (2-0) Cr. 2.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
The components of seed quality and how they are assessed in the laboratory, including traits derived from modern biotechnology. The impact of new technologies on seed quality testing. Variety maintenance procedures and breeder seed. Variety identification: phenotype and grow-out trials, isozyme testing, and DNA marker testing. Procedures for evaluating varieties. The variance tests appropriate for fixed effects analysis of variance. Statistical inference and stratification for yield trials. Use of strip plot testing.

AGRON 535: Introduction to the Seed Industry
(Cross-listed with STB). Cr. 1.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
An analysis of the defining characteristics of the seed industry and introduction to the Master in Seed Technology and Business curriculum. The tasks of crop improvement and seed production will be analytically related to basic management functions and classifications of management activities that are used in the study of business administration. Management tasks and roles will be analyzed in related to the public policy issues that shape the seed industry, including ethical and economical approaches to biotechnology, intellectual property, and corporate responsibility.

AGRON 536: Quantitative Methods for Seed
(Cross-listed with STB). (2-0) Cr. 2. F.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
Quantitative Methods for analyzing and interpreting agronomic and business information for the seed industry. Principles of experimental design and hypothesis testing, regression, correlation, analysis of variance, and graphical representation of data. Use of spreadsheets and statistical software for manipulating, analyzing and presenting data.

AGRON 538: Seed Physiology and the Environment
(Cross-listed with HORT). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: AGRON 316; CHEM 231 or CHEM 331
Physiological aspects of seed development, maturation, longevity, dormancy, and germination of agronomic and horticultural crops and their interactions with field and storage environments. Emphasis on current literature and advanced methodology.

AGRON 539: Seed Conditioning and Storage
(Cross-listed with STB). (2-0) Cr. 2. F.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
The technical operations which may be carried out on a seed lot from harvest until it is ready for marketing and use. The opportunities for quality improvement and the risks of deterioration which are present during that time. Analysis of the costs of and benefits of operations. Evaluation of equipment based on benefits to the customer and producer. Interpretation of the role of the conditioning plant and store as focal points within the overall operations of a seed company.

AGRON 541: Applied Agricultural Meteorology
Cr. 2-3. F.S.SS.
Prereq: AGRON 206 or upper division Biological Science
Applied concepts in agricultural meteorology. Basic concepts of weather and of crop/climate relationships influencing production, protection, yield and associated production risk factors. Self study sections are available to resident and to distant education students all semesters. Credit for only one of Agron 503 or 541 may be applied toward graduation.

AGRON 544: Host-Pest Interactions
Cr. 3. F.
Prereq: AGRON 501
Incorporation of the principles of integrated pest management and crop protection. Management systems (biological, cultural, chemical) and strategies which practice principles of weed science, plant pathology, and entomology. Enrollment is restricted to off-campus students in Agronomy MS in Plant Breeding.

AGRON 546: Strategies for Diversified Farming Systems
(Cross-listed with HORT, SUSAG). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: SUSAG 509
Project-focused engagement in food and farming systems using tools and perspectives drawn from multiple disciplines. Includes a field component.

AGRON 547: Seed Production
(Cross-listed with STB). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of instructor
Survey of crop production; including management of soil fertility, planting dates, populations, weed control, and insect control. Analysis of the principles of seed multiplication and the key practices which are used to ensure high quality in the products. Field inspection procedures and production aspects that differ from other crop production. Foundation seed production. Analysis of the typical organization of field production tasks. Resources and capabilities required. Survey of differences in seed production strategies between crops and impact of differences on management of seed production.

AGRON 551: Growth and Development of Perennial Grasses
(Cross-listed with HORT). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: Junior or senior or graduate classification or permission of instructor
Selected topics on anatomy, morphology, and physiology relative to growth and development of perennial grasses. Emphasis on growth and development characteristics peculiar to grasses and variations of such characteristics under natural and managed conditions.

AGRON 552: GIS for Geoscientists
(Dual-listed with AGRON 452). (Cross-listed with ENSCI, GEOL). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

AGRON 553: Soil-Plant Relationships
(Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: AGRON 354
Composition and properties of soils in relation to the nutrition and growth of plants.

AGRON 554: Advanced Soil Management
(2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: AGRON 354; MATH 165
Implications of soil management on the soil environment and root activity. Effect of soil physical properties on soil erosion.

AGRON 555: Environmental Soil Mineralogy
(Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: AGRON 473, CHEM 178. Recommend: GEOL 311
Structure and behavior of clay minerals, humic substances and biochar in soil environments, with emphasis on reactions and environmental implications.

AGRON 556: Agroecosystem Nutrient Cycles
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 3 credits in chemistry and 6 credits in biology; Recommended: ENSCI 382, ENSCI 553, or upper-level coursework in nutrient cycles
Major, biologically important agroecosystem nutrient cycles as linked to energy (carbon) and water. Effects of agricultural production and management on cycling within systems and transfer among system at local, regional and global scales will be emphasized.

AGRON 558: Laboratory Methods in Soil Chemistry
(Cross-listed with ENSCI). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: AGRON 354 and CHEM 211
Experimental and descriptive inorganic and organic analyses. Operational theory and principles of applicable instruments, including spectrophotometry, atomic and molecular absorption and emission spectroscopy, mass spectrometry, X-ray diffraction and fluorescence, gas and ion chromatography, and ion-selective electrodes.

AGRON 559: Environmental Soil and Water Chemistry
(Dual-listed with AGRON 459). (Cross-listed with ENSCI). (3-3) Cr. 4. F.
Prereq: Two semesters of college-level chemistry, MATH 140, AGRON 182 (or equivalent) or AGRON 360; GEOL 100 and AGRON 354 recommended
An introduction to the chemical properties of soils, chemical reactions and transformations in soils and surface waters, and their impact on the environment. Topics include solution chemistry in soils and surface waters, solid-phase composition of soils, reactions at the solid-solution interface, and applications to contemporary environmental issues.

AGRON 561: Population and Quantitative Genetics for Breeding
(Cross-listed with AN S). (4-0) Cr. 4. F.
Prereq: STAT 401
Population and quantitative genetics for plant and animal genetics. Study of the genetic basis and analysis of variation in quantitative traits in domestic or experimental populations using phenotypic and molecular marker data, including estimation of heritability and other genetic parameters, linkage analysis and mapping of quantitative trait loci, and the impact of inbreeding, heterosis, and genotype-by-environment interaction.

AGRON 563: Soil Formation and Landscape Relationships
(Dual-listed with AGRON 463). (Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. Credit for one of AGRON 463 or AGRON 463I may be applied for graduation.

AGRON 563I: Soil Formation and Landscape Relationships
(Dual-listed with AGRON 463I). (Cross-listed with ENSCI, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

AGRON 570: Risk Assessment for Food, Agriculture and Veterinary Medicine
(Cross-listed with TOX, VDPAM). (3-0) Cr. 3. F.
Prereq: Statistics 300-level or higher.
Risk assessment principles as applied to biological systems. Exposure and effects characterization in human and animal health and ecological risk assessment. Risk analysis frameworks and regulatory decision-making. Introduction to quantitative methods for risk assessment using epidemiological and distributional analysis. Uncertainty analysis. This course is available only by distance.

AGRON 575: Soil Formation and Transformation
(Cross-listed with ENSCI). (3-0) Cr. 3. F.
Prereq: AGRON 463 or equivalent
Advanced study of soil formation, emphasizing relationships among soils, landscapes, environment, humans, and land use.

AGRON 577: Soil Physics
(Dual-listed with AGRON 477). (Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: AGRON 182 or equivalent and MATH 166 recommended
The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

AGRON 578: Laboratory Methods in Soil Physics
(Cross-listed with ENSCI). (0-3) Cr. 1. S.
Prereq: concurrent enrollment in AGRON 477 or AGRON 577
Methods of measuring soil physical properties such as texture, density, and water content, and transport of heat, water, and gases.

AGRON 584: Organic Agricultural Theory and Practice
(Dual-listed with AGRON 484). (Cross-listed with HORT, SUSAG). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 9 cr. in biological or physical sciences
Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives.

AGRON 585: Soil and Environmental Microbiology
(Dual-listed with AGRON 485). (Cross-listed with ENSCI, MICRO). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

AGRON 588: GIS for Geoscientists II
(Dual-listed with AGRON 488). (Cross-listed with ENSCI, GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

AGRON 590: Special Topics
Cr. arr. Repeatable.
Prereq: 15 credits in agronomy
Literature reviews and conferences on selected topics in crops, soils, or agricultural meteorology according to needs and interest of student.

AGRON 591: Agronomic Systems Analysis
(3-0) Cr. 3. S.
Prereq: AGRON 511, AGRON 513, AGRON 531, AGRON 532, AGRON 533
Analysis of cropping systems from a problem-solving perspective. Case studies will be used to develop the students' ability to solve agronomic problems. Required course for the Master of Science in Agronomy degree program.

AGRON 592: Current Issues in Agronomy
(3-0) Cr. 3. S.
Prereq: AGRON 501, AGRON 503, AGRON 511, AGRON 512, AGRON 513, AGRON 514
Critical analysis and discussion of agricultural practices, programs, and policies of current interest to the field of agronomy. Leadership skill development through consideration of technical, social, and ethical components underlying controversial topics. Enhancement of communication proficiency through debate and writing in order to define problems, articulate possible solutions, and propose appropriate courses of action. Required course for the Master of Science in agronomy degree program.

AGRON 593: Workshop in Agronomy
Cr. arr. Repeatable.
Prereq: Graduate classification

AGRON 594: Agronomy MS Practicum
(1-0) Cr. 1. SS.
Prereq: AGRON 501, AGRON 502, AGRON 503, AGRON 514 (or current enrollment. Recommended: AGRON 511, AGRON 512, AGRON 513
Practical field and laboratory experiences integrating coursework in climatology, crops, and soils. Includes lectures, labs and local agri-business tours.

AGRON 595: Seed Quality, Production, and Research Management
(Cross-listed with STB). (3-0) Cr. 3.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
Advanced survey of the organization, staff capabilities and management characteristics typical in seed production and crop improvement in seed enterprises. Analysis of the use of quality information in the management of seed operations and sales. Process management applications for seed. Production planning for existing capacity. Analysis of the manager's tasks in the annual cycle and how the tasks of these managers relate to the general categories of business management roles. Difference in management strategies used with different situations and groups of employees.

AGRON 599: Creative Component
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599A: Agricultural Meteorology
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599B: Crop Production and Physiology
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599C: Plant Breeding
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599D: Soil Chemistry
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599E: Soil Fertility
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599F: Soil Management
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599G: Soil Microbiology and Biochemistry
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599H: Soil Morphology and Genesis
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599I: Soil Physics
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599K: Seed Science
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599L: Weed Science
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599M: Agronomy
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

Courses for graduate students:

AGRON 600: Seminar
(1-0) Cr. 1. Repeatable, maximum of 6 times. F.S.
Reports and discussion of recent literature and research.

AGRON 600A: Seminar: Plant Breeding
(1-0) Cr. 1. Repeatable, maximum of 6 times. F.S.
Instruction and practice in giving scientific presentations related to the fields of plant breeding, genetics, or genomics, with an emphasis on effective communication and presentation techniques. An oral seminar and a poster presentation are required, along with analyses of other seminars, and participation in planning and hosting invited speakers.

AGRON 600B: Seminar: Soils
(1-0) Cr. 1. Repeatable, maximum of 6 times. S.
Reports and discussion of recent literature and research.

AGRON 600C: Seminar: Crop Production and Physiology
(1-0) Cr. 1. Repeatable, maximum of 6 times. F.S.
Reports and discussion of recent literature and research.

AGRON 601: Agronomic Science Presentations
(3-0) Cr. 2. S.
Prereq: graduate status in agronomic science, permission of instructor.
Experience in critical communications in exchange of ideas through oral and poster presentations and scientific questioning/evaluation.

AGRON 605: Boundary-Layer Meteorology
(Cross-listed with MTEOR). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MTEOR 443 or equivalent-level course in engineering fluids
Atmospheric boundary-layer structure and dynamics. Diurnal and seasonal variations, turbulent fluxes and turbulence kinetic energy. Measurements and empirical relations for wind and temperature near the ground. Numerical simulation and applications to wind energy.

AGRON 610: Foundations of Sustainable Agriculture
(Cross-listed with A B E, ANTHR, SOC, SUSAG). (3-0) Cr. 3. F.
Prereq: Graduate classification, permission of instructor
Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts.

AGRON 621: Advanced Plant Breeding
(3-0) Cr. 3. S.
Prereq: AGRON 521, AGRON 526, AGRON 561, GEN 410
Estimation and interpretation of genetic effects and variances of plant breeding populations, analysis of mating designs, estimation of combining ability and heritability, best linear unbiased prediction, selection indices with and without molecular information, inbreeding and heterosis.

AGRON 625: Genetic Strategies in Plant Breeding
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: AGRON 521 and GDCB 510
Evaluation of genetic, molecular, and cellular approaches to crop improvement; gene transfer methods. Application and role of basic plant biology in breeding programs and processes; genome structure and function, gene isolation, expression, regulation, and modification. Integration of molecular and cellular methods in breeding strategies; analysis of alternative breeding methods, regulatory and ethical issues.

AGRON 655: Advanced Soil Fertility
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: AGRON 553
Evaluation of soil fertility and fertilizers; theory and applications.

AGRON 677: Advanced Soil Physics
(2-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: AGRON 577 and MATH 266; COM S 207 recommended
The flow and distribution of water, chemicals, and heat in soils. Physical principles and applications.

AGRON 685: Advanced Soil Biochemistry
(Cross-listed with ENSCI, MICRO). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: AGRON 585
Chemistry of soil organic matter and biochemical transformations brought about by microorganisms and enzymes in soils.

AGRON 696: Research Seminar
(Cross-listed with BBMB, FOR, GDCB, HORT, PLBIO). Cr. 1. Repeatable.
Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

AGRON 698: Agronomy Teaching Practicum
Cr. 1-2. Repeatable. F.S.SS.
Prereq: Graduate classification in agronomy and permission of instructor
Graduate student experience in the agronomy teaching program. Offered on a satisfactory-fail basis only.

AGRON 699: Research
Cr. arr. Repeatable.

AGRON 699A: Agricultural Meteorology
Cr. arr. Repeatable.

AGRON 699B: Crop Production and Physiology
Cr. arr. Repeatable.

AGRON 699C: Plant Breeding
Cr. arr. Repeatable.

AGRON 699D: Soil Chemistry
Cr. arr. Repeatable.

AGRON 699E: Soil Fertility
Cr. arr. Repeatable.

AGRON 699F: Soil Management
Cr. arr. Repeatable.

AGRON 699G: Soil Microbiology and Biochemistry
Cr. arr. Repeatable.

AGRON 699H: Soil Morphology and Genesis
Cr. arr. Repeatable.

AGRON 699I: Soil Physics
Cr. arr. Repeatable.

AGRON 699J: Plant Physiology
Cr. arr. Repeatable.

AGRON 699K: Seed Science
Cr. arr. Repeatable.

AGRON 699L: Weed Science
Cr. arr. Repeatable.

Air Force Aerospace Studies (AFAS)

Courses primarily for undergraduates:

AFAS 103: Introductory Leadership Laboratory with Physical Training
(0-4) Cr. 2. Repeatable, maximum of 4 credits. F.S.
Prereq: Membership as a cadet in AFROTC
Instruction for new cadets on Air Force customs and courtesies; drill and ceremonies, issuing military commands, studying the environment of an Air Force officer and learning about areas of opportunity available to commissioned officers while also using basic military training skills and instruction to develop confidence, leadership, and communication skills through physical fitness. Full participation in all events will be determined based on student's physical and medical eligibility. Offered on a satisfactory-fail basis only.

AFAS 141: Foundations of the United States Air Force
(1-0) Cr. 1. F.
Basic introduction to the United States Air Force and Air Force Reserve Officer Training Corps. Mission and organization of the Air Force, officership and professionalism, military customs and courtesies, Air Force officer opportunities, and communication skills.

AFAS 142: Foundations of the United States Air Force
(1-0) Cr. 1. S.
A continuation of 141. Topics include Air Force installations, Air Force core values, leadership and team building, further study of interpersonal communication, the Oath of Office and Commissioning.

AFAS 203: Basic Leadership Laboratory with Physical Training
(0-4) Cr. 2. Repeatable, maximum of 4 credits. F.S.
Prereq: Membership as a cadet in AFROTC
Instruction and critique of cadets on Air Force customs and courtesies, drill and ceremonies, and issuing military commands in preparation for AFROTC summer Field Training while also using basic military training skills and instruction to develop confidence, leadership, and communication skills through physical fitness. Full participation in all events will be determined based on student's physical and medical eligibility. Offered on a satisfactory-fail basis only.

AFAS 241: The Evolution of USAF Air & Space Power I
(1-0) Cr. 1. F.
Examines the general aspects of air and space power through a historical perspective. Utilizing this perspective, the course covers a time period from the first balloons and dirigibles to the Korean War. Historical examples are provided to illustrate the development of airpower capabilities and missions to demonstrate the evolution of what has become today's USAF air and space power.

AFAS 242: The Evolution of USAF Air & Space Power II
(1-0) Cr. 1. S.
A continuation of AFAS 241 that examines the general aspects of air and space power through a historical perspective. Utilizing this perspective, the course covers a time period from the Korean War to the space-age global positioning systems of the Persian Gulf War. Historical examples are provided to illustrate the development of airpower capabilities and missions to demonstrate the evolution of what has become today's USAF air and space power.

AFAS 303: Intermediate Leadership Laboratory with Physical Training
(0-4) Cr. 2. Repeatable, maximum of 4 credits. F.S.
Prereq: Membership as a cadet in AFROTC
Mid-level management of leadership experience involving planning and controlling of most AFROTC military activities. Students will help senior leadership to prepare and present briefings and other oral and written communications; provide interviews, guidance, and information that will increase the understanding, motivation, and performance of other cadets; and use advanced military training skills and instruction to develop confidence, leadership, and communication skills through physical fitness. Full participation in all events will be determined based on student's physical and medical eligibility. Offered on a satisfactory-fail basis only.

AFAS 341: Air Force Leadership Studies I
(3-0) Cr. 3. F.
A look at the fundamental issues of leadership and management in the U.S Air Force; a large and diverse organization. It examines the theoretical aspects of leadership, management, communications, motivation and problem-solving while studying them against the backdrop of the U.S. Air Force. The course also conducts hands-on exercises to apply principles learned. While the curriculum is focused on the Air Force as an organization, the principles studied are applicable to most organizations.

AFAS 342: Air Force Leadership Studies II
(3-0) Cr. 3. S.
Prereq: AFAS 341
A continuation of AFAS 341, that looks at the advanced issues of leadership and management in the U.S. Air Force; a large and diverse organization. It examines the theoretical aspects of leadership, managment, communications, motivation and problem-solving while studying them against the backdrop of the U.S. Air Force. The course also conducts hands-on exercises to apply principles learned. While the curriculum is focused on the Air Force as an organization, the principles studied are applicable to most oranizations.

AFAS 403: Advanced Leadership Laboratory with Physical Training
(0-4) Cr. 2. Repeatable, maximum of 6 credits. F.S.
Prereq: Membership as a cadet in AFROTC
Advanced leadership experience involving the planning and controlling of all upper-level AFROTC military activities. Students will prepare and present briefings and other oral and written communications; provide interviews, guidance, and information that will increase the understanding, motivation, and performance of other cadets; and use advanced military training skills and instruction to develop confidence, leadership, and communication skills through physical fitness. Full participation in all events will be determined based on student's physical and medical eligibility. Offered on a satisfactory-fail basis only.

AFAS 441: Preparation for Active Duty
(3-0) Cr. 3. F.
Traces the source of military authority and responsibilities from the U.S. Constitution through the DoD to an Air Force officer. Examines the structure and capabilities of the other services and joint structures. Addresses the supervisory duties of an Air Force officer associated with administrative actions and military law as force management tools. Builds upon leadership and management skill learned in AFAS 341/342 and includes demonstrations of written and verbal communications processes.

AFAS 442: National Security Affairs
(3-0) Cr. 3. S.
Examines the national security process through review of the Department of Defense's statutory administrative and operational relationships as context for this course's regional studies component. Reviews functions of air and space power as outlined in Air Force doctrine and introduces the concept of joint operations. Integrates these concepts with regional studies to survey issues of interest to professional military officers and governmental leaders. Selectively reviews and discusses Africa, Latin America, South Asia, East Asia, Europe, Russia and the Middle East. Meets International Perspectives Requirement.

American Indian Studies (AM IN)

Courses primarily for undergraduates:

AM IN 210: Introduction to American Indian Studies
(3-0) Cr. 3. F.S.SS.
Introduction to the multidisciplinary aspects of American Indian Studies. Topics include the relevant events and ideas defining the contemporary American Indian experience, on and off reservation, in the United States. Sovereignty, identity, jurisdiction, taxes, economic development, education, and other issues are addressed.
Meets U.S. Diversity Requirement

AM IN 240: Introduction to American Indian Literature
(Cross-listed with ENGL). (3-0) Cr. 3. F.
Prereq: Credit in or exemption from ENGL 150
Appreciation of oral and written forms of American Indian literatures. Tropes and techniques in oral, visual and written texts. Focus on the role of American Indians in interdisciplinary approaches to modern social and environmental issues as expressed in literary works.
Meets U.S. Diversity Requirement

AM IN 310: Topics in American Indian Studies
(3-0) Cr. 3. F.S.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. Topics vary by section. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310A: Topics in American Indian Studies: Federal Indian Policy
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section examines the impact of federal American Indian policies on Native communities. Topics discussed are sovereignty, recognition, the role of the Supreme Court, specific policies like allotment, and other relevant issues. The focus lies on contemporary Indian Country. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310B: Topics in American Indian Studies: Music, Performance, and Culture
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section examines American Indian cultures from the perspective of ethnomusicology and performances of identity. Topics include the role of music for culture, the development of an American Indian musical style, powwows and their significance, and other relevant issues. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310C: Topics in American Indian Studies: American Indian Film
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section examines the role of American Indians in the movie industry. The course explores the development of American Indian characters and filmmaking, and the relevance for Native communities, through feature films and academic analysis. One focus of the course is a comparison of non-Native and Native films in form, content, and message, and the changing character of Native representation in both. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310D: Topics in American Indian Studies: Religions and Spiritual Traditions
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section looks at American Indian religions, from traditional practices through the Native American Church to christianity and other mainstream religions. It explores the religious landscapes of contemporary Native North America and the connections to communities. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310E: Topics in American Indian Studies: American Indian Education
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section examines current and historical issues in American Indian education. Topics discussed include traditional education, changes to formal education, tribal colleges and universities, current school systems, and other relevant topics. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310F: Topics in American Indian Studies: Land, Water, and Resources
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section looks at land rights, water rights, and resource extraction. Topics discussed include the consequences of allotment and fractionation, water usage agreements, and resource policies as they apply to on- and off-reservation Native communities. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310G: Topics in American Indian Studies: Native Art
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section looks at Native art and the connections to identity and cultures. Topics discussed include traditional Native arts, the depiction of American Indians in art, the evolution of contemporary, modern Native art, the current global Native art market, and other relevant issues. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 315: Archaeology of North America
(Cross-listed with ANTHR). (3-0) Cr. 3. S.
Prereq: ANTHR 202
Prehistory and early history of North America as reconstructed from archaeological evidence; peopling of the New World; culture- historical sequences of major culture areas; linkages of archaeological traditions with selected ethnohistorically known Native American groups.
Meets U.S. Diversity Requirement

AM IN 320: Great Plains Archaeology
(Cross-listed with ANTHR). (3-0) Cr. 3. F.
Prereq: ANTHR 202
Prehistoric societies of the Great Plains region of North America, from initial occupation to European contact; emphasis on sociocultural changes, continuities, and adaptations to changing environments using archaeological, ecological, ethnographic information.
Meets U.S. Diversity Requirement

AM IN 322: Peoples and Cultures of Native North America
(Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 or AM IN 210
Origin, distribution, and pre-contact life of the indigenous peoples of North America. Survey of culture areas; language families, social and political systems, ecological and economic adaptations, religion and spirituality; impact of European contact; cultural resilience and revitalization in contemporary American Indian life.
Meets U.S. Diversity Requirement

AM IN 332: Current Issues in Native North America
(Dual-listed with AM IN 532). (Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 332A: Current Issues in Native North America: Gender and Family
(Dual-listed with AM IN 532A). (Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 332B: Current Issues in Native North America: Indigenous Ecologies and Geographies
(Dual-listed with AM IN 532B). (Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 332C: Current Issues in Native North America: Cultural and Political Movements
(Dual-listed with AM IN 532C). (Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 332D: Current Issues in Native North America: Regional Focus
(Dual-listed with AM IN 532D). (Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 342: American Indian Women Writers
(Cross-listed with ENGL, W S). (3-0) Cr. 3.
Prereq: ENGL 250
Literature of American Indian women writers which examines their social, political, and cultural roles in the United States. Exploration of American Indian women's literary, philosophical, and artistic works aimed at recovering elements of identity, redescribing stereotypes, resisting colonization, and constructing femininity.
Meets U.S. Diversity Requirement

AM IN 346: American Indian Literature
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 250
Survey of literature by Native Americans from pre-Columbian tales and songs to contemporary novels and poetry.
Meets U.S. Diversity Requirement

AM IN 426: Topics in Native American Architecture
(Cross-listed with ARCH). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of Native American/American Indian architecture, landscape architecture and planning considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment History, Theory, Culture. A maximum of 6 credits of ARCH 426 may be applied to degree program.
Meets U.S. Diversity Requirement

AM IN 490: Independent Study
Cr. arr. Repeatable, maximum of 9 credits.
Prereq: 6 credits in American Indian studies; permission of instructor and program director
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 6 credits in AM IN 490 may be counted toward graduation. If more than 3 credits in AM IN 490 are taken, they must be from different instructors.

American Sign Language (ASL)

Courses primarily for undergraduates:

ASL 101: American Sign Language I
(4-0) Cr. 4. F.S.
Introduction to American Sign Language (ASL). Development of expressive and receptive skills including vocabulary, grammar, usage, and cultural information. Note: Distinct from "Signed English". ASL is a natural language with its own rules of grammar and usage.
Meets U.S. Diversity Requirement

ASL 102: American Sign Language II
(4-0) Cr. 4. S.
Prereq: ASL 101
Introduction to American Sign Language (ASL) II continues development of expressive and receptive skills introduced in American Sign Language I, including vocabulary, grammar, usage, and cultural information. Distinct from "Signed English". ASL is a natural language with its own rules of grammar and usage.
Meets U.S. Diversity Requirement

ASL 107: Introduction to the Deaf-World
(1-0) Cr. 1.
Nature and significance of the Deaf-World as a cultural and linguistic minority.
Meets U.S. Diversity Requirement

ASL 201: Intermediate American Sign Language I
(4-0) Cr. 4. F.
Prereq: ASL 102 or equivalent.
Development of fluency for intermediate conversational skills. Review of grammar and varying grammatical forms for both structured and unstructured social situations such as sharing opinions, discussing weekend activities, and exchanging views on current topics.

ASL 202: Intermediate American Sign Language II
(4-0) Cr. 4. S.
Prereq: ASL 201 or equivalent.
A continuation and further application of language principles learned in ASL 201, to deepen ability to actively engage in dialogue both in structured and unstructured social situations. Further fluency in intermediate conversational skills will be developed, particularly in the areas of sematic equivalence and dialogic/monologic register.

ASL 275: Topics in Deaf Culture
(3-0) Cr. 3.
Focus on contemporary topics in Deaf Culture, Communities, and History. Readings and discussion from a wide range of sources. Topics vary according to faculty interest.
Meets U.S. Diversity Requirement

ASL 305: ASL Classifiers and Depiction
(3-0) Cr. 3.
Prereq: ASL 205
Focused analysis, documentation, discussion, and increased development of classifiers and depiction in ASL. Investigation in how these grammatical features are deliberately incorporated into conversational, presentational, scientific, and artistic language production.

ASL 325: Deaf Peoples: Pre-World War II
(3-0) Cr. 3. F.
Prereq: ASL 206 or instructor's permission.
Perspectives on and treatment of deaf people as individuals and groups prior to World War II. Taught in American Sign Language.
Meets U.S. Diversity Requirement

ASL 490: Independent Study
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: 6 credits in ASL and permission of department chair
Designed to meet the needs of students in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. No more than 6 credits of ASL 490 may be counted towards graduation.

Animal Ecology (A ECL)

Courses primarily for undergraduates:

A ECL 312: Ecology
(Cross-listed with BIOL, ENSCI). (3-3) Cr. 4. F.SS.
Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L
Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats.

A ECL 312I: Ecology
(Cross-listed with ENSCI, IA LL). Cr. 4. SS.
An introduction to the principles of ecology at the population, community and ecosystem level. Field studies of local lakes, wetlands and prairies are used to examine factors controlling distributions, interactions, and roles of plants and animals in native ecosystems.

A ECL 321: Fish Biology
(2-3) Cr. 3. S.
Prereq: A ECL 365
Biology, ecology, and evolution of fishes. Emphasis on structure, physiology, and behavior, including a focus on the conservation and management of fishes and their habitats. Laboratory focus on fish morphology, survey methods, identification, distribution, habits, and habitats of fishes.

A ECL 326I: Ornithology
(Cross-listed with IA LL). Cr. 4. SS.
The biology, ecology, and behavior of birds with emphasis on field studies of local avifauna. Group projects stress techniques of population analysis and methodology for population studies.

A ECL 333: Fisheries Techniques
(Cross-listed with NREM). (1-3) Cr. 2. F.
Prereq: BIOL 212
Introduction to techniques used in the collection and interpretation of fish population data in the field and in the lab. Course objectives include an understanding of population survey methodology and improving student critical thinking and teamwork skills. Laboratory focuses on field trips and hands-on sampling experience.

A ECL 365: Vertebrate Biology
(Cross-listed with BIOL). (3-2) Cr. 4. F.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L
Evolution, biology, and classification of fish, amphibians, reptiles, birds, and mammals. Emphasis on a comparative analysis of the structure and function of organ systems. Laboratory exercises concentrate on morphology and identification of orders of vertebrates.

A ECL 366: Natural History of Iowa Vertebrates
(2-3) Cr. 3. S.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L
Vertebrate fauna of Iowa, including fishes, amphibians, reptiles, birds, and mammals. Species identification, habitat requirements, community structure and assessment, conservation issues that include historical population changes and value of wild animals to the region's ecological and economic health.

A ECL 371: Ecological Methods
(Cross-listed with BIOL). (2-3) Cr. 3. S.
Prereq: A ECL 312; STAT 101 or STAT 104
Quantitative techniques used in management of natural resources with emphasis on inventory and manipulation of habitat and animal populations.

A ECL 401: Intro to Aquatic Animal Medicine
(Cross-listed with B M S). (1-2) Cr. 1. S.
8 week course. Introductory course with focus on fin fish production, health and medicine. Course content will help define future roles for veterinarians, producers, and service providers. Emphasis will be placed on anatomy, pathology, infectious diseases, nutrition, regulatory constraints in production, food safety, and current research. Field trip to aquaculture facility.

A ECL 404I: Behavioral Ecology
(Cross-listed with IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: Two semesters of biology
Animal coloniality, courtship, territoriality, predator defense, habitat selection, foraging, mating systems, and parental care will be examined in the field in order to evaluate various ecological and evolutionary theories of animal behavior.

A ECL 415: Ecology of Freshwater Invertebrates, Plants, and Algae
(Dual-listed with A ECL 515). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A ECL 312
Identification, biology, and ecological requirements of freshwater invertebrates, plants and algae. Additional emphases on community sampling methods and analysis, and use of organisms as tools for aquatic ecosystem health assessment.

A ECL 418: Stream Ecology
(Dual-listed with A ECL 518). (Cross-listed with ENSCI). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A ECL 486
Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

A ECL 419I: Vertebrate Ecology and Evolution
(Cross-listed with IA LL). Cr. 4. SS.
Field and laboratory study of representative vertebrates of northwestern Iowa. Observations and experimentation emphasize ecological histories by integrating concepts of functional morphology, behavioral ecology, and evolutionary biology.

A ECL 420I: Amphibians and Reptiles
(Cross-listed with IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: Two semesters of biology
Ecology, behavior, and conservation biology of amphibians and reptiles with emphasis on their anatomy and morphology; temperature and water regulation; locomotion; life history; reproduction; population and community ecology; and conservation.

A ECL 425: Aquatic Insects
(Dual-listed with A ECL 525). (Cross-listed with ENT). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312 or equivalent
Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

A ECL 440: Fishery Management
(Dual-listed with A ECL 540). (2-3) Cr. 3. F.
Prereq: A ECL 312, A ECL 321, STAT 101 or STAT 104; credit or enrollment in A ECL 486
Biological basis of fishery management, fishery problems, and management practices for freshwater, anadromous, and marine fisheries.

A ECL 442: Aquaculture
(Dual-listed with A ECL 542). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 211 and BIOL 212.
Concepts related to the culture of aquatic organisms including culture systems, water quality, nutrition, genetics, diseases, and marketing.

A ECL 451: Wildlife Ecology and Management
(2-3) Cr. 3. F.
Prereq: A ECL 371
Ecological theory and practice of wildlife management, including, population ecology, habitat management, and current issues in the field. Course involves a series of case studies addressing actual wildlife issues using field and quantitative methods.

A ECL 454: Principles of Wildlife Disease
(Dual-listed with A ECL 554). (3-0) Cr. 3. S.
Prereq: Junior standing and at least 10 credits in biological sciences at the 300+ level
Ecological and epidemiological aspects of diseases as they relate to wildlife populations. Topics to be covered include: major classes of disease; detection, description, monitoring, and management of disease; characteristics and interactions between disease agents and wildlife hosts; relationships among wildlife, domestic animal, and human health.

A ECL 455: International Wildlife Issues
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A ECL 365, A ECL 312 or graduate standing; NREM 120
Biological, political, social, and economic factors affecting the management of international wildlife resources.
Meets International Perspectives Requirement.

A ECL 457: Herpetology
(Cross-listed with BIOL). (2-0) Cr. 2. F.
Prereq: BIOL 351 or BIOL 365
Biology, ecology, and evolution of amphibians (salamanders, frogs, caecilians) and reptiles (lizards, snakes, tuatara, turtles, crocodilians). Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of amphibians and reptiles in ecosystems, and conservation. Laboratory focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

A ECL 457L: Herpetology Laboratory
(Cross-listed with BIOL). (0-3) Cr. 1. F.
Prereq: BIOL 351 or BIOL/A ECL 365; concurrent registration in BIOL 457 or A ECL 457
Laboratory to accompany Biology/Animal Ecology 457. Focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

A ECL 458: Ornithology
(Cross-listed with BIOL). (2-0) Cr. 2. S.
Prereq: A ECL 365 or BIOL 351
Biology, evolution, ecology and taxonomy of birds. Emphasis on structure, physiology, behavior, communication, navigation, reproduction, and conservation.

A ECL 458L: Ornithology Laboratory
(Cross-listed with BIOL). (0-3) Cr. 1. S.
Prereq: BIOL 351 or AECL/BIOL 365. Concurrent enrollment in AECL/BIOL 458 is required.
Laboratory complements lecture topics with emphasis on external anatomy, identification and distribution of Midwest birds, and field trips.

A ECL 459: Mammalogy
(Cross-listed with BIOL). (2-0) Cr. 2. S.
Prereq: BIOL 351 or A ECL 365
Biology, ecology, and evolution of mammals. Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of mammals in ecosystems, and conservation.

A ECL 459L: Mammalogy Laboratory
(Cross-listed with BIOL). (0-3) Cr. 1. S.
Prereq: BIOL 351 or BIOL/AECL 365; concurrent enrollment in AECL 459 or BIOL 459 required.
Laboratory focus on identification, survey methods, distribution, habits, and habitats of mammals. Several field trips.

A ECL 480: Studies in Marine Biology
Cr. 1-8. Repeatable. SS.
Courses taken at Gulf Coast Research Laboratory and other marine biological stations are transferred to Iowa State University under this number.

A ECL 486: Aquatic Ecology
(Dual-listed with A ECL 586). (Cross-listed with BIOL, ENSCI). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

A ECL 486L: Aquatic Ecology Laboratory
(Dual-listed with A ECL 586L). (Cross-listed with BIOL, ENSCI). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

A ECL 489: Population Ecology
(Dual-listed with A ECL 589). (Cross-listed with BIOL). (2-2) Cr. 3. F.
Prereq: BIOL 312, STAT 101 or STAT 104, a course in calculus, or graduate standing
Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation.

Courses primarily for graduate students, open to qualified undergraduates:

A ECL 515: Ecology of Freshwater Invertebrates, Plants, and Algae
(Dual-listed with A ECL 415). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A ECL 312
Identification, biology, and ecological requirements of freshwater invertebrates, plants and algae. Additional emphases on community sampling methods and analysis, and use of organisms as tools for aquatic ecosystem health assessment.

A ECL 516: Avian Ecology
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A ECL 365, A ECL 312, or graduate standing
Current topics and theories including avian breeding and foraging ecology, population biology, community structure, habitat selection, field methodologies, and data interpretation.

A ECL 518: Stream Ecology
(Dual-listed with A ECL 418). (Cross-listed with ENSCI). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A ECL 486
Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

A ECL 520: Fisheries Science
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A ECL 312, A ECL 321
Concepts, approaches, and techniques for assessment of recreational and commercial fisheries. Scope will range from individual fish to entire ecosystems, both freshwater and marine.

A ECL 523I: Fish Ecology
(Cross-listed with IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Basic principles of fish interaction with the biotic and abiotic environment. Field methods, taxonomy, and biology of fish with emphasis on the fish fauna of northwestern Iowa.

A ECL 525: Aquatic Insects
(Dual-listed with A ECL 425). (Cross-listed with ENT). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312 or equivalent
Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

A ECL 526I: Advanced Field Ornithology
(Cross-listed with IA LL). Cr. 2. SS.
Prereq: Concurrent registration in IA LL 326I
Field study of birds of the upper Midwest; extended field trip to Minnesota and Wisconsin; individual or group project.

A ECL 531: Conservation Biology
(Cross-listed with EEOB). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 312; BIOL 313 or graduate standing
Examination of conservation issues from a population and a community perspective. Population-level analysis will focus on the role of genetics, demography, and environment in determining population viability. Community perspectives will focus on topics such as habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology.

A ECL 531I: Conservation Biology
(Cross-listed with EEOB, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: IA LL 312I
Population-and community-level examination of factors influencing the viability of plant and animal populations from both demographic and genetic perspectives; assessment of biodiversity; design and management of preserves.

A ECL 535I: Restoration Ecology
(Cross-listed with EEOB, ENSCI, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: A course in ecology
Ecological principles for the restoration of native ecosystems; establishment (site preparation, selection of seed mixes, planting techniques) and management (fire, mowing, weed control) of native vegetation; evaluation of restorations. Emphasis on the restoration of prairie and wetland vegetation.

A ECL 540: Fishery Management
(Dual-listed with A ECL 440). (2-3) Cr. 3. F.
Prereq: A ECL 312, A ECL 321, STAT 101 or STAT 104; credit or enrollment in A ECL 486
Biological basis of fishery management, fishery problems, and management practices for freshwater, anadromous, and marine fisheries.

A ECL 542: Aquaculture
(Dual-listed with A ECL 442). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 211 and BIOL 212.
Concepts related to the culture of aquatic organisms including culture systems, water quality, nutrition, genetics, diseases, and marketing.

A ECL 551: Behavioral Ecology
(2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: a course in ecology or animal behavior
The study of how an animal's behavior affects its ability to survive and reproduce in its environment. Course topics, such as foraging behavior, sexual selection, parental care, etc., represent the interface of ecology, evolution, and behavior.

A ECL 554: Principles of Wildlife Disease
(Dual-listed with A ECL 454). (3-0) Cr. 3. S.
Prereq: Graduate classification
Ecological and epidemiological aspects of disease as they relate to wildlife populations. Topics to be covered include: major classes of disease; detection, description, monitoring, and management of disease; characteristics and interactions between disease agents and wildlife hosts; relationship among wildlife, domestic animal, and human health.

A ECL 570: Landscape Ecology
(Cross-listed with EEOB). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Permission of instructor; EEOB 588; a course in calculus
The study of ecological and evolutionary processes within a spatial context with emphasis on behavior, population, and community dynamics.

A ECL 573: Techniques for Biology Teaching
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 573A: Techniques for Biology Teaching : Animal Biology
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 573G: Techniques for Biology Teaching: Limnology
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 573I: Techniques for Biology Teaching: Insect Ecology
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 573W: Techniques for Biology Teaching: Project WET
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 586: Aquatic Ecology
(Dual-listed with A ECL 486). (Cross-listed with EEOB, ENSCI). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

A ECL 586L: Aquatic Ecology Laboratory
(Dual-listed with A ECL 486L). (Cross-listed with EEOB, ENSCI). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

A ECL 589: Population Ecology
(Dual-listed with A ECL 489). (Cross-listed with EEOB). (2-2) Cr. 3. F.
Prereq: BIOL 312, STAT 101 or STAT 104, a course in calculus, or graduate standing
Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation.

A ECL 590: Graduate Independent Study
(Cross-listed with ANTHR, EEOB, IA LL). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

A ECL 590I: Special Topics: Graduate Independent Study
(Cross-listed with ANTHR, EEOB, IA LL). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

A ECL 599: Creative Component
Cr. arr.
Prereq: Nonthesis M.S. option only

Courses for graduate students:

A ECL 611: Analysis of Populations
(Cross-listed with EEOB). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 312; STAT 401; a course in calculus
Quantitative techniques for analyzing vertebrate population data to estimate parameters such as density and survival. Emphasis on statistical inference and computing.

A ECL 698: Animal Ecology Teaching Practicum
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification in animal ecology and permission of instructor
Graduate student experience in the animal ecology teaching program. Offered on a satisfactory-fail basis only.

A ECL 699: Research
Cr. arr. Repeatable.

A ECL 699I: Research
(Cross-listed with ANTHR, EEOB, GDCB, IA LL). Cr. 1-4. Repeatable.

Animal Science (AN S)

Courses primarily for undergraduates:

AN S 101: Working with Animals
(1-2) Cr. 2. F.S.
A hands-on introductory course in skills for proper care and management of domestic animals. Husbandry skills including health observation, animal movement, identification, management procedures, and environmental assessment are covered.

AN S 110: Orientation in Animal Science and ISU
(2-0) Cr. 1. F.S.
Orientation to the university and Department of Animal Science. Challenges and opportunities available to the professional animal agriculturalist. Professional goal setting, portfolio development, and development of interpersonal skills in the context of pursuing a career in animal science.

AN S 114: Survey of the Animal Industry
(2-0) Cr. 2. F.S.
Ways domestic animals serve the basic needs of humans for food, shelter, protection, fuel, and emotional well-being. Terminology, basic structures of the industries surrounding the production, care, and marketing of domestic animals in the U.S.

AN S 116: Practicum in Safe Equine Handling and Welfare
(0-3) Cr. 1. F.SS.
Development of best practices for safe horse handling and practical equine health care tasks. Course will focus on equine welfare and human safety as well as provide training in necessary every day skills needed to own a horse or to work at a horse farm. Certificate of Safe Equine Handling and Welfare available upon course completion. Offered on satisfactory - fail grading basis only. Offered on a satisfactory-fail basis only.

AN S 190: Livestock Handling, Safety and Welfare
Cr. 2.
Prereq: AN S 101
Understanding of animal perception to develop best care practices involved in handing of livestock species (beef, sheep, swine, dairy, equine, poultry). Intensive development of skills associated with handling and moving healthy and compromised livestock in respect to human and animal welfare. Integration of scientific and theoretical knowledge of biosecurity and animal-human interactions as it related to livestock handling and movement.

AN S 199: Marketing and Management of Livestock Events
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Credit or enrollment in AN S 101 or AN S 114
Management and coordination of livestock shows, sales and events, including program planning, staff and volunteer management, time management, publicity and promotion for fairs, shows, clinics, expos, and other events. For section E students are expected to take the fall and spring courses consecutively. Offered on a satisfactory-fail basis only. A maximum of two credits of AnS 199 may be applied toward the total credits required for graduation.

AN S 199A: Marketing and Management of Livestock Events: Beef
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Credit or enrollment in AN S 101 or AN S 114
Management and coordination of livestock shows, sales and events, including program planning, staff and volunteer management, time management, publicity and promotion for fairs, shows, clinics, expos, and other events. For section E students are expected to take the fall and spring courses consecutively. Offered on a satisfactory-fail basis only. A maximum of two credits of AnS 199 may be applied toward the total credits required for graduation.

AN S 199E: Marketing and Management of Livestock Events: Horses
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Credit or enrollment in AN S 101 or AN S 114
Management and coordination of livestock shows, sales and events, including program planning, staff and volunteer management, time management, publicity and promotion for fairs, shows, clinics, expos, and other events. For section E students are expected to take the fall and spring courses consecutively. Offered on a satisfactory-fail basis only. A maximum of two credits of AnS 199 may be applied toward the total credits required for graduation.

AN S 207: The Art and Heritage of Livestock
(3-0) Cr. 3.
Using art as a venue to understand the legacy and heritage of livestock production and livestock's contribution to civilization and society; livestock's contributions to warfare, social class, industry, economies, etc.; history of the impact of livestock on painting, poetry, music, sculpture, advertising, pop culture, movies, religion and sports in society.

AN S 210: Career Preparation in Animal Science
(0-2) Cr. 1. F.S.
Prereq: Sophomore classification in An S
Life skill development emphasized in the context of career preparation. Assist students with career goal clarification, interview skills, resume and cover letter preparation. Internship development, job shadowing, and exploration of career option.

AN S 211: Issues Facing Animal Science
(0-2) Cr. 1. F.S.
Prereq: AN S 114, sophomore classification
Overview of the factors that define contemporary ethical and scientifically based issues facing animal agriculture. Life skill development (including interactive skills, communication ability, organization, information gathering, and leadership skills) emphasized in the context of issues study. Offered on a satisfactory-fail basis only.

AN S 214: Domestic Animal Physiology
(3-0) Cr. 3. F.S.
Prereq: BIOL 212, CHEM 163 or CHEM 177
Introduction to anatomy and physiology of the muscular, renal, skeletal, neural, mammary, cardiovascular, respiratory, immune, endocrine, reproductive, and digestive systems of domestic animals.

AN S 214L: Domestic Animal Anatomy and Physiology Lab
(0-2) Cr. 1. F.S.
Prereq: Concurrent enrollment in AN S 214
Basic anatomy of domestic animals.

AN S 216: Equine Science
(2-2) Cr. 3. F.S.SS.
Prereq: AN S 101 or AN S 114; one course in biology
Introduction to contemporary concepts, and basic practices and decisions necessary when managing horses through stages of their lives.

AN S 217: Equine Farm Practicum
(1-2) Cr. 2. F.
Prereq: Student majoring in Animal Science, riding experience An S, credit or concurrent enrollment in AN S 216
Intensified management of the equine farm. Provide students with experiential learning in all phases of horse production and management. Students assist with general farm management, preparing horses for sale, marketing techniques and web design.

AN S 223: Poultry Science
(2-2) Cr. 3. F.
Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising poultry through their production cycle.

AN S 224: Companion Animal Science
(2-2) Cr. 3. S.
Prereq: Course in biology
Introduction of students to contemporary concepts, and basic practices and decisions necessary when caring for the companion animal through stages of its life.

AN S 225: Swine Science
(2-2) Cr. 3. F.S.
Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising swine through the vertically integrated production cycle. Only AN S 280 and AN S 280L or AN S 225 may count toward graduation.

AN S 226: Beef Cattle Science
(2-2) Cr. 3. F.S.
Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising beef cattle through the vertically integrated production cycle.

AN S 229: Sheep Science
(2-2) Cr. 3. S.
Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising sheep through their production cycle.

AN S 235: Dairy Cattle Science
(2-2) Cr. 3. F.
Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising dairy cattle through the vertically integrated production cycle.

AN S 270: Foods of Animal Origin
(2-0) Cr. 2. F.S.SS.
Prereq: BIOL 212, CHEM 163 or CHEM 177
Principles, practices and issues impacting the production, processing and preservation of safe, wholesome, nutritious, and palatable meat, dairy, and egg products. Product evaluation, classification, value, and utilization.

AN S 270L: Foods of Animal Origin Laboratory
(0-2) Cr. 1. F.S.
Prereq: Credit or current enrollment in AN S 270
Determination of composition and quality of meat, eggs and milk based on industry and USDA standards. Fundamentals of processing foods of animal orgin to add value, maintain quality and ensure safety.

AN S 280: Basic Swine Science
(2-0) Cr. 2.
Prereq: AN S 101 AN S 114
Basic disciplines and concepts involved in swine production including; industry structure, trends and statistics; production phases and buildings; genetic improvement; reproduction; nutrition; health and biosecurity; nutrient management; marketing and meat quality and career opportunities in the swine industry. Only AN S 280 and AN S 280L or AN S 225 may count toward graduation.

AN S 305: Livestock Evaluation
(0-6) Cr. 3. F.
Prereq: Junior classification; AN S 270L recommended
Fall semester leads to 475A or D. Breeding animal and market animal evaluation of beef, swine and sheep using contemporary techniques and tools. Communication and decision-making skills are practiced in the context of making selection decisions.

AN S 306: Equine Evaluation
(0-6) Cr. 3. S.
Prereq: sophomore classification or permission of instructor
Detailed visual evaluation of conformation and performance of the equine athlete. Decision-making skills are practiced in the context of making selection choices. Development of written and oral communication skills as students defend their judgments. Industry trends will be addressed.

AN S 313: Exercise Physiology of Animals
(2-0) Cr. 2. F.S.
Prereq: AN S 214, BIOL 211, one course in chemistry
Physiological adaptations to athletic training in canine and equine athletes. Topics of emphasis include exercise-related adaptations in metabolism, locomotion, the cardiovascular system, musculoskeletal system, and endocrine system. The roles of nutrition and conditioning programs are assessed.

AN S 317: Fundamentals of Equine Behavior and Training
(0-6) Cr. 1-3.
Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. A maximum of 4 credits of An S 317 may be applied toward graduation.

AN S 317A: Fundamentals of Equine Behavior and Training: Young Horses at Halter
(0-6) Cr. 1-3. F.
Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. A maximum of 4 credits of An S 317 may be applied toward graduation.

AN S 317B: Fundamentals of Equine Behavior and Training: Yearlings
(0-6) Cr. 3.
Prereq: Permission of instructor
Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. A maximum of 4 credits of An S 317 may be applied toward graduation.

AN S 317C: Fundamentals of Equine Behavior and Training: Two-year olds and older
(0-6) Cr. 3.
Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. A maximum of 4 credits of An S 317 may be applied toward graduation.

AN S 319: Animal Nutrition
(3-0) Cr. 3. F.S.
Prereq: AN S 214, course in organic chemistry or biochemistry
Structure and function of organic and inorganic nutrients. Digestion, absorption, metabolism and utilization of nutrients for maintenance and productive functions. Essential nutritive requirements of domestic livestock, poultry, and companion animals. Sources of nutrients, application of energy systems and concepts, and regulation of feed intake in animals.

AN S 320: Animal Feeds and Feeding
(2-2) Cr. 3. F.S.
Prereq: AN S 319
Composition, physical properties, and storage and processing of feedstuffs. Nutrient requirements of and diet formulation, and preparation systems for food and companion animal species at varying stages of age, activity or production. Manual and computer methodologies for diet formulation.

AN S 324: Food Processing for Companion Animals
(3-0) Cr. 3. F.
Prereq: AN S 319, Junior Classification
Food processing and nutrition for carnivorous companion animals. Topics covered include meat processing and meat preservation for companion animal diets, regulatory standards, cutting edge technologies for processing meat for companion animals, dietary needs of carnivorous companion animals, effect of different processing methods on safety and nutrient bioavailability.

AN S 331: Domestic Animal Reproduction
(3-0) Cr. 3. F.S.
Prereq: Course in physiology
Comparative anatomy, physiology, and endocrinology of domestic mammalian animal reproduction. Techniques for the control and manipulation of reproductive processes.

AN S 332: Laboratory Methods in Animal Reproduction
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in AN S 331
Reproductive anatomy with emphasis on the physiology of normal reproductive function; ways to control and improve reproduction; principles of semen collection and artificial insemination; pregnancy testing; selected laboratory exercises with written report.

AN S 332A: Laboratory Methods in Animal Reproduction: Livestock, Companion, and Laboratory Animals
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in AN S 331.
Comparative reproductive anatomy with emphasis on the physiology of normal reproductive function; ways to control and improve reproduction; principles of semen collection and artificial insemination; pregnancy testing; selected laboratory exercises with written report.

AN S 332E: Laboratory Methods in Animal Reproduction: Equine
(0-2) Cr. 1. S.
Prereq: Credit or enrollment in AN S 331.
Reproductive anatomy with emphasis on the physiology of normal reproductive function; breeding season management; ways to control and improve reproduction; semen collection, evaluation, and processing; artificial insemination; pregnancy testing; parturition in the mare, foal care; selected laboratory exercises with written report.

AN S 333: Embryo Transfer and Related Technologies
(3-0) Cr. 3. F.
Prereq: AN S 331 or AN S 332
Application of embryo transfer and related technologies to genetic improvement of mammalian livestock. Techniques for control of female reproduction, embryo collection and transfer, embryo cryopreservation, and embryo manipulation. Gender selection. Economic and genetic aspects of embryo transfer.

AN S 334: Embryo Transfer Laboratory
(0-3) Cr. 1. F.
Prereq: Credit or concurrent enrollment in AN S 333; AN S 332 or VDPAM 416; permission of instructor
Selected laboratory exercises related to embryo transfer such as synchronization of estrus, superovulation, detection of estrus, artificial insemination, embryo collection, embryo evaluation, microscopy, embryo cryopreservation, in vitro fertilization, embryo sexing, rectal palpation, and ultrasonography will be demonstrated and/or performed.

AN S 335: Dairy Cattle Evaluation
(0-6) Cr. 3. S.
Prereq: Sophomore classification
Evaluation of breeding animals for dairy herds. Comparative terminology, decision making, and presentation of oral reasons. Trips to dairy cattle farms. Livestock handling.

AN S 336: Domestic Animal Behavior and Well-Being
(2-2) Cr. 3. F.
Prereq: One course in physiology
Principles of behavior relative to animal care, management and environmental design to ensure animal well-being. Examination of basic neural-endocrine mechanisms involved in the animal's response to its environment. Awareness of animal protection, law and legislation. Methods to objectively assess animal well-being.

AN S 337: Lactation
(3-0) Cr. 3. S.
Prereq: AN S 214
The structure, development and evolution of the mammary gland. Mammary metabolism, milk synthesis; neural and endocrine regulation of mammary function. Immune function and health of the mammary gland. Current events related to lactation.

AN S 345: Growth and Development of Domestic Animals
(3-0) Cr. 3. S.
Prereq: AN S 214; BIOL 313 or GEN 320
Basic principles of animal growth and development covered at the tissue, cellular and molecular level. Emphasis placed on skeletal muscle, adipose, bone, and immune system growth and development. The effects of genetics, nutrition, and pharmaceuticals on growth.

AN S 352: Genetic Improvement of Domestic Animals
(2-2) Cr. 3. F.S.
Prereq: One course in statistics, BIOL 211, course in genetics
Principles of qualitative and quantitative genetics applied to creating change in domestic animals. Impact of selection and mating schemes in achieving breeding program goals. Applications and impacts of biotechnological advancements in genetic manipulation.

AN S 360: Fresh Meats
(3-0) Cr. 3. F.
Prereq: AN S 270; a course in organic or biochemistry
Impact of muscle structure, composition, rigor mortis, inspection, fabrication, handling, packaging and cooking on the palatability, nutritional value, yields, market value, and safety of fresh meat.

AN S 382: Swine Environment Management
(1-0) Cr. 1.
Prereq: AN S 225 or 280 and 280L. Recommended TSM 210.
Response of swine to thermal environment, ventilation system design and analysis, heating and cooling systems, and examples of various designs for all phases of production. Troubleshooting ventilation systems and energy analysis of production units.

AN S 383: Swine Manure and Nutrient Management
(1-0) Cr. 1.
Prereq: An S 225 or An S 280 and An S 280L.
Function, application, and advantages and disadvantages of nutrient management systems. Manure production rates, manure handling systems, storage and manure management planning for land application and odor mitigation strategies.

AN S 384: Swine Health and Biosecurity
(1-0) Cr. 1.
Prereq: AN S 225 or An S 280 and An S 280L. Recommended a course in microbiology.
Overview of standard biosecurity protocols and identification of behavior and clinical signs of illness in pigs. Treatment administration and prevention methods. Introduction to immune system function and basic swine disease transmission.

AN S 399: Animal Science Internship
Cr. arr. Repeatable. F.S.SS.

AN S 399A: Animal Science Internship: Graded Internship Experience
Cr. 2-6. Repeatable. F.S.SS.
Prereq: Permission of the instructor
Learning experience focused on professional development for a career related to animal science. Journal, presentation, and creative component.

AN S 399B: Animal Science Internship: Supervised Internship Experience
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the instructor
Learning experience focused on professional development for a career related to animal science. Journal, presentation, and creative component.

AN S 411: Addressing Issues in Animal Science
(0-2) Cr. 1. F.S.
Prereq: Senior classification in An S
Life skill development emphasized in the context of exploring one's perspective of the most pressing moral and scientific issues facing animal agriculture. Clarification and communication of personal conclusions in small and large group settings expected.

AN S 415: Equine Systems Management
(2-2) Cr. 3. F.S.
Prereq: AN S 216, AN S 319, AN S 320, AN S 331
Identification and development of financial and production goals in a horse business. Scientific approach to make decisions in management of enterprises in the horse industry.

AN S 419: Advanced Animal Nutrition
(2-0) Cr. 2. F.
Prereq: AN S 214, AN S 319, AN S 320
Detailed consideration of digestion, metabolism, and assimilation of nutrients. Recent advances and developments in basic nutrition.

AN S 424: Companion Animal Systems Management
(2-2) Cr. 3. S.
Prereq: AN S 224, AN S 319, AN S 320, AN S 331, AN S 352
Decisions facing the administrator of a companion animal enterprise. Financial and business goal identification, problem clarification, and resource allocation to manage the companion animal system.

AN S 425: Swine Systems Management
(2-2) Cr. 3. F.
Prereq: AN S 225, AN S 270, AN S 270L, AN S 319, AN S 320, AN S 331, AN S 352; ECON 230 or equivalent recommended
Decisions facing the administrator of a swine enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the swine enterprise.

AN S 426: Beef Cattle Systems Management
(2-2) Cr. 3. F.S.
Prereq: AN S 226, AN S 270, AN S 270L, AN S 319, AN S 320, AN S 331, AN S 352; ECON 230 or equivalent recommended
Decisions facing the administrator of a beef cow-calf or feedlot enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the beef enterprise.

AN S 429: Sheep Systems Management
(2-2) Cr. 3. S.
Prereq: AN S 229, AN S 319, AN S 320, AN S 331, AN S 352; AGRON 334 recommended; ECON 230 or equivalent recommended
Decisions facing the administrator of a sheep enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the sheep enterprise.

AN S 434: Dairy Systems Management
(3-0) Cr. 3. F.
Prereq: AN S 235, AN S 319, AN S 331, AN S 320, AN S 337, AN S 352; ECON 230 or equivalent recommended
The scientific foundation of dairy cattle management. The impact of dairy farm management practices on the biological processes of the cow. Integrates concepts from the disciplines of lactation, reproduction, nutrition, genetics, and animal health.

AN S 435: Applied Dairy Farm Evaluation
(2-2) Cr. 3. S.
Prereq: AN S S 434; ECON 230
Evaluate nutrition, reproduction, milk quality, breeding, and related management practices of commercial dairy herds in a case study format. Students will apply knowledge gained in the classroom to commercial dairy farm situations and develop skills in information gathering, decision making, problem solving, and interpersonal communications.

AN S 441: International Animal Agriculture
(Cross-listed with GLOBE). (3-0) Cr. 3. S.
Prereq: Two courses from AN S 223, AN S 225, AN S 226, AN S 229, AN S 235
An overview of animal agriculture with emphasis on animal agriculture in developing countries. Historical, economic, environmental; and political considerations will be assessed and evaluated. Issues related to gender, resilience and sustainability for different production systems will be investigated.
Meets International Perspectives Requirement.

AN S 460: Processed Meats
(Dual-listed with AN S 560). (2-2) Cr. 3. S.
Prereq: AN S 270
Physical, chemical and biological properties of meat important to processed meat product characteristics. Ingredients, technology and equipment used for cured meats, loaf products and fresh, cooked, dry and semi-dry sausage products.

AN S 475: Intercollegiate Judging Training and Competition
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475A: Intercollegiate Judging Training and Competition: Meat Animals
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475B: Intercollegiate Judging Training and Competition: Dairy Cattle
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475C: Intercollegiate Judging Training and Competition: Meats
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475D: Intercollegiate Judging Training and Competition: Meat Animal Evaluation
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475E: Intercollegiate Judging Training and Competition: Horses
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475F: Intercollegiate Judging Training and Competition: Management Systems
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 480: Animal Industry Leadership Fellows
Cr. 1. Repeatable. F.S.
Prereq: A. AN S 226; permission of instructor C. AN S 225; permission of instructor
Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. This for-credit offering represents the central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only.

AN S 480A: Animal Industry Leadership Fellows: Beef
Cr. 1. Repeatable. F.S.
Prereq: AN S 226; permission of instructor
Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. This for-credit offering represents the central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only.

AN S 480C: Animal Industry Leadership Fellows: Pork
Cr. 1. Repeatable. F.S.
Prereq: AN S 225; permission of instructor
Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. This for-credit offering represents the central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only.

AN S 480G: Animal Industry Leadership Fellows: Poultry
Cr. 1. Repeatable. F.S.
Prereq: AN S 223; permission of instructor
Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. Central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only.

AN S 489: Issues in Food Safety
(Cross-listed with FS HN, HSP M, VDPAM). (1-0) Cr. 1. S.
Prereq: Credit or enrollment in FS HN 101 or FS HN 272 or HSP M 233; FS HN 419 or FS HN 420; FS HN 403
Capstone seminar for the food safety minor. Case discussions and independent projects about safety issues in the food system from a multidisciplinary perspective.

AN S 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490A: Independent Study: Animal Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490B: Independent Study: Dairy Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490C: Independent Study: Meat Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490D: Independent Study: Companion Animal Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490E: Independent Study: Equine Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490G: Independent Study: Poultry Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490H: Independent Study: Honors
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490I: Independent Study: Entrepreneurship
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 493: Workshop in Animal Science
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Workshop in livestock production. Includes current concepts in breeding, nutrition, reproduction, meats, and technologies that impact the animal industry.

AN S 495: Agricultural Travel Course Preparation
Cr. R. Repeatable. F.S.
Prereq: Permission of instructor
Limited enrollment. Students enrolled in this course will also register for Agron 495 and intend to register in Agron 496 and An S 496 the following term. Topics will include the agricultural industries, climate, crops, culture, history, livestock, marketing, soils, and preparation for travel to locations to be visited. Information normally available 9 months before departure.

AN S 496: Agricultural Travel Course
Cr. arr. Repeatable.
Prereq: Permission of instructor, 30 college credits
Limited enrollment. Students enroll in both An S 496 and Agron 496. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on livestock and crop production. Locations and duration of tours will vary. Summer tour will usually visit a northern location and winter tour will usually visit a southern location. Information usually available 9 months before departure. Tour expenses paid by students.

AN S 496A: Agricultural Travel Course: International Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor, 30 college credits
Limited enrollment. Students enroll in both An S 496 and Agron 496. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on livestock and crop production. Locations and duration of tours will vary. Summer tour will usually visit a northern location and winter tour will usually visit a southern location. Information usually available 9 months before departure. Tour expenses paid by students.
Meets International Perspectives Requirement.

AN S 496B: Agricultural Travel Course: Domestic tour
Cr. arr. Repeatable.
Prereq: Permission of instructor, 30 college credits
Limited enrollment. Students enroll in both An S 496 and Agron 496. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on livestock and crop production. Locations and duration of tours will vary. Summer tour will usually visit a northern location and winter tour will usually visit a southern location. Information usually available 9 months before departure. Tour expenses paid by students.

AN S 497: Undergraduate Teaching Experiences in Animal Science
Cr. 1-2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Permission of instructor
Development of oral and written communication skills of technical concepts in animal science. Emphasis on organizational skills, conducting activities and interpersonal communication skills. Responsibilities in a class under direct supervision of a faculty member. A maximum of 4 credits of An S 497 may be applied toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

AN S 500: Computer Techniques for Biological Research
(2-0) Cr. 1. F.
Introduction to UNIX and SAS for solving research problems, including organization of data files, transfer of files between workstations, developing models, and techniques for analysis of designed experiments. Introduction to matrix algebra for solving animal breeding problems using MATLAB and computer simulation.

AN S 500A: Computer Techniques for Biological Research: UNIX and SAS
(2-0) Cr. 1. F.
First half semester course. Introduction to UNIX and SAS for solving research problems, including organization of data files, transfer of files between workstations, developing models, and techniques for analysis of designed experiments. Introduction to matrix algebra for solving animal breeding problems using MATLAB and computer simulation.

AN S 500B: Computer Techniques for Biological Research: Problem solving using matrix algebra
(2-0) Cr. 1. F.
Second half semester course. Introduction to UNIX and SAS for solving research problems, including organization of data files, transfer of files between workstations, developing models, and techniques for analysis of designed experiments. Introduction to matrix algebra for solving animal breeding problems using MATLAB and computer simulation.

AN S 501: Survey of Animal Disciplines
(1-0) Cr. 1. F.
Required for Animal Science graduate students. Orientation to departmental and graduate school policies and procedures. Discussion of programs of research and outreach in Animal Science. Issues impacting the animal industry. Offered on a satisfactory-fail basis only.

AN S 503: Seminar in Animal Production
(1-0) Cr. 1. Repeatable. F.
Prereq: Permission of instructor
Discussion and evaluation of current topics in animal production and management.

AN S 515: Integrated Crop and Livestock Production Systems
(Cross-listed with A B E, AGRON, SUSAG). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: SUSAG 509
Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms.

AN S 518: Digestive Physiology and Metabolism of Non Ruminants
(Cross-listed with NUTRS). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: AN S 419 or NUTRS 501
Digestion and metabolism of nutrients. Nutritional requirements and current research and feeding programs for poultry and swine.

AN S 520: Digestive Physiology and Metabolism of Ruminants
(Cross-listed with NUTRS). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: AN S 419 or NUTRS 501
Digestive physiology and nutrient metabolism in ruminant and preruminant animals.

AN S 533: Physiology and Endocrinology of Animal Reproduction
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: General physiology course
Development of structure and function of the reproductive system. Physiologic and endocrine aspects including puberty, gametogenesis, estrous cycle, pregnancy, maternal recognition, fertilization and early embryonic development.

AN S 536: Perinatology
(2-0) Cr. 2. S.
Prereq: One course in physiology; one course in biochemistry
Regulation of metabolism and development in the mammalian fetus and neonate is explored in a comparative manner. Emphasis will be on the dynamic changes in these relationships occurring at birth.

AN S 537: Topics in Animal Behavior, Welfare
(3-0) Cr. 3.
Prereq: permission of instructor; M.S. or Ph.D. student
Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

AN S 537A: Topics in Animal Behavior, Welfare: Animal Behavior
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor; M.S. or Ph.D. student
Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

AN S 537B: Topics in Animal Behavior, Welfare: Contemporary Issues.
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor; M.S. or Ph.D. student
Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

AN S 537C: Topics in Animal Behavior, Welfare: Animal Welfare
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: permission of instructor; M.S. or Ph.D. student
Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

AN S 537D: Topics in Animal Behavior, Welfare: Immune and Stress
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor; M.S. or Ph.D. student
Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

AN S 540: Livestock Immunogenetics
(Cross-listed with MICRO, V MPM). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: AN S 561 or MICRO 575 or V MPM 520
Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance.

AN S 549: Advanced Vertebrate Physiology I
(Cross-listed with KIN, NUTRS). (4-0) Cr. 4. F.
Prereq: Biol 335; credit or enrollment in BBMB 404 or BBMB 420
Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems.

AN S 552: Advanced Vertebrate Physiology II
(Cross-listed with KIN, NUTRS). (3-0) Cr. 3. S.
Prereq: BIOL 335; credit or enrollment in BBMB 404 or BBMB 420
Cardiovascular, renal, respiratory, and digestive physiology.

AN S 556: Current Topics in Genome Analysis
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BBMB 405 or GDCB 510
Introduction to principles and methodology of molecular genetics useful in analyzing and modifying large genomes.

AN S 560: Processed Meats
(Dual-listed with AN S 460). (2-2) Cr. 3. S.
Prereq: AN S 270
Physical, chemical and biological properties of meat important to processed meat product characteristics. Ingredients, technology and equipment used for cured meats, loaf products and fresh, cooked, dry and semi-dry sausage products.

AN S 561: Population and Quantitative Genetics for Breeding
(Cross-listed with AGRON). (4-0) Cr. 4. F.
Prereq: STAT 401
Population and quantitative genetics for plant and animal genetics. Study of the genetic basis and analysis of variation in quantitative traits in domestic or experimental populations using phenotypic and molecular marker data, including estimation of heritability and other genetic parameters, linkage analysis and mapping of quantitative trait loci, and the impact of inbreeding, heterosis, and genotype-by-environment interaction.

AN S 562: Methodologies for Population/Quantitative Genetics
(2-0) Cr. 2. S.
Prereq: AN S 561, STAT 402
Basic theory for genetic analysis of animal breeding data. Course A (1st half semester) covers linear models, selection index methods, and basic theory for best linear unbiased prediction. Course B (2nd half semester) best linear unbiased prediction, including genetic groups, environmental adjustment, repeated records, multiple trait models, maternal effects models, and theory for maximum likelihood estimation of genetic parameters.

AN S 562A: Methodologies for Population/Quantitative Genetics: Linear Models and Genetic Prediction
(2-0) Cr. 2. S.
Prereq: AN S 561, STAT 402
Basic theory for genetic analysis of animal breeding data. Course A (1st half semester) covers linear models, selection index methods, and basic theory for best linear unbiased prediction. Course B (2nd half semester) best linear unbiased prediction, including genetic groups, environmental adjustment, repeated records, multiple trait models, maternal effects models, and theory for maximum likelihood estimation of genetic parameters.

AN S 562B: Methodologies for Population/Quantitative Genetics: Advanced Genetic Prediction&Parameter Estimation
(2-0) Cr. 2. S.
Prereq: AN S 561, STAT 402
Basic theory for genetic analysis of animal breeding data. Course A (1st half semester) covers linear models, selection index methods, and basic theory for best linear unbiased prediction. Course B (2nd half semester) best linear unbiased prediction, including genetic groups, environmental adjustment, repeated records, multiple trait models, maternal effects models, and theory for maximum likelihood estimation of genetic parameters.

AN S 570: Advanced Meat Science and Applied Muscle Biology
(2-2) Cr. 3. S.
Prereq: AN S 460
Ante and postmortem factors impacting composition, structure, and chemistry of red meat and poultry muscle/meat, the conversion of muscle to meat, and the sensory and nutritional attributes of fresh meats. Oral research reports and a research proposal.

AN S 571: Advanced Meat Processing Principles and Technology
(2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: AN S 460 or AN S 570
Physical/chemical relationships during processing. Effects of modern technology, non-meat additives and preservation techniques on quality and safety of processed meat. Laboratory demonstration of principles and technology.

AN S 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590A: Special Topics: Animal Breeding
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590B: Special Topics: Animal Nutrition
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590C: Special Topics: Meat Animal Production
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590D: Special Topics: Dairy Production
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590E: Special Topics: Meat Science
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590F: Special Topics: Physiology of Reproduction
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590G: Special Topics: Muscle Biology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590H: Special Topics: Poultry Nutrition
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590I: Special Topics: Poultry Products
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590J: Special Topics: Experimental Surgery
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590K: Special Topics: Professional Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590L: Special Topics: Teaching
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590M: Special Topics: Molecular Biology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590N: Special Topics: Ethology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 599: Creative Component
Cr. 1-8. F.S.SS.
Prereq: Nonthesis M.S
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AN S 599A: Creative Component: Animal Breeding and Genetics
Cr. 1-8. F.S.SS.
Prereq: Nonthesis M.S
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AN S 599B: Creative Component: Animal Nutrition
Cr. 1-8. F.S.SS.
Prereq: Nonthesis M.S
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AN S 599C: Creative Component: Animal Physiology
Cr. 1-8. F.S.SS.
Prereq: Nonthesis M.S
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AN S 599D: Creative Component: Animal Science
Cr. 1-8. F.S.SS.
Prereq: Nonthesis M.S
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AN S 599E: Creative Component: Meat Science
Cr. 1-8. F.S.SS.
Prereq: Nonthesis M.S
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

Courses for graduate students:

AN S 603: Seminar in Animal Nutrition
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor
Discussion of current literature; preparation and submission of abstracts.

AN S 618: Vitamins and Minerals
(Cross-listed with NUTRS). Cr. 2. Alt. S., offered even-numbered years.
Prereq: Biochemistry, physiology, basic nutrition
Understanding molecular aspects of vitamin and mineral metabolism and homeostasis in humans and animals. An in-depth examination of the chemistry of vitamins and minerals, including genetic mutations, proteins involved in absorption and excretion, and their necessity in biological processes.

AN S 619: Advanced Nutrition and Metabolism - Protein
(Cross-listed with NUTRS). (2-0) Cr. 2. F.
Prereq: BBMB 405
Digestion, absorption, and intermediary metabolism of amino acids and protein. Regulation of protein synthesis and degradation. Integration of cellular biochemistry and physiology of mammalian protein metabolism.

AN S 620: Advanced Nutrition and Metabolism - Energy
(Cross-listed with NUTRS). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: BBMB 405
Energy constituents of feedstuffs and energy needs of animals as related to cellular biochemistry and physiology. Interpretations of classical and current research.

AN S 633: Seminar in Animal Reproduction
(1-0) Cr. 1. Repeatable. F.
Prereq: Permission of instructor
Discussion of current literature and preparation of reports and seminars on selected topics concerning animal physiology.

AN S 652: Animal Breeding Strategies
(2-0) Cr. 2.
Prereq: AN S 561
Basic concepts and methods for design and evaluation of genetic improvement programs for livestock. Topic A. (1st half semester) Prediction of response to selection, selection index theory, multiple trait selection, inbreeding, crossbreeding, and marker-assisted selection. Topic B. (2nd half semester) Advanced concepts in design and evaluation of animal breeding programs, including modeling and optimization, derivation of economic values, gene-flow, and predicting rates of inbreeding. Each topic may be taken only one time for academic credit.

AN S 652A: Animal Breeding Strategies: Breeding Goals and Response to Selection
(2-0) Cr. 2.
Prereq: AN S 561
Basic concepts and methods for design and evaluation of genetic improvement programs for livestock. Topic A. (1st half semester) Prediction of response to selection, selection index theory, multiple trait selection, inbreeding, crossbreeding, and marker-assisted selection. Topic B. (2nd half semester) Advanced concepts in design and evaluation of animal breeding programs, including modeling and optimization, derivation of economic values, gene-flow, and predicting rates of inbreeding. Each topic may be taken only one time for academic credit.

AN S 652B: Animal Breeding Strategies: Design and Evaluation of Animal Breeding Programs
(2-0) Cr. 2.
Prereq: AN S 561
Basic concepts and methods for design and evaluation of genetic improvement programs for livestock. Topic A. (1st half semester) Prediction of response to selection, selection index theory, multiple trait selection, inbreeding, crossbreeding, and marker-assisted selection. Topic B. (2nd half semester) Advanced concepts in design and evaluation of animal breeding programs, including modeling and optimization, derivation of economic values, gene-flow, and predicting rates of inbreeding. Each topic may be taken only one time for academic credit.

AN S 653: Applied Animal Breeding Strategies
(2-0) Cr. 2. F.
Prereq: AN S 561 recommended
Industrial applications of breeding systems, selection methods, and new genetic technologies. One or more field trips to an industry breeding company.

AN S 653A: Applied Animal Breeding Strategies: Swine and Poultry
(2-0) Cr. 2. F.
Prereq: AN S 561 recommended
Industrial applications of breeding systems, selection methods, and new genetic technologies. One or more field trips to an industry breeding company.

AN S 653B: Applied Animal Breeding Strategies: Beef and Dairy
(2-0) Cr. 2. F.
Prereq: AN S 561 recommended
Industrial applications of breeding systems, selection methods, and new genetic technologies. One or more field trips to an industry breeding company.

AN S 655: Advanced Computational Methods in Animal Breeding and Genetics
(3-1) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: AN S 500, AN S 562, Com S 207
Computational methods and strategies for analysis of large data sets with animal breeding data for use in research and industry applications. Course A (1st half semester) Strategies for handling large sets and for prediction using best linear unbiased prediction using a formal language and utility programs. Course B (2nd half semester) Strategies for estimation of genetic parameters and for use of non-linear models for genetic analysis of categorical and survival type data.

AN S 655A: Computational Strategies for Predicting Breeding Values
(3-1) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: AN S 500, AN S 562, COM S 207
Computational methods and strategies for analysis of large data sets with animal breeding data for use in research and industry applications. Strategies for handling large sets and for prediction using best linear unbiased prediction using a formal language and utility programs.

AN S 655B: Computational Strategies for Genetic Parameter Estimation
(3-1) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: AN S 500, AN S 562, COM S 207
Computational methods and strategies for analysis of large data sets with animal breeding data for use in research and industry applications. Strategies for estimation of genetic parameters and for use of non-linear models for genetic analysis of categorical and survival type data.

AN S 656: Statistical Methods for Mapping Quantitative Trait Loci
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: AN S 562, STAT 447
Statistical methods for mapping quantitative trait loci in out-bred populations. Methods based on modeling covariances between relatives. Likelihood based methods using half-sib and full-sib families and extended pedigrees. Bayesian methods applied.

AN S 658: Seminar in Animal Breeding and Genetics
(1-0) Cr. 1. Repeatable. F.S.
Presentation of current research related to animal breeding and genetics.

AN S 670: Molecular Biology of Muscle
(Cross-listed with KIN). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BBMB 405, BBMB 420, or BBMB 502
Ultrastructure of muscle; chemistry, structure, function, and molecular biology of muscle proteins. Molecular aspects of muscle contraction, development and turnover. Cytoskeletal proteins and dynamics.

AN S 684: Seminar in Meat Science
(1-0) Cr. 1. Repeatable. S.
Prereq: Permission of instructor
Discussion and evaluation of current topics in research publications in meat science.

AN S 685: Seminar in Muscle Biology
(1-0) Cr. 1. Repeatable. S.
Prereq: Permission of instructor
Reports and discussion of recent literature and current investigations.

AN S 695: Seminar in Animal Science
(1-0) Cr. 1. Repeatable. S.
Reports and discussion of current issues and research in animal science. One credit is required for all M.S. degree candidates with graduate majors in the Department of Animal Science, and two credits are required for all Ph.D. candidates with graduate majors in the Department of Animal Science. Offered on a satisfactory-fail basis only.

AN S 699: Research
Cr. arr. Repeatable.

AN S 699A: Research: Animal Breeding
Cr. arr. Repeatable.

AN S 699B: Research: Animal Nutrition
Cr. arr. Repeatable.

AN S 699C: Research: Meat Animal Production
Cr. arr. Repeatable.

AN S 699D: Research: Dairy Production
Cr. arr. Repeatable.

AN S 699E: Research: Meat Science
Cr. arr. Repeatable.

AN S 699F: Research: Physiology of Reproduction
Cr. arr. Repeatable.

AN S 699G: Research: Muscle Biology
Cr. arr. Repeatable.

AN S 699H: Research: Poultry Nutrition
Cr. arr. Repeatable.

AN S 699I: Research: Poultry Products
Cr. arr. Repeatable.

AN S 699J: Research: Animal Ethology
Cr. arr. Repeatable.

Anthropology (ANTHR)

Courses primarily for undergraduates:

ANTHR 201: Introduction to Cultural Anthropology
(3-0) Cr. 3. F.S.SS.
Comparative study of culture as key to understanding human behaviors in different societies. Using a global, cross-cultural perspective, patterns of family life, economic and political activities, religious beliefs, and the ways in which cultures change are examined.
Meets International Perspectives Requirement.

ANTHR 202: Introduction to Biological Anthropology and Archaeology
(3-0) Cr. 3. F.S.
Human biological and cultural evolution; survey of the evidence from fossil primates, the human fossil record and the archaeological record, as well as living primates; introduction to research methods in archaeology and biological anthropology.

ANTHR 220: Globalization and Sustainability
(Cross-listed with ENV S, GLOBE, M E, MAT E, SOC, T SC). (3-0) Cr. 3. F.S.
An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.
Meets International Perspectives Requirement.

ANTHR 230: Globalization and the Human Condition
(3-0) Cr. 3. F.S.
An introduction to understanding key global issues in the contemporary world. Focuses on social relations, cultural practices and political-economic linkages among Africa, the Americas, Asia, Europe and the Pacific.
Meets International Perspectives Requirement.

ANTHR 250: Primate Behavior
(2-2) Cr. 3. F.S.SS.
Prereq: ANTHR 202 and/or basic biology course recommended
An introduction to the Order Primates with a focus on their behavior. Biological and social adaptations of monkeys, apes, and prosimians; basic evolutionary concepts, current trends and theories in the field of Primatology and issues related to primate conservation.

ANTHR 306: Cultural Anthropology
(2-2) Cr. 3. S.
Prereq: ANTHR 201
Survey of the major theoretical, methodological and empirical foundations of cultural anthropology. Participatory lab: focus on ethnographic methods through individual research projects.
Meets International Perspectives Requirement.

ANTHR 307: Biological Anthropology
(2-2) Cr. 3. S.
Prereq: ANTHR 202
Human evolution as known from fossil evidence, comparative primate studies, and genetic variations in living populations. Laboratory-tutorial sessions include study and discussion of human osteology, fossil hominids, simple Mendelian traits, and bio-ethics in applied biological anthropology.

ANTHR 308: Archaeology
(2-2) Cr. 3. F.
Prereq: ANTHR 202
Methods and techniques for the recovery and interpretation of archaeological evidence, its role in reconstructing human behavior and past environments. Laboratory sessions include experience in the interpretation of archaeological evidence, the use of classification systems, and prehistoric technologies such as ceramics and stone tools.

ANTHR 309: Introduction to Culture and Language
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: ANTHR 201 recommended
Introduction to study of language, culture and society from an anthropological perspective. Focus on language and thought, ethnography of speaking, discourse and narrative, writing and literacy, and media communication. Discussion of key theories and methods of linguistic anthropology.
Meets International Perspectives Requirement.

ANTHR 313: Kinship and Marriage in a Global Perspective
(Dual-listed with ANTHR 513). (3-0) Cr. 3. S.
Prereq: ANTHR 201 recommended
Comparative and historical overview of the family, marriage and kinship. Examination of cross-cultural differences in the construction and functioning of family and kin relations; role of kinship in structuring individual and collective activities; current critical and theoretical issues in kinship studies, especially integrating work on gender and sexuality.
Meets International Perspectives Requirement.

ANTHR 315: Archaeology of North America
(Dual-listed with ANTHR 515). (Cross-listed with AM IN). (3-0) Cr. 3. S.
Prereq: ANTHR 202
Prehistory and early history of North America as reconstructed from archaeological evidence; peopling of the New World; culture- historical sequences of major culture areas; linkages of archaeological traditions with selected ethnohistorically known Native American groups.
Meets U.S. Diversity Requirement

ANTHR 319: Skeletal Biology
(Dual-listed with ANTHR 519). (2-2) Cr. 3. F.
Prereq: ANTHR 307 or college level biology
Comprehensive study of the skeletal anatomy, physiology, genetics, growth, development and population variation of the human skeleton. Applications to forensic anthropology, paleopathology and bioarchaeology are introduced.

ANTHR 320: Great Plains Archaeology
(Dual-listed with ANTHR 520). (Cross-listed with AM IN). (3-0) Cr. 3. F.
Prereq: ANTHR 202
Prehistoric societies of the Great Plains region of North America, from initial occupation to European contact; emphasis on sociocultural changes, continuities, and adaptations to changing environments using archaeological, ecological, ethnographic information.
Meets U.S. Diversity Requirement

ANTHR 321: World Prehistory
(Dual-listed with ANTHR 521). (3-0) Cr. 3. S.
Prereq: ANTHR 202 recommended
An introduction to archaeological sites from around the world including the Near East, Africa, Europe, Mesoamerica, and North and South America. Emphasis is on the interpretation of material cultural remains in reconstructing past societies.

ANTHR 322: Peoples and Cultures of Native North America
(Dual-listed with ANTHR 522). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or AM IN 210
Origin, distribution, and pre-contact life of the indigenous peoples of North America. Survey of culture areas; language families, social and political systems, ecological and economic adaptations, religion and spirituality; impact of European contact; cultural resilience and revitalization in contemporary American Indian life.
Meets U.S. Diversity Requirement

ANTHR 323: Topics in Latin American Anthropology
(Dual-listed with ANTHR 523). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.

ANTHR 323A: Latin American Anthropology: Violence and Memory
(Dual-listed with ANTHR 523A). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 323B: Latin American Anthropology: Social movements and Democracy
(Dual-listed with ANTHR 523B). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 323C: Latin American Anthropology: Race, Class and Gender
(Dual-listed with ANTHR 523C). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 323D: Latin American Anthropology: Regional Focus
(Dual-listed with ANTHR 523D). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 323E: Latin American Anthropology: Culture and Sport.
(Dual-listed with ANTHR 523E). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 325: Peoples and Cultures of Africa.
(Cross-listed with AF AM). (3-0) Cr. 3.
Prereq: 201 or 306 recommended.
Survey of diverse African culture areas across the continent and globally; local level description and analysis of individuals as members of African communities; regional, national and global scales of identification.
Meets International Perspectives Requirement.

ANTHR 332: Current Issues in Native North America
(Dual-listed with ANTHR 532). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 332A: Current Issues in Native North America: Gender and Family
(Dual-listed with ANTHR 532A). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 332B: Current Issues in Native North America: Indigenous Ecologies and Geographies
(Dual-listed with ANTHR 532B). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 332C: Current Issues in Native North America: Cultural and Political Movements
(Dual-listed with ANTHR 532C). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 332D: Current Issues in Native North America: Regional Focus
(Dual-listed with ANTHR 532D). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 333: Asian American Material Cultures
(Cross-listed with HIST). (3-0) Cr. 3.
Examination of material objects made and used by Asian Americans with both historical and contemporary focuses; transnational and interdisciplinary lenses to interpret the material world; contemporary approaches to analysis of artifacts.
Meets U.S. Diversity Requirement

ANTHR 336: Global Development
(Dual-listed with ANTHR 536). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ANTHR 201 or ANTHR 306
Cross-cultural analysis of current development practices from an anthropological perspective; focus on international aid, development institutions, agrarian reform, indigenous knowledge, humanitarianism and human rights; introduction to main theories of political and economic anthropology.
Meets International Perspectives Requirement.

ANTHR 340: Magic, Witchcraft, and Religion
(Dual-listed with ANTHR 540). (Cross-listed with RELIG). (3-0) Cr. 3. S.
Prereq: ANTHR 201 or ANTHR 306
Survey of global religious belief and practice from an anthropological perspective. Emphasis on myth and ritual, shamanism, magic, witchcraft, beliefs in spirits, conceptions of the soul, mind and body relationships, and healing and therapeutic practices. Discussion of religious response to dramatic political and social change; effects of globalization on religious practice.
Meets International Perspectives Requirement.

ANTHR 354: War and the Politics of Humanitarianism
(Cross-listed with POL S). (3-0) Cr. 3. S.
Prereq: Pol S 235, Pol S 251, or Anthr 230
Humanitarianism as a system of thought and a system of intervention in conflict and post-conflict situations: role of humanitarian organizations and actors in addressing human suffering caused by conflict or war military action as a form of humanitarian intervention.
Meets International Perspectives Requirement.

ANTHR 376: Classical Archaeology
(Cross-listed with CL ST, RELIG). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

ANTHR 376A: Classical Archeology: Bronze Age and Early Iron Age Greece
(Cross-listed with CL ST, RELIG). (3-0) Cr. 3. S.
Bronze Age (Minoan and Mycenaean palatial cultures) and Early Iron Age Greece. (ca 3000-700 BCE). Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

ANTHR 376B: Classical Archeology: Archaic through Hellenistic Greece (ca 700-30 BCE)
(Cross-listed with CL ST, RELIG). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

ANTHR 376C: Classical Archaeology: Roman Archaeology (ca 1000 BCE-400 CE)
(Cross-listed with CL ST). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Roman world and the role of archaeological context in understanding the varied aspects of ancient Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

ANTHR 411: Anthropology for Global Professionals
(Dual-listed with ANTHR 511). (3-0) Cr. 3. F.
Prereq: ANTHR 201 or ANTHR 306
Theory and methods for conducting ethnographic research in academic and non-academic settings; application of anthropological knowledge to contemporary cultural, political, economic, environmental and spatial issues; development of skills necessary for professional practice as an anthropologist.
Meets International Perspectives Requirement.

ANTHR 418: Global Culture, Consumption and Modernity
(Dual-listed with ANTHR 518). (3-0) Cr. 3. F.
Prereq: ANTHR 201 or ANTHR 306 recommended
Cross-cultural study of the impact of globalization, with an emphasis on economic consumption and the movement of goods, ideas, and peoples across cultural and national boundaries.
Meets International Perspectives Requirement.

ANTHR 419: Topics in Cultural Anthropology
(3-0) Cr. 3.
Prereq: ANTHR 306
In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. Each section may be taken once for credit up to 9 credits. No more than 9 credits of ANTHR 419 courses may be applied towards graduation.

ANTHR 419A: Topics in Cultural Anthropology: Theory
(3-0) Cr. 3.
Prereq: ANTHR 306
In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. No more than 9 credits of ANTHR 419 courses may be applied towards graduation.

ANTHR 419B: Topics in Cultural Anthropology: Methods
(3-0) Cr. 3.
Prereq: ANTHR 306
In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. No more than 9 credits of ANTHR 419 courses may be applied towards graduation.

ANTHR 419C: Topics in Cultural Anthropology: Regional Focus
(3-0) Cr. 3.
Prereq: ANTHR 306
In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. No more than 9 credits of ANTHR 419 courses may be applied towards graduation.

ANTHR 419D: Topics in Cultural Anthropology: Others
(3-0) Cr. 3.
Prereq: ANTHR 306
In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. No more than 9 credits of ANTHR 419 courses may be applied towards graduation.

ANTHR 424: Forensic Anthropology
(Dual-listed with ANTHR 524). (2-2) Cr. 3. S.
Prereq: ANTHR 202 or ANTHR 307; ANTHR 319 recommended
Comprehensive study of forensic anthropology, a specialized subfield of biological anthropology. Emphasis is placed on personal identifications from extremely fragmentary, comingled, burnt, cremated and incomplete skeletal remains. All parameters of forensic study are included as they pertain to anthropology, including human variation, taphonomy, entomology, archaeology, pathology, epidemiology; genetics and the non-biological forensic disciplines. An appreciation for the wide range of medicolegal and bioethical issues will also be gained.

ANTHR 425: Professional Preparation in Anthropology
(2-0) Cr. 2. F.
Prereq: Junior classification in anthropology or permission from the instructor
Instruction and guidance in the development of professional skills needed for success in academic and non-academic anthropological careers. Topics will include strategies for internship and job searches, creating resumes and CVs, composing personal statements and cover letters, and developing contacts and sources. Offered on a satisfactory-fail basis only.

ANTHR 427I: Field Archaeology
(Cross-listed with IA LL). Cr. 4. SS.
Nature of cultural and environmental evidence in archaeology and how they are used to model past human behavior and land use; emphasis on Iowa prehistory; basic reconnaissance surveying and excavation techniques.

ANTHR 428: Topics in Archaeological Laboratory Methods and Techniques
(Dual-listed with ANTHR 528). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition and organization, and computer applications.

ANTHR 428A: Topics in Archaeological Laboratory Methods and Techniques
(Dual-listed with ANTHR 528A). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 428B: Topics in Archaeological Laboratory Methods and Techniques: Ceramics
(Dual-listed with ANTHR 528B). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 428C: Topics in Archaeological Laboratory Methods and Techniques: Faunal remains
(Dual-listed with ANTHR 528C). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 428D: Topics in Archaeological Laboratory Methods and Techniques: General
(Dual-listed with ANTHR 528D). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 429: Topics in Archaeological Laboratory Methods and Techniques: Archaeological Field School
(Dual-listed with ANTHR 529). Cr. 4-6. SS.
Prereq: ANTHR 202 or ANTHR 308
Summer field school for training in archaeological reconnaissance and excavation techniques; documentation and interpretation of archaeological evidence.

ANTHR 431: Ethnographic Field School
(Dual-listed with ANTHR 531). Cr. 4-6.
Hands-on training in ethnographic field methods; students will carry out research projects in socio-cultural anthropology, learning a variety of investigative research techniques commonly used in social sciences.

ANTHR 434: Internship
Cr. 2-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior standing
Supervised practice in government agencies, museums, and business organizations. Offered on a satisfactory-fail basis only. Not more than 6 credits of internship experience may count towards the major. No credits in Anthr 434 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor.

ANTHR 434A: Internship: Archaeology
Cr. 2-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior standing
Supervised practice in government agencies, museums, and business organizations. Offered on a satisfactory-fail basis only. Not more than 6 credits of internship experience may count towards the major. No credits in Anthr 434 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor.

ANTHR 434B: Internship: Cultural Anthropology
Cr. 2-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior standing
Supervised practice in government agencies, museums, and business organizations. Offered on a satisfactory-fail basis only. Not more than 6 credits of internship experience may count towards the major. No credits in Anthr 434 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor.

ANTHR 434C: Internship: Biological Anthropology
Cr. 2-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior standing
Supervised practice in government agencies, museums, and business organizations. Offered on a satisfactory-fail basis only. Not more than 6 credits of internship experience may count towards the major. No credits in Anthr 434 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor.

ANTHR 434D: Internship: Linguistic Anthropology
Cr. 2-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior standing
Supervised practice in government agencies, museums, and business organizations. Offered on a satisfactory-fail basis only. Not more than 6 credits of internship experience may count towards the major. No credits in Anthr 434 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor.

ANTHR 438: Primate Evolutionary Ecology and Behavior
(Dual-listed with ANTHR 538). Cr. 3. S.
Prereq: ANTHR 202 or ANTHR 307
Primate behavior and ecology in evolutionary perspective: biological and social adaptations of prosimians, monkeys, and apes. Introduction to the Order Primates, basic evolutionary concepts, and techniques of behavioral observation. Focus on theory and methods current in Primatology, including applied conservation biology.

ANTHR 444: Sex and Gender in Cross-cultural Perspective
(Dual-listed with ANTHR 544). (Cross-listed with W S). (3-0) Cr. 3. S.
Prereq: ANTHR 201; ANTHR 306 recommended
Cross-cultural examination of the social construction of genders out of the biological fact of sex. Emphasis on non-western societies. Topics, presented through examination of ethnographic data, will include the range of gender variation, status and roles, the institution of marriage, and symbols of gender valuation.
Meets International Perspectives Requirement.

ANTHR 445: Biological Field School
(Dual-listed with ANTHR 545). Cr. 4-6. SS.
Prereq: ANTHR 202 or BIOL 101
Summer field school for training in behavioral and ecological methods for primatologists. Proposal, data collection and analyses, and presentation of research topic in primatology.

ANTHR 450: Historical and Theoretical Approaches in Anthropology
(3-0) Cr. 3. F.
Prereq: ANTHR 306
Survey of the historical foundations of anthropology and its interrelated four sub-fields; key figures in 19th and 20th century anthropology with a focus on major theoretical contributions.

ANTHR 451: Practicum in Anthropology
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: ANTHR 201 or ANTHR 202 or ANTHR 308
Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis.

ANTHR 451A: Practicum in Anthropology: Archaeology
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: ANTHR 201 or ANTHR 202 or ANTHR 308
Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis.

ANTHR 451B: Practicum in Anthropology: Cultural Anthropology
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: ANTHR 201 or ANTHR 202 or ANTHR 308
Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis.

ANTHR 451C: Practicum in Anthropology: Biological Anthropology
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: ANTHR 201 or ANTHR 202 or ANTHR 308
Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis.

ANTHR 451D: Practicum in Anthropology: Linguistic Anthropology
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: ANTHR 201 or ANTHR 202 or ANTHR 308
Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis.

ANTHR 482: Topics in Biological Anthropology
(Dual-listed with ANTHR 582). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 482A: Topics in Biological Anthropology: Paleoanthropology
(Dual-listed with ANTHR 582A). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 482B: Topics in Biological Anthropology: Primate Cognition
(Dual-listed with ANTHR 582B). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 482C: Topics in Biological Anthropology: Primate Conservation
(Dual-listed with ANTHR 582C). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 482D: Topics in Biological Anthropology: Population Genetics and Human Evolution
(Dual-listed with ANTHR 582D). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 490: Independent Study
Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology
No more than 9 credits of Anthr 490 may be counted toward graduation.

ANTHR 490A: Independent Study: Archaeology
Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology
No more than 9 credits of Anthr 490 may be counted toward graduation.

ANTHR 490B: Independent Study: Cultural Anthropology
Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology
No more than 9 credits of Anthr 490 may be counted toward graduation.

ANTHR 490C: Independent Study: Biological Anthropology
Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology
No more than 9 credits of Anthr 490 may be counted toward graduation.

ANTHR 490D: Independent Study: Linguistic Anthropology
(Cross-listed with LING). Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology.
No more than 9 credits of Anthr 490 may be counted toward graduation.

ANTHR 490H: Independent Study: Honors
Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology
No more than 9 credits of Anthr 490 may be counted toward graduation.

ANTHR 490I: Iowa Lakeside Laboratory
(Cross-listed with IA LL, NREM). Cr. 1-6. Repeatable, maximum of 9 credits.
Prereq: 8 credits in biology and permission of instructor
Research opportunities for undergraduate students in the biological sciences. No more than 9 credits in Biol 490 may be counted toward graduation and of those, only 6 credits may be applied to the major.

Courses primarily for graduate students, open to qualified undergraduates:

ANTHR 503: Biological Anthropology and Archaeology
(3-0) Cr. 3.
Prereq: ANTHR 307 and ANTHR 308
History of biological anthropology and archaeology, current developments and theoretical issues related to major events in human biocultural evolution and world prehistory.

ANTHR 509: Agroecosystems Analysis
(Cross-listed with AGRON, SOC, SUSAG). (3-4) Cr. 3. F.
Prereq: Senior or above classification
Experiential, interdisciplinary examination of Midwestern agricultural and food systems, emphasizing field visits, with some classroom activities. Focus on understanding multiple elements, perspectives (agronomic, economic, ecologic, social, etc.) and scales of operation.

ANTHR 510: Theoretical Dimensions of Cultural Anthropology
(3-0) Cr. 3. F.
Prereq: 6 credits in anthropology
Survey of historical and current developments in topical and theoretical approaches to sociocultural anthropology. Examination and assessment of controversies; new research directions and theoretical approaches.

ANTHR 511: Anthropology for Global Professionals
(Dual-listed with ANTHR 411). (3-0) Cr. 3. F.
Prereq: ANTHR 201 or ANTHR 306
Theory and methods for conducting ethnographic research in academic and non-academic settings; application of anthropological knowledge to contemporary cultural, political, economic, environmental and spatial issues; development of skills necessary for professional practice as an anthropologist.
Meets International Perspectives Requirement.

ANTHR 513: Kinship and Marriage in a Global Perspective
(Dual-listed with ANTHR 313). (3-0) Cr. 3. S.
Prereq: ANTHR 201 recommended
Comparative and historical overview of the family, marriage and kinship. Examination of cross-cultural differences in the construction and functioning of family and kin relations; role of kinship in structuring individual and collective activities; current critical and theoretical issues in kinship studies, especially integrating work on gender and sexuality.
Meets International Perspectives Requirement.

ANTHR 515: Archaeology of North America
(Dual-listed with ANTHR 315). (3-0) Cr. 3. S.
Prereq: ANTHR 202
Prehistory and early history of North America as reconstructed from archaeological evidence; peopling of the New World; culture- historical sequences of major culture areas; linkages of archaeological traditions with selected ethnohistorically known Native American groups.
Meets U.S. Diversity Requirement

ANTHR 518: Global Culture, Consumption and Modernity
(Dual-listed with ANTHR 418). (3-0) Cr. 3. F.
Prereq: ANTHR 201 or ANTHR 306 recommended
Cross-cultural study of the impact of globalization, with an emphasis on economic consumption and the movement of goods, ideas, and peoples across cultural and national boundaries.
Meets International Perspectives Requirement.

ANTHR 519: Skeletal Biology
(Dual-listed with ANTHR 319). (2-2) Cr. 3. F.
Prereq: ANTHR 307 or college level biology
Comprehensive study of the skeletal anatomy, physiology, genetics, growth, development and population variation of the human skeleton. Applications to forensic anthropology, paleopathology and bioarchaeology are introduced.

ANTHR 520: Great Plains Archaeology
(Dual-listed with ANTHR 320). (3-0) Cr. 3. F.
Prereq: ANTHR 202
Prehistoric societies of the Great Plains region of North America, from initial occupation to European contact; emphasis on sociocultural changes, continuities, and adaptations to changing environments using archaeological, ecological, ethnographic information.
Meets U.S. Diversity Requirement

ANTHR 521: World Prehistory
(Dual-listed with ANTHR 321). (3-0) Cr. 3. S.
Prereq: ANTHR 202 recommended
An introduction to archaeological sites from around the world including the Near East, Africa, Europe, Mesoamerica, and North and South America. Emphasis is on the interpretation of material cultural remains in reconstructing past societies.

ANTHR 522: Peoples and Cultures of Native North America
(Dual-listed with ANTHR 322). (3-0) Cr. 3.
Prereq: ANTHR 201 or AM IN 210
Origin, distribution, and pre-contact life of the indigenous peoples of North America. Survey of culture areas; language families, social and political systems, ecological and economic adaptations, religion and spirituality; impact of European contact; cultural resilience and revitalization in contemporary American Indian life.
Meets U.S. Diversity Requirement

ANTHR 523: Topics in Latin American Anthropology
(Dual-listed with ANTHR 323). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.

ANTHR 523A: Latin American Anthropology: Violence and Memory
(Dual-listed with ANTHR 323A). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 523B: Latin American Anthropology: Social movements and Democracy
(Dual-listed with ANTHR 323B). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 523C: Latin American Anthropology: Race, Class and Gender
(Dual-listed with ANTHR 323C). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 523D: Latin American Anthropology: Regional Focus
(Dual-listed with ANTHR 323D). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 523E: Latin American Anthropology: Culture and Sport.
(Dual-listed with ANTHR 323E). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 524: Forensic Anthropology
(Dual-listed with ANTHR 424). (2-2) Cr. 3. S.
Prereq: ANTHR 202 or ANTHR 307; ANTHR 319 recommended
Comprehensive study of forensic anthropology, a specialized subfield of biological anthropology. Emphasis is placed on personal identifications from extremely fragmentary, comingled, burnt, cremated and incomplete skeletal remains. All parameters of forensic study are included as they pertain to anthropology, including human variation, taphonomy, entomology, archaeology, pathology, epidemiology; genetics and the non-biological forensic disciplines. An appreciation for the wide range of medicolegal and bioethical issues will also be gained.

ANTHR 528: Topics in Archaeological Laboratory Methods and Techniques
(Dual-listed with ANTHR 428). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 528A: Topics in Archaeological Laboratory Methods and Techniques
(Dual-listed with ANTHR 428A). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 528B: Topics in Archaeological Laboratory Methods and Techniques: Ceramics
(Dual-listed with ANTHR 428B). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 528C: Topics in Archaeological Laboratory Methods and Techniques: Faunal remains
(Dual-listed with ANTHR 428C). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 528D: Topics in Archaeological Laboratory Methods and Techniques: General
(Dual-listed with ANTHR 428D). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 529: Topics in Archaeological Laboratory Methods and Techniques: Archaeological Field School
(Dual-listed with ANTHR 429). Cr. 4-6. SS.
Prereq: ANTHR 202 or ANTHR 308
Summer field school for training in archaeological reconnaissance and excavation techniques; documentation and interpretation of archaeological evidence.

ANTHR 530: Ethnographic Field Methods
Cr. 3. F.
Prereq: 6 credits in anthropology, permission of instructor
Field training experience in ethnography. Problems emphasizing field studies in the contemporary societies of the world. Focus on techniques of data gathering and analysis.

ANTHR 531: Ethnographic Field School
(Dual-listed with ANTHR 431). Cr. 4-6.
Hands-on training in ethnographic field methods; students will carry out research projects in socio-cultural anthropology, learning a variety of investigative research techniques commonly used in social sciences.

ANTHR 532: Current Issues in Native North America
(Dual-listed with ANTHR 332). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 532A: Current Issues in Native North America: Gender and Family
(Dual-listed with ANTHR 332A). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 532B: Current Issues in Native North America: Indigenous Ecologies and Geographies
(Dual-listed with ANTHR 332B). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 532C: Current Issues in Native North America: Cultural and Political Movements
(Dual-listed with ANTHR 332C). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 532D: Current Issues in Native North America: Regional Focus
(Dual-listed with ANTHR 332D). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 536: Global Development
(Dual-listed with ANTHR 336). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ANTHR 201 or ANTHR 306
Cross-cultural analysis of current development practices from an anthropological perspective; focus on international aid, development institutions, agrarian reform, indigenous knowledge, humanitarianism and human rights; introduction to main theories of political and economic anthropology.
Meets International Perspectives Requirement.

ANTHR 538: Primate Evolutionary Ecology and Behavior
(Dual-listed with ANTHR 438). Cr. 3. S.
Prereq: ANTHR 202 or ANTHR 307
Primate behavior and ecology in evolutionary perspective: biological and social adaptations of prosimians, monkeys, and apes. Introduction to the Order Primates, basic evolutionary concepts, and techniques of behavioral observation. Focus on theory and methods current in Primatology, including applied conservation biology.

ANTHR 540: Magic, Witchcraft, and Religion
(Dual-listed with ANTHR 340). (Cross-listed with RELIG). (3-0) Cr. 3. S.
Prereq: ANTHR 201 or ANTHR 306
Survey of global religious belief and practice from an anthropological perspective. Emphasis on myth and ritual, shamanism, magic, witchcraft, beliefs in spirits, conceptions of the soul, mind and body relationships, and healing and therapeutic practices. Discussion of religious response to dramatic political and social change; effects of globalization on religious practice.
Meets International Perspectives Requirement.

ANTHR 541: Seminar in Forensic Sciences
(1-0) Cr. 1. Repeatable. S.
Prereq: One 200-level science course or graduate classification
Seminars by professional criminalists, research scientists, Certificate students, and educators. Emphasis on opportunities for research and development, citizen involvement, and educational outreach related to forensic science. Weekly report required.

ANTHR 542: Independent Research and Presentation in Forensic Science
(1-0) Cr. 1. S.
Prereq: Enrollment in the Graduate Certificate in Forensic Sciences
Research topic approved by course instructor. Written and oral reports required. Oral report given in forensics seminar, Chem 540.

ANTHR 544: Sex and Gender in Cross-cultural Perspective
(Dual-listed with ANTHR 444). (Cross-listed with W S). (3-0) Cr. 3. S.
Prereq: ANTHR 201; ANTHR 306 recommended
Cross-cultural examination of the social construction of genders out of the biological fact of sex. Emphasis on non-western societies. Topics, presented through examination of ethnographic data, will include the range of gender variation, status and roles, the institution of marriage, and symbols of gender valuation.
Meets International Perspectives Requirement.

ANTHR 545: Biological Field School
(Dual-listed with ANTHR 445). Cr. 4-6. SS.
Prereq: ANTHR 202 or BIOL 101
Summer field school for training in behavioral and ecological methods for primatologists. Proposal, data collection and analyses, and presentation of research topic in primatology.

ANTHR 582: Topics in Biological Anthropology
(Dual-listed with ANTHR 482). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 582A: Topics in Biological Anthropology: Paleoanthropology
(Dual-listed with ANTHR 482A). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 582B: Topics in Biological Anthropology: Primate Cognition
(Dual-listed with ANTHR 482B). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 582C: Topics in Biological Anthropology: Primate Conservation
(Dual-listed with ANTHR 482C). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 582D: Topics in Biological Anthropology: Population Genetics and Human Evolution
(Dual-listed with ANTHR 482D). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 590: Graduate Independent Study
(Cross-listed with A ECL, EEOB, IA LL). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

ANTHR 590I: Special Topics: Graduate Independent Study
(Cross-listed with A ECL, EEOB, IA LL). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

ANTHR 591: Orientation to Anthropology
(1-0) Cr. 1. F.
Prereq: Admission to the Anthropology Graduate Program
Introduction to the Anthropology program, including the requirements for successful degree completion, department administrative procedures, ethics in anthropology and current trends in the four subfields of anthropology. Required of graduate students. Offered on a satisfactory-fail basis only.

Courses for graduate students:

ANTHR 610: Foundations of Sustainable Agriculture
(Cross-listed with A B E, AGRON, SOC, SUSAG). (3-0) Cr. 3. F.
Prereq: Graduate classification, permission of instructor
Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts.

ANTHR 699: Research
Cr. arr. Repeatable.

ANTHR 699I: Iowa Lakeside Laboratory (Same as Ia LL 699I.)
(Cross-listed with A ECL, EEOB, GDCB, IA LL). Cr. arr. Repeatable.

Apparel, Events, and Hospitality Management (AESHM)

Courses primarily for undergraduates:

AESHM 112: Orientation for AESHM
(1-0) Cr. 1. F.S.
Prereq: Concurrent enrollment with AESHM 113
Orientation policies and procedures of university and college. Guest speakers representing the university. Some online lectures.

AESHM 113: Professional Development for AESHM
(1-0) Cr. 1. F.S.
Career exploration, presentation and professional skills, teamwork and leadership, creativity, critical thinking, technology, and service learning components. Orientation to policies and procedures of college, department, and program.

AESHM 113E: Professional Development for AESHM: Event Management and Hospitality Management
(1-0) Cr. 1. F.S.
EVENT and HSP M career exploration, presentation and professional skills, teamwork and leadership, creativity, critical thinking, technology, and service learning components. Orientation to policies and procedures of CHS college; AESHM department; and Event Management and Hospitality Management programs.

AESHM 113N: Professional Development for AESHM: Apparel, Merchandising, and Design
(1-0) Cr. 1. F.S.
AMD career exploration, presentation and professional skills, teamwork and leadership, creativity, critical thinking, technology, and service learning components. Orientation to policies and procedures of CHS college, AESHM department, and AMD program.

AESHM 170: Supervised Work Experience I
Cr. 1. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Adviser permission required; freshman classification or permission
Supervised work experience with a cooperating firm or organization. Offered on a satisfactory-fail basis only. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 170D: Supervised Work Experience I: Hospitality
Cr. 1. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Adviser permission required
Supervised work experience with a cooperating firm or organization. Offered on a satisfactory-fail basis only. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 170F: Supervised Work Experience I: Event Management
Cr. 1. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Adviser permission required
Supervised work experience with a cooperating firm or organization. Offered on a satisfactory-fail basis only. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 170N: Supervised Work Experience I: Apparel
Cr. 1. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Adviser permission required; freshman classification
Supervised work experience with a cooperating firm or organization. Offered on a satisfactory-fail basis only. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 170P: Supervised Work Experience I: ISU Dining
Cr. 1. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Adviser permission required; freshman classification or permission
Supervised work experience with a cooperating firm or organization. Offered on a satisfactory-fail basis only. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 175: Financial Applications for Retail and Hospitality Industries
(2-0) Cr. 2. S.
Using an online delivery method, students will learn basic mathematical concepts, calculations and formulas commonly used in the apparel and hospitality industries. Emphasis on problem solving, critical/creative thinking, and mathematical interpretation of calculations and formulas used within the apparel and hospitality industries.

AESHM 175D: Financial Applications for Retail and Hospitality Industries: Hospitality Management
(2-0) Cr. 2. S.
Using an online delivery method, students will learn basic mathematical concepts, calculations and formulas commonly used in the apparel and hospitality industries. Emphasis on problem solving, critical/creative thinking, and mathematical interpretation of calculations and formulas used within the hospitality industries.

AESHM 175N: Financial Applications for Retail and Hospitality Industries: Retail Merchandising
(2-0) Cr. 2. S.
Using an online delivery method, students will learn basic mathematical concepts, calculations and formulas commonly used in the apparel and hospitality industries. Emphasis on problem solving, critical/creative thinking, and mathematical interpretation of calculations and formulas used within the apparel industries.

AESHM 211: Leadership Experiences and Development (LEAD)
(3-0) Cr. 3. S.
Introduction to leadership behaviors. Development and utilization of leadership behaviors to positively impact school life, community life, and work life.

AESHM 222: Creativity on Demand
(3-0) Cr. 3. S.
Learn to use creativity strategies to solve everyday problems related to personal and professional lives. Application of creative thinking techniques to view things from different perspectives; identify unique opportunities; and generate and evaluate original ideas. Field trips might be required.

AESHM 270: Supervised Work Experience II
Cr. 1-2. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Minimum 2.0 GPA; Adviser permission required; sophomore classification
Supervised work experience with a cooperating firm or organization. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 270D: Supervised Work Experience II: Hospitality
Cr. 1-2. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Minimum 2.0 GPA; Adviser permission required; sophomore classification; 6 cr in AESHM or HSP M, credits in AESHM 170
Supervised work experience with a cooperating firm or organization. No more than 12 credits total from AESHM 170, AESHM 270, and 470 may be applied toward graduation.

AESHM 270F: Supervised Work Experience II: Event Management
Cr. 1-2. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Minimum 2.0 GPA; Adviser permission required; 6 cr in AESHM, HSP M, or EVENT; employer location should be different than employer location used for AESHM 170 and 470.
Supervised work experience with a cooperating firm or organization. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 270N: Supervised Work Experience II: Apparel
Cr. 1-2. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Minimum 2.0 GPA; Adviser permission required. Sophomore AMD classification
Supervised work experience with a cooperating firm or organization. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 270P: Supervised Work Experience II: ISU Dining
Cr. 1-2. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Minimum 2.0 GPA; Adviser permission required; sophomore classification; 6 cr in AESHM or HSP M, credit in AESHM 170.
Supervised work experience with a cooperating firm or organization. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 272: Fashion Show Production and Promotion
(2-2) Cr. 1-3. Repeatable, maximum of 4 credits. F.S.
Prereq: Application and instructor permission, application form available from the AESHM Department office
Planning and production of fashion show including developing budgets, public relations, advertising, fund-raising, choreography, staging, lighting, and food. Promotion of fashion show and similar events. Maximum of 4 credits can be applied to graduation

AESHM 280: Orientation to U.S. Field Study
Cr. R. Repeatable, maximum of 2 times. F.S.
Orientation to the field study location during the semester preceding the trip.

AESHM 281: Orientation to International Field Study
Cr. 1. Repeatable, maximum of 2 times. F.S.
Orientation to the field study location during the semester preceding the trip.

AESHM 287: Principles of Management in Human Sciences
(3-0) Cr. 3. F.S.
Introduction to management concepts and principles with application to human sciences-related businesses and organizations. Includes service quality management, professionalism, and social responsibility.

AESHM 311: Seminar on Careers and Internships
(1-0) Cr. 1. F.S.
Prereq: AESHM 113; Sophomore classification. Good academic standing
Internship and career planning, professional expectations and responsibilities. Résumé development, cover letters, interviewing techniques, and business etiquette.

AESHM 311E: Seminar on Careers and Internships: Event Management and Hospitality Management
(1-0) Cr. 1. F.S.
Prereq: AESHM 113; Sophomore classification. Good academic standing.
Internship and career planning, professional expectations and responsibilities. Résumé development, cover letters, interviewing techniques, and business etiquette.

AESHM 311N: Seminar on Careers and Internships: Apparel, Merchandising, and Design
(1-0) Cr. 1. F.S.
Prereq: AESHM 113; Sophomore classification. Good academic standing
Internship and career planning, professional expectations and responsibilities. Résumé development, cover letters, interviewing techniques, and business etiquette.

AESHM 340: Hospitality and Apparel Marketing Strategies
(3-0) Cr. 3. F.S.
Prereq: ECON 101
Application of marketing principles to the hospitality-, events-, and apparel-related industries. Emphasis on the role of marketing in an organization's overall strategic planning. Development and evaluation techniques available to hospitality, events, apparel, and related businesses, including advertising, sales promotion, packaging, and public relations.

AESHM 342: Aesthetics of Consumer Experience
(3-0) Cr. 3. F.S.
Prereq: Sophomore classification
Design principles, aesthetic concepts, and research applied to consumer experiences, with an emphasis on hospitality and retail environments and events. Influence of individual differences and cultural patterns on aesthetic preferences.
Meets U.S. Diversity Requirement

AESHM 380: U.S. Field Study
(Dual-listed with AESHM 580). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in A M D, AESHM, EVENT, and/or HSP M; sophomore classification; minimum 2.0 GPA. Permission by application
Study and tours of areas of interest to majors in the AESHM Department. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 380D: U.S. Field Study: Hospitality Management
(Dual-listed with AESHM 580D). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in AESHM or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 280 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 380F: U.S. Field Study: Event Management
(Dual-listed with AESHM 580F). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in EVENT, AESHM, or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 280 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the majors in the Event Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 380N: U.S. Field Study: Apparel, Merchandising, and Design
(Dual-listed with AESHM 580N). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in A M D or AESHM; sophomore classification; minimum 2.0 GPA; AESHM 280 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 381: International Field Study
(Dual-listed with AESHM 581). Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in A M D, AESHM, EVENT, and/or HSP M; sophomore classification; minimum 2.0 GPA. Permission by application
Study and tours of areas of interest to majors in the AESHM Department. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 381D: International Field Study: Hospitality Management
(Dual-listed with AESHM 581D). Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in AESHM and/or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 281 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 381F: International Field Study: Event Management
(Dual-listed with AESHM 581F). Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in AESHM, EVENT, and/or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 281 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Event Management major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 381N: International Field Study: Apparel, Merchandising, and Design
(Dual-listed with AESHM 581N). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in A M D and/or AESHM; sophomore classification; minimum 2.0 GPA; AESHM 281 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 398: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of adviser; junior classification
Required of all cooperative education students seeking full-time status. Students register for this course prior to commencing each work period.

AESHM 411: Seminar on Current Issues
Cr. 1. F.S.
Prereq: Permission of instructor.
Trends, issues, research, and scholarship in apparel, events, and hospitality management.

AESHM 411E: Seminar on Current Issues: Events and Hospitality
Cr. 1. F.S.
Prereq: senior classification in AESHM.
Trends, issues, research, and scholarship in events and hospitality management.

AESHM 411N: Seminar on Current Issues: Apparel
(1-0) Cr. 1. Repeatable, maximum of 2 times. F.S.
Prereq: AESHM 470N
Trends, issues, research, and scholarship in apparel.

AESHM 421: Developing Global Leadership: Maximizing Human Potential
(3-0) Cr. 3. S.
Development of leadership in a global environment. Focus on global concerns that impact on the well-being of individuals, families, and communities. Strategies for working with individuals, families and communities in other countries and cultures. Taking local action on global issues. Participation in a service activity.
Meets International Perspectives Requirement.

AESHM 438: Human Resource Management
(3-0) Cr. 3. F.S.
Prereq: AESHM 270, AESHM 275 or AESHM 287; junior classification
Principles and practices of human resource management relevant to human science-related organizations. Emphasis on the entry-level manager's role.

AESHM 470: Supervised Professional Internship
Cr. 3-6. Repeatable. F.S.SS.
Supervised work experience with a cooperating firm or organization.

AESHM 470D: Supervised Professional Internship: Hospitality
Cr. 3-6. Repeatable. F.S.SS.
Prereq: AESHM 270, 311, 9 credits in HSP M, and minimum 2.0 GPA; permission by application; junior or senior classification; employer location should be different than employer/location used for AESHM 170 and 270
Supervised work experience with a cooperating firm or organization. No more than 12 credits from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 470F: Supervised Professional Internship: Event Management
Cr. 3-6. Repeatable. F.S.SS.
Prereq: AESHM 311, EVENT 271; employer/location should be different than employer/location used for AESHM 170 and 270
Supervised work experience with a cooperating firm or organization. No more than 12 credits from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 470N: Supervised Professional Internship: Apparel
Cr. 3-6. Repeatable. F.S.SS.
Prereq: AESHM 311, 9 credits in A M D, and minimum 2.0 GPA; permission by application; junior or senior classification; employer/location should be different than employer/location for AESHM 170 and 270
Supervised work experience with a cooperating firm or organization. No more than 12 credits from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 470P: Supervised Professional Internship: ISU Dining
Cr. 3-6. Repeatable. F.S.SS.
Prereq: AESHM 170, 311, 9 credits in AESHM or HSP M, and minimum 2.0 GPA; permission by application; junior or senior classification; employer/location should be different than employer/location used for AESHM 170 and 270
Supervised work experience with a cooperating firm or organization. No more than 12 credits from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 472: Fashion Show Management
(2-2) Cr. 1-3. Repeatable, maximum of 5 credits. S.
Prereq: Permission of instructor
Provide leadership and communicate direction for planning and production of fashion show, including developing budgets, publicity, advertising, fundraising, choreography, staging, lighting, and food. Maximum of 5 credits can be applied to graduation

AESHM 474: Entrepreneurship in Human Sciences
(Dual-listed with AESHM 574). (3-0) Cr. 3. F.S.
Prereq: A M D 275 or AESHM 287 or ACCT 284 or 3 cr in MKT or permission of instructor
Comprehensive approach to entrepreneurship including concepts of innovation, creativity, opportunity assessment, and business planning. Focus on human sciences-related businesses: retail, service, hospitality, event, food-related, family-owned, rural, and community businesses. Interaction with entrepreneurs, market research, feasibility analysis, business proposals, and business/community outreach and consulting.

AESHM 497: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of adviser; senior or graduate classification
Required of cooperative education students. Students must register for this course prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

AESHM 510: Research Methods in Apparel and Hospitality
Cr. 3. SS.
Prereq: Graduate standing in the Department
Overview of research methods. Methods for collecting and analyzing quantitative and qualitative data. Development of research plan.

AESHM 511: Seminar
Cr. 1-3. Repeatable, maximum of 6 times.
Prereq: 6 graduate credits in A M D, AESHM, or HSP M. Permission of instructor
Discussion of scholarship and current issues. Topics vary.

AESHM 570: Practicum
Cr. 1-3. Repeatable, maximum of 2 times. F.S.SS.
Prereq: 6 graduate credits in program area; permission of instructor
Supervised experience related to career objective. Proposal must be approved semester before placement.

AESHM 570A: Apparel Merchandising and Design
Cr. 1-3. Repeatable, maximum of 2 times. F.S.SS.
Prereq: 6 graduate credits in program area; permission of instructor
Supervised experience related to career objective. Proposal must be approved semester before placement.

AESHM 570B: Hospitality Management
Cr. 1-3. Repeatable, maximum of 2 times. F.S.SS.
Prereq: 6 graduate credits in program area; permission of instructor
Supervised experience related to career objective. Proposal must be approved semester before placement.

AESHM 574: Entrepreneurship in Human Sciences
(Dual-listed with AESHM 474). (3-0) Cr. 3. F.S.
Prereq: A M D 275 or AESHM 287 or ACCT 284 or 3 cr in MKT or permission of instructor
Comprehensive approach to entrepreneurship including concepts of innovation, creativity, opportunity assessment, and business planning. Focus on human sciences-related businesses: retail, service, hospitality, event, food-related, family-owned, rural, and community businesses. Interaction with entrepreneurs, market research, feasibility analysis, business proposals, and business/community outreach and consulting.

AESHM 580: U.S. Field Study
(Dual-listed with AESHM 380). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in A M D, AESHM, EVENT, and/or HSP M; sophomore classification; minimum 2.0 GPA. Permission by application
Study and tours of areas of interest to majors in the AESHM Department. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 580D: U.S. Field Study: Hospitality Management
(Dual-listed with AESHM 380D). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in AESHM or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 280 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 580F: U.S. Field Study: Event Management
(Dual-listed with AESHM 380F). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in EVENT, AESHM, or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 280 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the majors in the Event Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 580N: U.S. Field Study: Apparel, Merchandising, and Design
(Dual-listed with AESHM 380N). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in A M D or AESHM; sophomore classification; minimum 2.0 GPA; AESHM 280 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 581: International Field Study
(Dual-listed with AESHM 381). Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in A M D, AESHM, EVENT, and/or HSP M; sophomore classification; minimum 2.0 GPA. Permission by application
Study and tours of areas of interest to majors in the AESHM Department. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 581D: International Field Study: Hospitality Management
(Dual-listed with AESHM 381D). Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in AESHM and/or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 281 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 581F: International Field Study: Event Management
(Dual-listed with AESHM 381F). Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in AESHM, EVENT, and/or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 281 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Event Management major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 581N: International Field Study: Apparel, Merchandising, and Design
(Dual-listed with AESHM 381N). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in A M D and/or AESHM; sophomore classification; minimum 2.0 GPA; AESHM 281 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

Courses for graduate students:

AESHM 611: Seminar
Cr. 1-3. Repeatable.
Prereq: 6 graduate credits in AESHM, A M D, or HSP M. Permission of instructor
Scholarship and current issues. Topics vary.

AESHM 670: Teaching Practicum
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 graduate credits in program area; permission of instructor
Supervised experience in the university classroom. Proposal must be approved semester before placement.

AESHM 670A: Teaching Practicum: Apparel Merchandising and Design
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 graduate credits in program area; permission of instructor
Supervised experience in the university classroom. Proposal must be approved semester before placement.

AESHM 670B: Teaching Practicum: Hospitality Management
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 graduate credits in program area; permission of instructor
Supervised experience in the university classroom. Proposal must be approved semester before placement.

Apparel, Merchandising and Design (A M D)

Courses primarily for undergraduates:

A M D 120: Apparel Construction Techniques
(3-0) Cr. 3. SS.
Assemble components and completed garments with the use of basic sewing equipment. Learn basic construction techniques, applications and vocabulary. Students will need access to a home sewing machine, iron, computer and the internet. Not available for credit for A M D majors.

A M D 121: Apparel Assembly Processes
(1-4) Cr. 3. F.S.
Prereq: A M D 204 concurrent recommended
Principles of garment assembly. Use of mass production equipment and methods to analyze, develop and assemble garments.

A M D 131: Fashion Products and Markets
(3-0) Cr. 3. F.
Fashion industry structure from concept to consumer. Focus on fashion-driven consumer goods. Development and prototyping of fashion products for a target market.

A M D 165: Dress and Diversity in Society
(3-0) Cr. 3. F.S.
Examination of diversity among consumers and introduction to forecasting trends in dress. Introduction to social justice issues.
Meets U.S. Diversity Requirement

A M D 178: Introduction to Apparel Design Studio
(1-4) Cr. 3. F.S.
Introduction to the elements and principles of design in fashion and apparel including skill development in fashion illustration, technical drawing, and fabric rendering using traditional media. Application of written and verbal presentations to communicate fashion and apparel design concepts and terminology. Fashion presentation and introduction to portfolio development.

A M D 204: Textile Science
(3-2) Cr. 4. F.S.
Prereq: A M D 131
Textile fibers, yarns, fabrication, coloration, and finishes. Quality and performance application to textile products. Lab work included.

A M D 206: Design Selective Advancement
Cr. R. Repeatable, maximum of 2 times. F.S.
Prereq: Completion or enrollment in A M D 121, A M D 131, A M D 178, and A M D 204 and enrollment in major
Project review and skill assessment related to 2-dimensional and 3-dimensional visualization, apparel assembly, basic product knowledge, design problem solving, illustration, textiles. Offered on a satisfactory-fail basis only.

A M D 210: Computer Applications in Digital Design and Data Management
(2-2) Cr. 3. F.S.
Prereq: A M D 131, A M D 245 or concurrent; AESHM 113N
Applications of basic skills in Photoshop, Illustrator, PLM-type software, Excel, and databases. Introduction to digital product design and line development. Focus on elements and principles of design. Introduction to digital portfolio development for design and merchandising. Online lectures.

A M D 225: Patternmaking I: Drafting and Flat Pattern
(1-4) Cr. 3. F.S.
Prereq: A M D 121, A M D 204, AMD 206.
Application of patternmaking tools and their functions, measurement techniques, pattern labeling, and patternmaking communication documents. Sloper drafting and flat pattern manipulation methods for women's apparel. Design and construction of original garments using drafted slopers and flat pattern manipulation methods to enable the analysis of fit.

A M D 231: Product Development and Manufacturing
(3-2) Cr. 4. F.S.
Prereq: A M D 204
Analysis of apparel product development, sourcing, and manufacturing processes. Focus on materials and specifications relative to quality, performance, cost, and price. Applications of software for PLM.

A M D 245: Aesthetics and Brand Image
(3-0) Cr. 3. F.S.
Prereq: A M D 131, A M D 165, A M D 204 or concurrent
Elements and principles of design. Analysis of sensory, expressive, and symbolic aspects that build brand image, with a focus on fashion products and promotional settings.

A M D 257: Museum Studies
(3-0) Cr. 3. F.
Prereq: Sophomore standing
Overview of museums including history, functions, and philosophy. Collection and curatorial practices. Funding and governance issues. Hands-on object research and exhibit development. Required field trip.

A M D 275: Retail Merchandising
(3-0) Cr. 3. F.S.
Prereq: 3 credits in Math
Principles of merchandising as applied to retail-, service-, events-, and hospitality-related businesses. Study of the planning, development, and presentation of apparel- and hospitality-related products, services, and experiences. Industry and market research, planning of new offerings, and development of promotional and competitive strategies for various retail formats.

A M D 278: Fashion Illustration
(0-6) Cr. 3. F.S.
Prereq: A M D 178, A M D 210 or concurrent enrollment, A M D 245 or concurrent enrollment. Permission of instructor.
Development of fashion plates and focused apparel lines/collections. Proficiency in drawing the fashion figure, technical drawings/flats, and apparel using a variety of media. Continuation of fashion presentation and portfolio development.

A M D 290: Independent Study
Cr. 1-2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Freshmen or Sophomore Classification; Permission of instructor, adviser, and department chair.
Independent study on topics of special interest to the student, facilitated by approved faculty member. Total number of A M D 290 and A M D 490 credits applied to graduation cannot exceed 9 credits.

A M D 305: Quality Assurance of Textiles and Apparel
(Dual-listed with A M D 505). (2-2) Cr. 3. F.
Prereq: A M D 231, one course in natural science (chemistry with lab preferred); STAT 101, STAT 226, or STAT 401
Principles of product and materials evaluation and quality assurance. Developing specifications and using standard practices for evaluating materials, product characteristics, performance, and quality.

A M D 310: Computer Aided Apparel Patternnmaking
(0-6) Cr. 3. F.S.
Prereq: A M D 210, 225; Permission of instructor.
Computer-aided patternmaking technology used in pattern drafting, grading, marker making, and 3-D virtual prototyping.

A M D 321: Computer Integrated Textile and Fashion Design
(0-6) Cr. 3. F.S.
Prereq: A M D 210, A M D 278 or concurrent enrollment. Permission of instructor
Analysis and advanced use of computer-aided design software for textile and fashion design for various target markets. Digital presentation and portfolio development.

A M D 325: Patternmaking II: Draping
(0-6) Cr. 3. F.S.
Prereq: A M D 206, A M D 225; permission of instructor.
Principles of patternmaking through basic draping techniques on industry standard body forms. Apparel design through analysis of fit and design; problem solving and interaction of fabric characteristics with style features.

A M D 328: Design Seminar
(Dual-listed with A M D 528). Cr. arr. Repeatable. F.S.SS.
Prereq: Vary with topic.
Focus on artisanal textile, apparel, or surface and structural design techniques. Design processes for specialty fabrics and markets. Topics vary by term.

A M D 329: Digital Textile Printing for Apparel Design
(2-2) Cr. 3. F.S.
Prereq: A M D 321; A M D 325 or concurrent
Overview of the use of digital printing in the textile and apparel industry, color matching, repeat print patterns, engineered prints, and creation of apparel prototypes.

A M D 354: History of European and North American Dress
(3-0) Cr. 3. F.
Prereq: 3 credits from Hist or Art H
Survey of history of dress from ancient times up to the American Civil War; focus on European and North American dress. Emphasis on connection of dress to the social, cultural, environmental, and technological contexts of the Western world.
Meets International Perspectives Requirement.

A M D 356: History of Twentieth Century Fashion
(3-0) Cr. 3. S.
Prereq: 3 credits HIST or ART H; A M D 204 recommended.
Survey of major design and technological developments from the American Civil War through the 20th Century. Emphasis on fashion as a system of design and production, culture of consumption, fashion change, and trends in art, society, and culture.

A M D 362: Cultural Perspectives of Dress
(3-0) Cr. 3. S.
Prereq: A M D 165 or 3 credits in anthropology, psychology, or sociology.
Analysis of multiple factors related to dress in selected societies, including technology, cultural identity, aesthetics, social organization, ritual, stability and change. Applications to fair trade and social responsibility.
Meets International Perspectives Requirement.

A M D 372: Sourcing and Global Issues
(3-0) Cr. 3. F.S.
Prereq: A M D 231, A M D 275; ECON 101 or ECON 102 recommended
Evaluation of key issues facing textile and apparel industries in global markets considering ethical, economic, political, social, and professional implications. Sourcing strategies in a global environment. Corporate and consumer social responsibility and sustainability.
Meets International Perspectives Requirement.

A M D 376: Merchandise Planning and Control
(3-2) Cr. 4. F.S.
Prereq: A M D 275; A M D 210 or COM S 113; 3 credits from ACCT 284, MATH 104, MATH 105, MATH 140, MATH 150, or equivalent.
Calculations and computer application in the planning and control of merchandise. Emphasis on retail math as it pertains to assortment planning, the six-month buying plan process, and other buying concepts and strategies. Online modules.

A M D 377: Visual Presentation and Promotions
(3-0) Cr. 3. F.S.
Prereq: A M D 245 or AESHM 342; AESHM 340 or MKT 340
Principles of visual aspects of brand development and management; emphasis on branding, visual merchandising, design/layout of retail spaces. Includes applications such as visual communication and documentation using Adobe Creative Suite(R), hands-on display projects, and brand case studies.

A M D 393: Apparel, Merchandising, and Design Workshop
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: A M D Junior or Senior Classification and Permission of Instructor.
Intensive 2 to 8 week workshop exploration. Topics vary each time offered. Maximum of 6 credits applied to graduation.

A M D 404: Advanced Textile Science
(Dual-listed with A M D 504). (2-2) Cr. 3. S.
Prereq: A M D 204, CHEM 163 and CHEM 163L or equivalent
Theories and principles of textile science. Textile product serviceability. Effect of fiber structure on properties and performance. New developments in textiles.

A M D 415: Technical Design Processes
(2-2) Cr. 3. F.
Prereq: A M D 225; A M D 231
Garment development and analysis of fit, performance, quality, cost. Exploration of alternative materials, construction methods, grading; specifications and portfolio development.

A M D 426: Creative Design Processes
(1-4) Cr. 3. Alt. F., offered irregularly.S.
Prereq: A M D 206, A M D 321, A M D 325 or concurrent
Exploration of the creative process and sources of inspiration with emphasis on wearable art; experimentation of advanced design problem solving, alternative materials, fabric manipulation, and pattern-making techniques.

A M D 431: Apparel Production Management
(3-0) Cr. 3. S.
Prereq: A M D 231; A M D 121 recommended; A M D 372 or concurrent.
Procedures and experiences related to application and use of process controls: method analysis, work measurement, costing, pricing, and production planning. Resource management, technology applications, and quality assurance.

A M D 457: Textile Conservation and Collection Management
(Dual-listed with A M D 557). (3-0) Cr. 3.
Prereq: A M D 204
Condition assessment, repair, and stabilization of textiles and apparel in museum collections. Dry and aqueous cleaning. Examination of storage and exhibition techniques, materials, and conditions. Experience with cataloging and management practices.

A M D 467: Consumer Studies in Apparel and Fashion Products
(2-2) Cr. 3. F.
Prereq: A M D 165; AESHM 340 or MKT 340; STAT 101 or STAT 104 or STAT 226;
Application of concepts and theories from the social sciences to the study of consumer behavior related to dress, textile and apparel products, and retail experiences. Experience in conducting consumer research.

A M D 475: Retail Information Analysis
(2-2) Cr. 3. S.
Prereq: A M D 376
Evaluation of information needed to make effective retail decisions. Use of technology in analyzing and interpreting retail systems data. Application of concepts related to forecasting, consumer demand, assortment planning, market research, data mining, database interface, pattern recognition, supply-chain/logistics management, retail technology applications such as Visual Retailing, PLM, and Sourcing Simulator.

A M D 477: Omni-channel Retailing
(3-0) Cr. 3. S.
Prereq: 3 credits in marketing or A M D 275 or AESHM 287
A customer-centric view of marketing with a focus on the retailer-customer relationship and omni-channel strategies. Analysis and evaluation of integrated retail applications and strategies using digital media, including store formats, e-commerce, catalog, mobile, crowdsourcing, and social media.

A M D 490: Independent Study
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair
Independent Study. Maximum of 9 credits of both A M D 290 and A M D 490 can be applied toward graduation.

A M D 490A: Independent Study: Textile Science
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair

A M D 490B: Independent Study: Historical, Cultural, and Museum Studies of Dress and Textiles
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair

A M D 490C: Independent Study: Textile and Apparel Design
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair

A M D 490E: Independent Study: Merchandising, Aesthetics, and Entrepreneurship
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair

A M D 490F: Independent Study: Sociological, Psychological, and Consumer Behavioral Aspects of Dress
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair

A M D 490H: Independent Study: Honors
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair

A M D 490J: Independent Study: Product Development, Innovation, and Sourcing
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in textiles and clothing. Permission of the instructor, adviser, and department chair

A M D 490S: Independent Study: Production and Quality Assurance
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in textiles and clothing. Permission of the instructor, adviser, and department chair

A M D 490W: Independent Study: Fashion Show, Fashion Public Relations and Marketing
Cr. arr. Repeatable. F.S.SS.
Prereq: Prereq: 6 credits in textiles and clothing. Permission of the instructor, adviser, and department chair

A M D 495: Senior Design Studio
(Dual-listed with A M D 595). (0-6) Cr. 3. F.
Prereq: A M D 310, A M D 325. Permission of instructor.
Creation of an apparel line from target market research to prototypes through the use of manual techniques and CAD technologies. The line is to be included in a professional portfolio and pieces submitted to a juried exhibition.

A M D 496: Fashion Product Development and Prototyping
(3-0) Cr. 3. S.
Prereq: A M D 231, A M D 245, A M D 275
Applying consumer, aesthetic, and quantitative trend information to develop value-added fashion products and product lines with merchandising/promotion campaigns for diverse target markets. Multi-function team projects. Development of a prototype and presentation to industry representatives.

A M D 499: Undergraduate Research
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Senior classification, 15 credits in A M D. Permission of instructor, adviser, and department chair
Research experience in textiles and clothing with application to a selected problem.

Courses primarily for graduate students, open to qualified undergraduates:

A M D 504: Advanced Textile Science
(Dual-listed with A M D 404). (2-2) Cr. 3. S.
Prereq: A M D 204, CHEM 163 and CHEM 163L or equivalent
Theories and principles of textile science. Textile product serviceability. Effect of fiber structure on properties and performance. New developments in textiles.

A M D 505: Quality Assurance of Textiles and Apparel
(Dual-listed with A M D 305). (2-2) Cr. 3. F.
Prereq: A M D 231, one course in natural science (chemistry with lab preferred); STAT 101, STAT 226, or STAT 401
Principles of product and materials evaluation and quality assurance. Developing specifications and using standard practices for evaluating materials, product characteristics, performance, and quality.

A M D 510: Foundation of Scholarship in Textiles and Clothing
(3-0) Cr. 3. F.Alt. SS., offered irregularly.
Prereq: Graduate classification or permission of instructor
Overview of scholarship in textiles and clothing with emphasis on current and future directions. Fundamentals of writing literature reviews. Examination of ethical issues in scholarship and academic life. Introduction to creativity, sustainability, and entrepreneurship. Development of teaching units.

A M D 521: Digital Technologies in Textile and Apparel Design
(3-0) Cr. 3.
Prereq: Research Methods course. Permission of instructor.
Digital technologies in textile and apparel design. Theories and practices of mass customization and personalization, digital textile printing, 3D body scanning, creating avatars from body scans, and fitting digital apparel designs.

A M D 528: Design Seminar
(Dual-listed with A M D 328). Cr. arr. Repeatable. F.S.SS.
Prereq: Vary with topic.
Focus on artisanal textile, apparel, or surface and structural design techniques. Design processes for specialty fabrics and markets. Topics vary by term.

A M D 545: Consumer Aesthetics and Retail Branding
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: One course in design elements and principles, psychology, consumer behavior, or marketing
Examination of hedonic nature of consumer experience and its application to experiential design and branding of retail/hospitality establishments. Emphasis on consumer behavior, environmental psychology, and marketing literature.

A M D 557: Textile Conservation and Collection Management
(Dual-listed with A M D 457). (3-0) Cr. 3.
Prereq: A M D 204
Condition assessment, repair, and stabilization of textiles and apparel in museum collections. Dry and aqueous cleaning. Examination of storage and exhibition techniques, materials, and conditions. Experience with cataloging and management practices.

A M D 565: Sustainability: Theory and Practical Application
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 3 credits in research methods; basic knowledge of apparel industry and product development; permission of instructor.
Overview of current sustainability theory, research, and methodology. Emphasis on the evaluation and discussion of current sustainability literature and sustainable practice of apparel, textiles, and related products and services through people, processes, and the environment. Development and presentation of original scholarly and creative design work under various sustainability frameworks.

A M D 567: Consumer Behavior and Apparel
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A M D 467 or MKT 447; STAT 401
Application of concepts and theories from the social sciences to the study of consumer behavior. Experience in conducting research; manuscript writing.

A M D 572: Sourcing and Global Issues
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A course in merchandising or marketing
Evaluation of textile and apparel industries in global markets considering ethical, economic, political, social, and professional implications. Sourcing strategies in a global environment. Corporate and consumer social responsibility and sustainability. Experience in conducting research using secondary data.
Meets International Perspectives Requirement.

A M D 576: Industry Applications in Merchandising and Management
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A M D 376 or equivalent; A M D 275 or equivalent. Permission of instructor
Using the case study method, students apply merchandising theory, principles, and practices to industry scenarios. Emphasis on problem solving, creative thinking, data analysis, and data interpretation involved in business operations. Focus on the development of leadership skills while functioning in small and large groups.

A M D 577: E-Commerce for Apparel and Hospitality Companies
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Course in marketing or permission of instructor
Analysis of technology and consumer trends, industry practices, and marketing strategies for e-commerce including big data, data mining, and social media. Evaluation and development of apparel or hospitality company websites. Theory application to the development of multi-channel business strategies.

A M D 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed A M D-related projects that reflect the special interests of the student.

A M D 590A: Special Topics: Textile Science
Cr. arr. Repeatable.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed A M D-related projects that reflect the special interests of the student.

A M D 590B: Special Topics: Historical, Cultural, and Museum Studies of Dress and Textiles
Cr. arr. Repeatable.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed A M D-related projects that reflect the special interests of the student.

A M D 590C: Special Topics: Textile and Apparel Design
Cr. arr. Repeatable.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed A M D-related projects that reflect the special interests of the student.

A M D 590E: Special Topics: Merchandising, Aesthetics, and Entrepreneurship
Cr. arr. Repeatable.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed A M D-related projects that reflect the special interests of the student.

A M D 590F: Special Topics: Sociological, Psychological, and Consumer Behavioral Aspects of Dress
Cr. arr. Repeatable.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed A M D-related projects that reflect the special interests of the student.

A M D 590J: Special Topics: Product Development, Innovation, and Sourcing
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed textile and clothing-related projects that reflect the special interests of the student.

A M D 590S: Special Topics: Production and Quality Assurance
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed textile and clothing-related projects that reflect the special interests of the student.

A M D 590W: Special Topics: Fashion Show, Fashion Public Relations and Marketing
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed textile and clothing-related projects that reflect the special interests of the student.

A M D 595: Senior Design Studio
(Dual-listed with A M D 495). (0-6) Cr. 3. F.
Prereq: A M D 310, A M D 325. Permission of instructor.
Creation of an apparel line from target market research to prototypes through the use of manual techniques and CAD technologies. The line is to be included in a professional portfolio and pieces submitted to a juried exhibition.

A M D 599: Creative Component
Cr. arr. Repeatable.
Prereq: 9 graduate credits in A M D

Courses for graduate students:

A M D 611: Seminar
Cr. 1-3. Repeatable.
Prereq: 6 graduate credits in A M D. Permission of instructor
Discussion of scholarship and current issues. Topics vary.

A M D 625: Design Theory and Process
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor.
Analysis and application of design theory and creative processes, including strategies for solving aesthetic, functional, and/or technology-focused design problems. Creation and dissemination of design scholarship.

A M D 665: Social Science Theories of Appearance
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 6 credits in sociology or psychology
Analysis of social science theories and concepts applicable to appearance research. Emphasis on qualitative research and philosophy of knowledge, including postmodern, symbolic interaction, semiotic, and feminist theories. Collection and analysis of qualitative data.

A M D 676: Merchandising Theory and Research Applications
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A M D 275 or equivalent; statistics course recommended.
Review of current merchandising theory, research, and methodology. Emphasis on the evaluation and discussion of current and seminal merchandising literature, understanding research processes, interpretation of findings, assessing implications of research for future directions in merchandising, and the development and presentation of original scholarly work.

A M D 690: Advanced Topics
Cr. arr. Repeatable.
Prereq: Enrollment in doctoral program, permission of instructor; and approval of D.O.G.E

A M D 699: Research
Cr. arr. Repeatable.

Arabic (ARABC)

Courses primarily for undergraduates:

ARABC 101: Elementary Arabic I
(4-0) Cr. 4. F.
Beginning level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture. Attention to the use of the Arabic alphabet.

ARABC 102: Elementary Arabic II
(4-0) Cr. 4. S.
Prereq: ARABC 101 or placement by department exam.
Continuation of ARABC 101. Beginning level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture.
Meets International Perspectives Requirement.

ARABC 195: Study Abroad
Cr. arr. Alt. SS., offered irregularly.
Supervised instruction in Arabic language and culture, formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Arabic.

ARABC 201: Intermediate Arabic I
(4-0) Cr. 4. F.
Prereq: ARABC 102 or placement by department exam
Intermediate level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture.
Meets International Perspectives Requirement.

ARABC 202: Intermediate Arabic II
(4-0) Cr. 4.
Prereq: ARABC 201 or placement by department exam
Intermediate development of reading, writing, listening comprehension, and speaking skills in Modern Standard Arabic within the context of the Arabic world.
Meets International Perspectives Requirement.

ARABC 295: Study Abroad
Cr. arr. Alt. SS., offered irregularly.
Prereq: ARABC 102 or equivalent
Supervised instruction in Arabic language and culture, formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Arabic.

ARABC 490: Independent Study
Cr. 1-6. Repeatable.
Prereq: Permission of Arabic staff and department Chair.
Independent study with focus on areas other than those in which courses are offered. No more than 6 credits in ARABC 490 may be counted toward graduation.

Architecture (ARCH)

Courses primarily for undergraduates:

ARCH 201: Architectural Design I
(1-15) Cr. 6. F.
Prereq: Completion of the pre-professional program and admission into the professional program in Architecture
Introduction to architectural design. Introduction to architectural design, including precedent research, drawing conventions, model making, and diagramming. Studio projects focus on investigating the impact of specific site conditions on design, threshold conditions, and small-scale domestic space. Students will learn skills in problem solving, visualization, and written, oral, and graphic communication. Field trips to relevant architectural sites.

ARCH 201H: Architectural Design I, Honors
(1-15) Cr. 6-7. F.
Prereq: Completion of the pre-professional program and admission into the professional program in Architecture
Introduction to architectural design. Introduction to architectural design, including precedent research, drawing conventions, model making, and diagramming. Studio projects focus on investigating the impact of specific site conditions on design, threshold conditions, and small-scale domestic space. Students will learn skills in problem solving, visualization, and written, oral, and graphic communication. Field trips to relevant architectural sites.

ARCH 202: Architectural Design II
(1-15) Cr. 6. S.
Prereq: ARCH 201; MATH 142; PHYS 111
Continuation of fundamental architectural design exploration. Studio projects focus on the generation of ideas based on experience and an understanding of urban spaces. Emphasis on systematic analysis of urban culture, scale, materiality, and networks. Students work in groups and individually. Representational methods expand on architectural conventions through experimentation. Fieldtrips to relevant architectural sites.

ARCH 202H: Architectural Design II, Honors
(1-15) Cr. 6-7. S.
Prereq: ARCH 201, MATH 142 and PHYS 111
Continuation of fundamental architectural design exploration. Studio projects focus on the generation of ideas based on experience and an understanding of urban spaces. Emphasis on systematic analysis of urban culture, scale, materiality, and networks. Students work in groups and individually. Representational methods expand on architectural conventions through experimentation. Fieldtrips to relevant architectural sites.

ARCH 221: History of Architecture I
(3-0) Cr. 3. F.
Survey of western architectural ideas and practices in their social, cultural, and representational contexts. Comparisons with global examples. Ancient through 1750.
Meets International Perspectives Requirement.

ARCH 222: History of Architecture II
(3-0) Cr. 3. S.
Survey of western architectural ideas and practices in their social, cultural and representational contexts. Comparisons with global examples. 1750 to present.
Meets International Perspectives Requirement.

ARCH 230: Design Communications I
(2-2) Cr. 3. F.
Prereq: Admission to the professional program in architecture
Investigations of various design media--including computer graphics and freehand drawing--and their applications to design, specifically to the course work in ARCH 201. Exercises to develop manual skill and perceptual sensitivity.

ARCH 301: Architectural Design III
(1-15) Cr. 6. F.
Prereq: ARCH 202
Consideration of landscape as a constructed, cultural artifact. Projects address the perceptual aspects and strategies of situation and location; examination of environmental phenomena and patterns of use and settlement as revealed and affected by the architectural artifact. Development of a critical design process is stressed.

ARCH 301H: Architectural Design III, Honors
(1-15) Cr. 6-7. F.
Prereq: ARCH 202
Consideration of landscape as a constructed, cultural artifact. Projects address the perceptual aspects and strategies of situation and location; examination of environmental phenomena and patterns of use and settlement as revealed and affected by the architectural artifact. Development of a critical design process is stressed.

ARCH 302: Architectural Design IV
(1-15) Cr. 6. S.
Prereq: ARCH 301 and minimum 2.0 GPA in previous studio courses
Continuation of ARCH 301, examining housing in the urban situation; diverse scales of use and occupation within the city as shaped by cultural tendencies. Projects examine collective and individual identities related by the condition of adjacency, the ability to consider varieties of scale within a project, and a further development of critical and technical methods.

ARCH 302H: Architectural Design IV, Honors
(1-15) Cr. 6-7. S.
Prereq: ARCH 301 and minimum 2.0 GPA in previous studio courses
Continuation of ARCH 301, examining housing in the urban situation; diverse scales of use and occupation within the city as shaped by cultural tendencies. Projects examine collective and individual identities related by the condition of adjacency, the ability to consider varieties of scale within a project, and a further development of critical and technical methods.

ARCH 321: History of the American City
(3-0) Cr. 3.
Prereq: Sophomore classification
Study of the development of the built environment and urban condition in the United States from the colonial period to today. Through the theme of infrastructure, primary attention is given to urban spatial organization, built form, technological change, regulatory and funding patterns, and social categories such as class, race, and gender. Credit counts toward fulfillment of History, Theory, Culture requirements.
Meets U.S. Diversity Requirement

ARCH 323: Theories of Architecture
(3-0) Cr. 3.
Prereq: ARCH 221, 222. Course restricted to ARCH majors only.
Survey of theories impacting the production of architecture, historically and in contemporary practice. Emphasis will be given to recent movements and architectural manifestations, as well as close examinations of socio-cultural conditions. Weekly readings and an analytic term paper (3000 words minimum) are required.

ARCH 334: Computer Applications in Architecture
(2-2) Cr. 3.
Current and potential applications of digital computers in architecture. Projects employing computer graphics and modeling methods. Awareness of programming languages related to applications.

ARCH 335: Three-Dimensional Studio
(Cross-listed with ARTIS). (1-4) Cr. 3. Repeatable, maximum of 6 credits.
This course deals with three dimensional problems in visual invention, organization, and expression emphasizing creative manipulation of tools, materials, and techniques as means for three dimensional thinking. Projects cover the additive (modeling), subtractive (carving), substitutional (casting) as well as constructive techniques.

ARCH 345: Building Science and Technology I
(Dual-listed with ARCH 545). (2-0) Cr. 2. F.
Prereq: Undergraduate: Admission to the professional program in architecture; concurrent enrollment in ARCH 345L; graduate: Admission to the M. Arch. program and concurrent enrollment in ARCH 505 and ARCH 595; concurrent enrollment in ARCH 545L
First course in a sequence focused on architectural building technologies. Lectures and labs cover: environmental forces and systems (solar orientation, climate, daylighting, natural ventilation, human comfort and occupancy patterns), materials and assemblies (drawing conventions, building codes, and physical properties of materials) and fundamental structural principles (forces/loads, equilibrium, and stability).

ARCH 345L: Building Science and Technology I Lab
(0-2) Cr. 1. F.
Prereq: Admission to the professional program in architecture; concurrent enrollment in ARCH 345.
Laboratory to accompany Arch 345 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format.

ARCH 346: Building Science and Technology II
(Dual-listed with ARCH 546). (3-0) Cr. 3. S.
Prereq: Undergraduate: ARCH 345, ARCH 345L, MATH 145 and PHYS 111; concurrent enrollment in ARCH 346L. Graduate: ARCH 505, ARCH 545, ARCH 545L, and ARCH 595; concurrent enrollment in ARCH 506, ARCH 546L and ARCH 596.
Second course in a sequence focused on architectural building technologies. Lectures and labs cover: environmental systems (heat transfer in the building envelope, passive heating and cooling, daylighting, thermal comfort, analytical guidelines and building energy calculation methods), materials & assemblies (building envelope systems, accessibility, egress, and material properties), and structural systems (structural system selection/comparison, and design and analysis of "form-active" compression and tension structures).

ARCH 346L: Building Science and Technology II Lab
(0-4) Cr. 2. S.
Prereq: ARCH 345, ARCH 345L, MATH 145 and PHYS 111; concurrent enrollment in ARCH 346.
Laboratory to accompany Arch 346 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format.

ARCH 347: Building Science and Technology III
(Dual-listed with ARCH 547). (3-0) Cr. 3. F.
Prereq: Undergraduate: ARCH 346, Arch 346L; concurrent enrollment in ARCH 347L. Graduate: ARCH 506, ARCH 546, ARCH 546L, and ARCH 596 or advanced standing in the M.Arch program; concurrent enrollment in ARCH 601 and ARCH 547L.
Third course in a sequence focused on architectural building technologies. Lectures and labs cover: multistory building framing, assembly, and enclosure systems, sizing and selecting structural framing components (foundations, columns, beams, etc.), and an environmental design process that demonstrates the ability to integrate climate into the control of thermal, luminous, ventilative and acoustic environments. Introduction to plumbing and rain water collection systems.

ARCH 347L: Building Science and Technology III Lab
(0-4) Cr. 2. F.
Prereq: ARCH 346, Arch 346L; concurrent enrollment in ARCH 347.
Laboratory to accompany Arch 347 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format.

ARCH 348: Building Science and Technology IV
(Dual-listed with ARCH 548). (3-0) Cr. 3. S.
Prereq: Undergraduate: ARCH 347, Arch 347L; concurrent enrollment in ARCH 348L. Graduate: ARCH 547, ARCH 547L and ARCH 601; concurrent enrollment in ARCH 548L.
Fourth course in a sequence focused on architectural building technologies. Lectures and labs cover: ability to demonstrate active environmental HVAC control systems design, use and design of mechanical, electrical, plumbing, fire safety, transportation, and conveying systems and subsystems, constructed building assemblies and details (building envelope details for waterproofing and enclosure, advanced material properties, costs, and serviceability), and structural design for multi-story structures (design and documenting various framing patterns, integration with other building systems, and lateral stability strategies for wind and seismic).

ARCH 348L: Building Science and Technology IV Lab
(0-4) Cr. 2. S.
Prereq: ARCH 347, Arch 347L; concurrent enrollment in ARCH 348.
Laboratory to accompany Arch 348 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format.

ARCH 351: Whole Building Energy Performance Modeling
(2-2) Cr. 3.
Prereq: ARCH 202, 245, 341. Open to non-majors by permission of instructor.
Architectural design, design evaluation and technical analysis using energy performance modeling tools. Emphasis will be given to whole building energy efficiency including passive and active systems integration.

ARCH 371: Human Behavior and Environmental Theory
(3-0) Cr. 3.
Prereq: Completion of the pre-professional program and admission into the professional program in architecture
Exploration of theories that describe social structure and order and the manner in which individuals and societies organize themselves and structure their environment.

ARCH 401: Architectural Design V
(1-15) Cr. 6. F.
Prereq: ARCH 302
A rigorous examination of how buildings participate sustainably in socio-political and environmental systems. Student projects consider in a comprehensive proposal how issues of physical site, socio-economic context, programming, structure, form, materiality, and building systems are interconnected through the design process and within the built environment. Projects typically focus on a smaller scale urban public building that is closely connected to its physical, environmental, and social context.

ARCH 401H: Architectural Design V, Honors
(1-15) Cr. 6-7. F.
Prereq: ARCH 302
A rigorous examination of how buildings participate sustainably in socio-political and environmental systems. Student projects consider in a comprehensive proposal how issues of physical site, socio-economic context, programming, structure, form, materiality, and building systems are interconnected through the design process and within the built environment. Projects typically focus on a smaller scale urban public building that is closely connected to its physical, environmental, and social context.

ARCH 402: Architectural Design VI
(1-15) Cr. 6. S.
Prereq: ARCH 401 and minimum 2.0 GPA in previous studio courses
An examination of the relationship between architecture and the city. Studio projects stress analysis and interpretation of the diverse forces and conditions that impact and inform architecture in the urban environment. Urban design project. Study abroad option.
Meets International Perspectives Requirement.

ARCH 402H: Architectural Design VI, Honors
(1-15) Cr. 6-7. S.
Prereq: 401 and minimum 2.0 GPA in previous studio courses
An examination of the relationship between architecture and the city. Studio projects stress analysis and interpretation of the diverse forces and conditions that impact and inform architecture in the urban environment. Urban design project. Study abroad option.
Meets International Perspectives Requirement.

ARCH 403: Architectural Design VII
(1-15) Cr. 6. F.
Prereq: ARCH 402
A rigorous examination of architecture's relationship with culture and technology. Studio projects stress the interpretation and integration of contextual and historical considerations, as well as structural, environmental, and communication systems, in a comprehensive design proposal.

ARCH 403H: Architectural Design VII, Honors
(1-15) Cr. 6-7. F.
Prereq: ARCH 402
A rigorous examination of architecture's relationship with culture and technology. Studio projects stress the interpretation and integration of contextual and historical considerations, as well as structural, environmental, and communication systems, in a comprehensive design proposal.

ARCH 404: Architectural Design VIII
(1-15) Cr. 6. S.
Prereq: ARCH 403
Advanced forum for architectural research and/or design. Choice of thematic studios or student initiated research and design. Experimentation and innovation are encouraged. DSN S 446 or DSN S 546, for 6 cr. each time taken, can be substituted for this class and be taken up to a maximum of 12 credits.

ARCH 404H: Architectural Design VIII, Honors
(1-15) Cr. 6-7. S.
Prereq: ARCH 403
Advanced forum for architectural research and/or design. Choice of thematic studios or student initiated research and design. Experimentation and innovation are encouraged. DSN S 446 or DSN S 546, for 6 cr. each time taken, can be substituted for this class and be taken up to a maximum of 12 credits.

ARCH 420: Topics in American Architecture
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of American architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment of History, Theory, Culture requirements. A maximum of 6 credits of ARCH 420 may be applied to degree program.
Meets U.S. Diversity Requirement

ARCH 422: Topics in Medieval Architecture
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of medieval architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment of History, Theory, Culture requirements. A maximum of 6 credits of ARCH 422 may be applied to degree program.
Meets International Perspectives Requirement.

ARCH 423: Topics in Renaissance to Mid-Eighteenth Century Architecture
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of renaissance to mid-eighteenth century architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment of History, Theory, Culture requirements. A maximum of 6 credits of ARCH 423 may be applied to degree program.
Meets International Perspectives Requirement.

ARCH 424: Topics in Nineteenth Century Architecture
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of nineteenth century architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment History, Theory, Culture requirements. A maximum of 6 credits of ARCH 424 may be applied to degree program.

ARCH 425: Topics in Twentieth Century Architecture
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
History, theory, and principles of twentieth century architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment History, Theory, Culture requirements. A maximum of 6 credits of ARCH 425 may be applied to degree program.

ARCH 426: Topics in Native American Architecture
(Cross-listed with AM IN). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of Native American/American Indian architecture, landscape architecture and planning considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment History, Theory, Culture. A maximum of 6 credits of ARCH 426 may be applied to degree program.
Meets U.S. Diversity Requirement

ARCH 427: History, Theory, and Criticism of Chinese Architecture
(Dual-listed with ARCH 527). (3-0) Cr. 3. F.
Prereq: Junior classification
The history and theoretical concept of Chinese built environment with emphasis on the morphology of built form and its relationship to art, landscape design, and urban structure. Credit counts toward fulfillment History, Theory, Culture.
Meets International Perspectives Requirement.

ARCH 429: Topics in Italian Architecture and Urbanism
(3-0) Cr. 3. S.
History, theory and principles of Italian architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 431: Analytical Drawing
(1-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARCH 230 and ARCH 302
Exploration of 2- and 3-dimensional representations. Emphasis on on-site freehand sketching, perspective and orthographic drawing, rendering of shadows and textures, and use of diverse media.

ARCH 432: Advanced Computer Lighting and Rendering
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ARCH 230 and ARCH 301
Exploration of the computer as a design and communication tool. Emphasis on lighting and rendering techniques.

ARCH 433: File to Fabrication
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.
Prereq: ARCH 230 and ARCH 301
Exploration of the computer as a design and manufacturing tool. Emphasis on fabrication techniques and rapid prototyping including laser-cutting, 3-D printing and CNC routing.

ARCH 434: Computer-aided Architectural and Environmental Design
(1-4) Cr. 3.
Prereq: ARCH 334
Emphasis on application of the computer as a design tool, topical applications and computer graphic methods, development of computer software for architectural and environmental problem solving.

ARCH 436: Advanced Design Media
(2-2) Cr. 3. Repeatable. F.SS.
Prereq: ARCH 230
Special topics in design media applications.

ARCH 437: Architectural Photography
(3-0) Cr. 3.
Prereq: ARCH 202
Emphasis on use of the camera and lighting in photographing drawings and interior and exterior building environments.

ARCH 445: Building Science and Technology V
(2-0) Cr. 2. F.
Prereq: ARCH 348, Arch 348L; concurrent enrollment in ARCH 445L.
Final course in a sequence of architectural building technology courses comprising environmental systems, materials/assembly, and building structures topics. Using both lectures and labs, the three interrelated modules each emphasize a particular building technology subject with an overall focus on synthesizing and integrating building technologies together in sustainable design strategies. Topics include: integration of active environmental control and service systems into the design of larger scale buildings, the development of construction details for building shell and interiors, and the design and analysis of various long-span structural systems.

ARCH 445L: Building Science and Technology V Lab
(0-2) Cr. 1. F.
Prereq: ARCH 348, Arch 348L; concurrent enrollment in ARCH 445.
Laboratory to accompany Arch 445 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format.

ARCH 482: Professional Practice
(Dual-listed with ARCH 582). (3-0) Cr. 3. F.
Prereq: ARCH 202
Emphasis on the circumstances and opportunities of the professional practice of architecture: practice as profession, process, organization, business, and evolving models of practice.

ARCH 486: Design: Made in Italy
(3-0) Cr. 3. S.
An investigation of the history of Italian design in its contemporary form as part of International study abroad program in Rome. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 490: Independent Study
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490A: Independent Study: Design Communications.
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490B: Independent Study: Design
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490C: Independent Study: Building Science and Technology
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490D: Independent Study: Architectural History
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490E: Independent Study: Behavioral Studies
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490F: Independent Study: Practice
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490H: Independent Study: Honors
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

Courses primarily for graduate students, open to qualified undergraduates:

ARCH 505: Architectural Design and Media I: Mapping, Programming, Building
(0-10) Cr. 5. F.
Prereq: Admission to the M Arch program. Concurrent enrollment in ARCH 541 and ARCH 595
An introduction to comprehensive architectural design projects that focuses on three interrelated design skills: mapping, programming and building. Projects establish a framework for designing buildings that considers multiple factors such as environmental forces, construction methods, building codes, urban regulations, social relationships, and cultural values.

ARCH 506: Architectural Design and Media II: Materiality and Representation
(0-10) Cr. 5. S.
Prereq: ARCH 505, ARCH 541, ARCH 595 and concurrent enrollment in ARCH 542 and ARCH 596
Small-scale architectural design projects that investigate design representation through analogue and digital means. The projects explore different representation strategies to help students develop an understanding of the particular modes of architectural representation that advance the designer's knowledge of space as a complex interaction between materials with inherent physical characteristics, mobile socializing bodies, and changing environmental cycles.

ARCH 507: Architectural Design and Media III: Design in Detail
(0-10) Cr. 5. SS.
Prereq: ARCH 506, ARCH 542, ARCH 596 and concurrent enrollment in ARCH 581
Design projects that emphasize the multi-faceted role of the architectural detail in the design process through first, understanding the historical specificity of building construction and detailing; second, utilizing working drawing as a mode of communication; and third, designing with details. The term-long project will consider a set of working drawings of past buildings as a site for design intervention.

ARCH 517: Big and Tall: A History of Construction
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of construction from ancient times through today. Analytic project or term paper and weekly readings with discussion questions. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 519: Middle Eastern Cities
(Cross-listed with C R P). (3-0) Cr. 3.
Prereq: Graduate or Senior classification
Introduction to basic academic writings on Middle Eastern cities in addition to other contemporary cultural productions of the region. Study of various aspects of Middle Eastern life and the built environments that this life produces.
Meets International Perspectives Requirement.

ARCH 521: Celluloid Cities, Urbanism in Film
(3-0) Cr. 3.
Prereq: Junior classification
Urban theory and history as manifested in popular films and videos, both fiction and documentary. Term projects require students to make short videos. (Experience with video-making not necessary.) Credits counts towards fulfillment of History, Theory, Culture requirement.

ARCH 525: Meaning and Form in Architecture
(3-0) Cr. 3.
Prereq: Graduate or Junior or Senior classification
Seminar on critical analysis of meaning and form in architecture and human-made environment in various cultural contexts examined from historical and theoretical perspectives. Analytic term paper and weekly readings with discussion questions. Credit counts toward fulfillment of History, Theory, Culture requirements Meets International Perspectives Requirement.
Meets International Perspectives Requirement.

ARCH 527: History, Theory, and Criticism of Chinese Architecture
(Dual-listed with ARCH 427). (3-0) Cr. 3. F.
Prereq: Junior classification
The history and theoretical concept of Chinese built environment with emphasis on the morphology of built form and its relationship to art, landscape design, and urban structure. Credit counts toward fulfillment History, Theory, Culture.
Meets International Perspectives Requirement.

ARCH 528: Topical Studies in Architecture
(3-0) Cr. 2-3. Repeatable, maximum of 6 times.
Prereq: ARCH 221, ARCH 222 or senior classification or graduate standing
Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 528A: Studies in Architecture: Culture
(3-0) Cr. 2-3. Repeatable, maximum of 6 times.
Prereq: ARCH 221, ARCH 222 or senior classification or graduate standing

ARCH 528B: Studies in Architecture: Technology
(3-0) Cr. 2-3. Repeatable, maximum of 6 times.
Prereq: ARCH 221, ARCH 222 or senior classification or graduate standing
n/a.

ARCH 528C: Studies in Architecture: Communications
(3-0) Cr. 2-3. Repeatable, maximum of 6 times.
Prereq: ARCH 221, ARCH 222 or senior classification or graduate standing
n/a.

ARCH 528E: Studies in Architecture: Practice
(3-0) Cr. 2-3. Repeatable, maximum of 6 times.
Prereq: ARCH 221, ARCH 222 or senior classification or graduate standing

ARCH 529: Spatial Dialectics in the American Midwest
(3-0) Cr. 3.
Prereq: Graduate or Senior classification
The American Midwest has witnessed dramatic transformation during the last two centuries which impacted its physical, environmental, economic and social characteristics. This course is an interdisciplinary study of the evolution and sustainability of Midwestern space in relationship to forces of flow shaped by the mobility of bodies, products, meanings, and symbols that are enforced, incorporated, reproduced or destroyed. Credit counts toward fulfillment of History, Theory, Culture requirements.
Meets U.S. Diversity Requirement

ARCH 534: Advanced Computer-aided Architectural Design
(1-4) Cr. 3. Repeatable, maximum of 6 credits. F.
Prereq: ARCH 434 and permission of instructor
Emphasis on concepts, algorithms, data structures, advanced modeling, rendering, animation, and virtual reality applications in architectural design.

ARCH 535: Advanced Three-Dimensional Studio
(1-4) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ARCH 335 or Graduate classification
Advanced investigation of sculptural expression with emphasis on individual projects.

ARCH 541: Science and Technology for Architects I
(4-2) Cr. 5. F.
Prereq: Admission to the M. Arch. program and concurrent enrollment in ARCH 505 and 595
Introduction to Human Factors, Descriptive Geometry, Basic Building Materials, and Small-Scale Building Envelopes. Theory and case studies, stressing the connectivity of technical issues to broader formal, social, and cultural spheres.

ARCH 542: Science and Technology for Architects II
(4-2) Cr. 5. S.
Prereq: ARCH 505, ARCH 541, ARCH 595 and concurrent enrollment in ARCH 506 and ARCH 596
Elementary Statics and Beam Theory, Basic Construction Materials, and Site and Building Circulation. Theory and case studies stressing the connectivity of technical issues to broader formal, social, and cultural spheres.

ARCH 545: Building Science and Technology I
(Dual-listed with ARCH 345). (2-0) Cr. 2. F.
Prereq: Undergraduate: Admission to the professional program in architecture; concurrent enrollment in ARCH 345L; graduate: Admission to the M. Arch. program and concurrent enrollment in ARCH 505 and ARCH 595; concurrent enrollment in ARCH 545L
First course in a sequence focused on architectural building technologies. Lectures and labs cover: environmental forces and systems (solar orientation, climate, daylighting, natural ventilation, human comfort and occupancy patterns), materials and assemblies (drawing conventions, building codes, and physical properties of materials) and fundamental structural principles (forces/loads, equilibrium, and stability).

ARCH 545L: Building Science and Technology I Lab
(0-6) Cr. 3. F.
Prereq: Admission to the M. Arch. program and concurrent enrollment in ARCH 505 and ARCH 595; concurrent enrollment in ARCH 545.
Laboratory to accompany Arch 545 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format. Readings and project presentations.

ARCH 546: Building Science and Technology II
(Dual-listed with ARCH 346). (3-0) Cr. 3. S.
Prereq: Undergraduate: ARCH 345, ARCH 345L, MATH 145 and PHYS 111; concurrent enrollment in ARCH 346L. Graduate: ARCH 505, ARCH 545, ARCH 545L, and ARCH 595; concurrent enrollment in ARCH 506, ARCH 546L and ARCH 596.
Second course in a sequence focused on architectural building technologies. Lectures and labs cover: environmental systems (heat transfer in the building envelope, passive heating and cooling, daylighting, thermal comfort, analytical guidelines and building energy calculation methods), materials & assemblies (building envelope systems, accessibility, egress, and material properties), and structural systems (structural system selection/comparison, and design and analysis of “form-active” compression and tension structures).

ARCH 546L: Building Science and Technology II Lab
(0-4) Cr. 2. S.
Prereq: ARCH 505, ARCH 545, ARCH 545L, and ARCH 595; concurrent enrollment in ARCH 506, ARCH 546 and ARCH 596.
Laboratory to accompany Arch 546 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format. Readings and project presentations.

ARCH 547: Building Science and Technology III
(Dual-listed with ARCH 347). (3-0) Cr. 3. F.
Prereq: Undergraduate: ARCH 346, Arch 346L; concurrent enrollment in ARCH 347L. Graduate: ARCH 506, ARCH 546, ARCH 546L, and ARCH 596 or advanced standing in the M.Arch program; concurrent enrollment in ARCH 601 and ARCH 547L.
Third course in a sequence focused on architectural building technologies. Lectures and labs cover: multistory building framing, assembly, and enclosure systems, sizing and selecting structural framing components (foundations, columns, beams, etc.), and an environmental design process that demonstrates the ability to integrate climate into the control of thermal, luminous, ventilative and acoustic environments. Introduction to plumbing and rain water collection systems.

ARCH 547L: Building Science and Technology III Lab
(0-2) Cr. 1. F.
Prereq: ARCH 506, ARCH 546, ARCH 546L, and ARCH 596 or advanced standing in the M.Arch program; concurrent enrollment in ARCH 547 and ARCH 601.
Laboratory to accompany Arch 547 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format. Readings and project presentations.

ARCH 548: Building Science and Technology IV
(Dual-listed with ARCH 348). (3-0) Cr. 3. S.
Prereq: Undergraduate: ARCH 347, Arch 347L; concurrent enrollment in ARCH 348L. Graduate: ARCH 547, ARCH 547L and ARCH 601; concurrent enrollment in ARCH 548L.
Fourth course in a sequence focused on architectural building technologies. Lectures and labs cover: ability to demonstrate active environmental HVAC control systems design, use and design of mechanical, electrical, plumbing, fire safety, transportation, and conveying systems and subsystems, constructed building assemblies and details (building envelope details for waterproofing and enclosure, advanced material properties, costs, and serviceability), and structural design for multi-story structures (design and documenting various framing patterns, integration with other building systems, and lateral stability strategies for wind and seismic).

ARCH 548L: Building Science and Technology IV Lab
(0-2) Cr. 1. S.
Prereq: ARCH 547, ARCH 547L and ARCH 601; concurrent enrollment in ARCH 548.
Laboratory to accompany Arch 548 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format. Readings and project presentations.

ARCH 558: Sustainability and Green Architecture
(3-0) Cr. 3.
Prereq: Graduate or Senior classification
Issues of Sustainability as related to living patterns and city design, population, pollution and use and availability of natural resources for the built environment; Issues of Green Architecture as it relates to building material selection, systems of building materials, the environment of the United States and the World, architects and examples of buildings with green or sustainable designations.

ARCH 567: Preservation, Restoration, and Rehabilitation
(3-0) Cr. 3. S.
Prereq: Senior classification
Construction standards and procedures for preserving, restoring, reconstructing, and rehabilitating existing buildings following the guidelines of the National Park Service and the National Trust for Historic Preservation. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 568: Historic Preservation
(3-0) Cr. 3. F.
Prereq: Senior classification
The history and theory of the Historic Preservation movement including an overview of the National Trust for Historic Preservation; the National Register of the Historic Places; the National Park Service; federal programs, funding sources, preservation law, national landmarks, and historic distracts. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 571: Design for All People
(Cross-listed with GERON). (3-0) Cr. 3. S.
Prereq: Graduate or Senior classification
Principles and procedures of universal design in response to the varying ability level of users. Assessment and analysis of existing buildings and sites with respect to standards and details of accessibility for all people, including visually impaired, mentally impaired, and mobility restricted users. Design is neither a prerequisite nor a required part of the course. Enrollment open to students majoring in related disciplines. Credit counts toward fulfillment of History, Theory, Culture requirements.
Meets U.S. Diversity Requirement

ARCH 575: Contemporary Urban Design Theory
(3-0) Cr. 3.
Prereq: Graduate or Senior classification
Current urban design theory and its application to urban problems. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 576: Study Abroad Options
Cr. 1-12. Repeatable, maximum of 12 credits. SS.
Special topics in environmental design, architectural history and contemporary practice. Travel to relevant countries. General cultural and historical studies, topical projects and individual inquiry. Courses may be taught by departmental faculty or faculty from approved Iowa State Study Abroad programs. See current offerings for detailed syllabus.
Meets International Perspectives Requirement.

ARCH 581: Service Learning
(1-12) Cr. 5. SS.
Prereq: ARCH 506, 542 and ARCH 596
Planning and execution of a project serving a community need. Learning occurs through both theory and active involvement in on-site work. Projects connect previous coursework to practical applications and community involvement.

ARCH 582: Professional Practice
(Dual-listed with ARCH 482). (3-0) Cr. 3. F.
Prereq: ARCH 202
Emphasis on the circumstances and opportunities of the professional practice of architecture: practice as profession, process, organization, business, and evolving models of practice.

ARCH 583: Research in Practice
(3-0) Cr. 3. S.
Prereq: Graduate or Senior classification
Foundational course in the methods and conceptual tools of design research in the context of practice. Through team and individual guided projects, students generate, analyze and represent knowledge in design-related communications and contexts. Alternative models of practice, client groups and communities are addressed within projects that precede, feed, follow, or overlap with architectural contracts.

ARCH 590: Special Topics
Cr. 1-5. Repeatable.
Prereq: Written approval of instructor and department chair on approved form
Investigation of architectural issues having a specialized nature.

ARCH 595: Seminar on the Built Environment I: History
(5-0) Cr. 5. F.
Prereq: Admission to the M. Arch. program and concurrent enrollment in ARCH 505 and ARCH 541
Introduction to historical canons and traditions of architecture and urbanism. Discussion of the relationship between historical inquiry and contemporary practice. Students learn skills in critical thinking, visual analysis, and research methods. Course sessions develop thematically with interdisciplinary readings, group discussions, student presentations, and research projects.

ARCH 596: Seminar on the Built Environment II: Landscape and Society
(5-0) Cr. 5. S.
Prereq: ARCH 505, ARCH 541, ARCH 595 and concurrent enrollment in ARCH 506 and ARCH 542
Introduction to landscape as artifact and multi-disciplinary knowledge-base for design thinking. Literatures and methods of environmental psychology, cultural geography, landscape and architectural history and theory, site and circulation design as intersection of built infrastructural, natural, and social systems. Emphasis on sensory perception, and human movement; investigations of climate, environmental conditions, and values toward consumption and sustainability in everyday experience of the built environment.

ARCH 597: Seminar on the Built Environment III: Theory
(3-0) Cr. 3. F.
Prereq: Graduate or Senior classification
Multidisciplinary overview of contemporary theories concerned with the production of the built environment. Particular attention to urbanism as a discourse that relates social interactions and power structures to material space.
Meets International Perspectives Requirement.

ARCH 598: Seminar on the Built Environment IV: Topical Study
(3-0) Cr. 3. S.
Prereq: Graduate or Senior classification
A research seminar which considers a topic within contemporary discourses on the built environment outside of Europe and North America. The topic will be studied from multiple perspectives highlighting the historical and theoretical relationships between architecture, global cultures, geography, landscape, and urban planning. Credit counts toward fulfillment History, Theory, Culture requirements.

Courses for graduate students:

ARCH 601: Sustainable Building Design
(0-12) Cr. 6. F.
Prereq: ARCH 507, ARCH 542, ARCH 596 and concurrent enrollment in ARCH 643
Design projects that are developed through integrative design strategies that explore the relationship between buildings and environmental forces to maximize non-wasteful, efficient use of resources such as energy, water and building materials. Projects will include investigations of the impact of solar energy, airflow, building materials, passive and active systems and wall sections on spatial quality and form making. Design decisions will be quantitatively validated through energy modeling and performance simulation.

ARCH 602: Community, Building and the Environment
(0-12) Cr. 6. S.
Prereq: ARCH 601, ARCH 643, ARCH 597 and concurrent enrollment in ARCH 644
Design projects that explore the relationships between architectural, cultural, and environmental landscapes. Emphasis on regional sites, socio-economic conditions, and sustainable design and planning practices at multiple scales. Projects stress engagement with local circumstances and stakeholders; systemic interconnections and strategies; and the application of interdisciplinary research.

ARCH 603: Comprehensive Design
(0-12) Cr. 6. F.
Prereq: ARCH 601
Rigorous examination of architecture's relationship with culture and technology. Studio projects stress the interpretation of contextual and historical considerations, as well as structural, environmental, mechanical, electrical and plumbing systems, in a comprehensive design proposal. This course fulfills the Graduate College Creative Component Requirement.

ARCH 604: Design Studio Options
(0-12) Cr. 6. Repeatable, maximum of 12 credits. S.
Prereq: ARCH 602
Design studio selected by the students, which may include but is not limited to: independent design study, interdisciplinary design studio, study abroad, and design build. DSN S 546 for 6 cr. may be substituted for this course.

ARCH 643: Science and Technology for Architects III
(2-2) Cr. 3. F.
Prereq: ARCH 507, ARCH 542, ARCH 596, ARCH 581 and concurrent enrollment in ARCH 601 or or Graduate classification and concurrent enrollment in ARCH 601
Third in a four-course series in building science and technologies. Structural Elements and Systems, and Building Services. Theory and case studies stressing the connectivity of technical issues to broader formal, social and cultural spheres.

ARCH 644: Science and Technology for Architects IV
(2-2) Cr. 3. S.
Prereq: ARCH 643 or Graduate classification
Fourth of a four-course series in building science and technologies. Building Enclosures, Interior Construction and Sensory Qualities, Fabrication and Construction. Theory and case studies stressing the connectivity of technical issues to broader formal, social and cultural spheres. Summative Student Project.

ARCH 690: Independent Design Study
(1-15) Cr. 6. Repeatable.
Prereq: Admission to the M. S. in Arch. program
Independent architectural design projects commensurate with student interests requiring approval of Architecture Graduate Committee.

ARCH 698: Graduate Seminar
Cr. R. Repeatable. F.S.
Prereq: Admission to the M. Arch. or M. S. in Arch. programs
Special topics and guest speakers.

ARCH 699: Research
(1-18) Cr. 3-9. Repeatable.
Research.

Art Education (ARTED)

Courses primarily for undergraduates:

ARTED 209: Methods of Teaching in and Through Art
Cr. 2. F.S.
Prereq: Sophomore level
Methods of teaching in and through visual art are experienced and applied in this course. Art-centered and interdisciplinary art education methods for K-8 teaching are designed to develop creativity, authentic expression, collaboration, aesthetic sensitivity and pluralistic, global perspectives.

ARTED 211: Introduction to Art Education
(0-6) Cr. 3. F.S.
Prereq: Sophomore level
Teaching methods for K-12 art education. Hands-on discipline-specific and integrated art activities are experienced and designed; emphasis is on creativity, artistic and human diversity, community building, and development of thinking skills in holistic, pluralistic art education.

ARTED 490: Independent Study
Cr. arr. F.

Art History (ART H)

Courses primarily for undergraduates:

ART H 280: History of Art I
(3-0) Cr. 3. F.
Development of the visual arts including painting, sculpture, architecture, and crafts, from the prehistoric through Gothic periods.
Meets International Perspectives Requirement.

ART H 281: History of Art II
(3-0) Cr. 3. S.
Development of the visual arts of western civilization including painting, sculpture, architecture, and crafts; from the Renaissance to the twentieth century.
Meets International Perspectives Requirement.

ART H 281H: History of Art II: Honors
(3-0) Cr. 3. S.
Development of the visual arts of western civilization including painting, sculpture, architecture, and crafts; from the Renaissance to the twentieth century.
Meets International Perspectives Requirement.

ART H 292: Introduction to Visual Culture Studies
(3-0) Cr. 3.
An introduction to various topics in visual culture studies. The lecture course will provide students with a creative and intellectual context in which to study historical and contemporary instances of the visual in culture. Individual lectures examine significant trends in the visual arts, mass media, scientific imagery, visual communications, and other areas related to visual literacy and visual representation in local and global contexts. Cross cultural viewpoints and issues of diversity will be presented in relation to visual culture and related fields.
Meets U.S. Diversity Requirement

ART H 293: Origins and Evolution of Modern Design
(3-0) Cr. 3. F.S.
History of designed artifacts, their creators, and their cultural environments in Western Europe and America from the beginning of the Industrial Revolution to the present.

ART H 382: Art and Architecture of Asia
(3-0) Cr. 3.
Introduction to the history of art and architecture in Asia before the modern era. Cultures may include China, Korea, Japan, and India. Visual materials selected based on important themes that are critical in understanding Asian cultures and art traditions.
Meets International Perspectives Requirement.

ART H 383: Greek and Roman Art
(Cross-listed with CL ST). (3-0) Cr. 3.
Greek art from Neolithic to Hellenistic periods. Roman art from the traditional founding to the end of the empire in the West.

ART H 383H: Greek and Roman Art: Honors
(Cross-listed with CL ST). (3-0) Cr. 3-4.
Greek art from Neolithic to Hellenistic periods. Roman art from the traditional founding to the end of the empire in the West.

ART H 384: Art of Islam
(3-0) Cr. 3.
Historical survey of the painting, sculpture, crafts, and architecture of the various civilizations of the Islamic world.
Meets International Perspectives Requirement.

ART H 384H: Art of Islam, Honors
(3-0) Cr. 3-4.
Historical survey of the painting, sculpture, crafts, and architecture of the various civilizations of the Islamic world.
Meets International Perspectives Requirement.

ART H 385: Renaissance Art
(3-0) Cr. 3.
European art including painting, sculpture, architecture, and crafts; thirteenth through sixteenth centuries.

ART H 385H: Renaissance Art, Honors
(3-0) Cr. 3.
European art including painting, sculpture, architecture, and crafts; thirteenth through sixteenth centuries.

ART H 386: American Art to 1945
(3-0) Cr. 3.
Survey of American art from the early colonial period to 1945, with emphasis on historical and cultural issues that underlie art production in the United States.
Meets U.S. Diversity Requirement

ART H 388: Modern Art and Theory
(3-0) Cr. 3.
Visual arts and critical theory of the early 20th century, including Expressionism, Cubism, Futurism, Suprematism, Dada, and Surrealism.

ART H 395: Art and Theory Since 1945
(3-0) Cr. 3.
Visual arts and critical theory after 1945, including Abstract Expressionism, Pop Art, and Performance Art.
Meets U.S. Diversity Requirement

ART H 396: History of Photography
(3-0) Cr. 3.
Survey of the evolution of photography and photojournalism from the 1830s to the present, seen from an art historical perspective, emphasizing causative factors, cultural influences,and major masters and schools.

ART H 481: Art and Architecture of India
(3-0) Cr. 3.
Survey of Indian-style art and architecture through history. Examination of how art and architecture developed in the Indian world has come to define the Indian identity religiously, culturally, socially, and politically. Meets International Perspectives Requirement.

ART H 486: Art History Field Study
Cr. R. Repeatable.
Prereq: Concurrent enrollment in an art history course and permission of instructor
Study and tours of museums, galleries, artist and/or designer studios and other areas of interest within art history. Offered on a satisfactory-fail basis only.

ART H 487: Nineteenth-Century Art
(3-0) Cr. 3.
European and American art and architecture from 1780 to 1900 focusing on the major movements of western Europe, including: Neo-Classicism, Romanticism, Realism, Impressionism, and Post-Impressionism.

ART H 489: History of Comics
(Dual-listed with ART H 589). Cr. 3.
An art-historical survey of comic strips, comic books, and graphic novels from their origins in the 19th century to present.

ART H 489H: History of Comics: Honors
Cr. 3-4.
An art-historical survey of comic strips, comic books, and graphic novels from their origins in the 19th century to present.

ART H 490: Independent Study
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form before the semester of enrollment
Student must have completed art history coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ART H 490H: Independent Study, Honors
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form before the semester of enrollment
Student must have completed art history coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ART H 491: Art History in Europe Seminar
(1-0) Cr. 1.
Prereq: Permission of instructor and planned enrollment in ART H 492
Cultural and historical aspects of art and design in Western Europe in preparation for study abroad. Area of study varies each time offered. Offered on a satisfactory-fail basis only.
Meets International Perspectives Requirement.

ART H 492: Art History in Europe
(Dual-listed with ART H 592). (3-0) Cr. 3.
Prereq: Graduate classification, ART H 491 or equivalent, permission of instructor
International study abroad program in western Europe. Visits to design studios, art museums, and educational facilities. Related activities depending on specific area of study which may vary each time offered. Meets International Perspectives Requirement.

ART H 494: Women/Gender in Art
(Cross-listed with W S). (3-0) Cr. 3.
Issues of gender related to cultural environments from the Middle Ages to contemporary times in Europe and America. Feminist movement beginning in the 1970s and specifically gender issues in art that are becoming widespread in the artistic culture.
Meets U.S. Diversity Requirement

ART H 497: Museum/Gallery Internship
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Advanced classification in a department curriculum
Written approval of supervising instructor on required form in advance of semester of enrollment. Supervised experience with a cooperating museum or gallery or art center. Offered on a satisfactory-fail basis only.

ART H 498: Selected Topics in Art History
(Dual-listed with ART H 598). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Specialized study in the history or criticism of art and/or design.

ART H 499: Visual Culture Studies Senior Capstone Seminar
(4-0) Cr. 4.
Prereq: Admission to the B.A. in Art and Design--Visual Culture Studies Concentration, and senior standing; or permission of instructor.
Sustained exploration of topics related to Visual Culture Studies. Course incorporates reading of major texts in the field of visual culture studies, writing exercises, and guided instruction in the process of conducting research and reporting results of the research process. Course will result in an original paper.

Courses primarily for graduate students, open to qualified undergraduates:

ART H 501: Issues in Visual and Material Culture Seminar
(3-0) Cr. 3.
Prereq: Permission of instructor
Issues and debates that pertain to the study of visual objects and material artifacts in their cultural context. Examination of the role of visual and material culture studies as both relate to allied disciplines including, but not limited to: anthropology, art history, design history, design studies, and new media studies.

ART H 586: Museum/Gallery Internship
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Graduate classification and permission of instructor. Written approval in advance of semester of enrollment.
Supervised experience with a cooperating museum or gallery or art center. Offered on a satisfactory-fail basis only.

ART H 587: Nineteenth Century Art
(3-0) Cr. 3.
Prereq: Graduate classification or permission of instructor
European and American art and architecture from 1780 to 1900, focusing on the major movements of western Europe including: Neo-Classicism, Romanticism, Realism, Impressionism, and Post-Impressionism.

ART H 588: Modern Art and Theory
(3-0) Cr. 3.
Prereq: Graduate classification and permission of instructor
Visual arts and critical theory of the early 20th century, including: Expressionism, Cubism, Futurism, Suprematism, Dada and Surrealism.

ART H 589: History of Comics
(Dual-listed with ART H 489). Cr. 3.
An art-historical survey of comic strips, comic books, and graphic novels from their origins in the 19th century to present.

ART H 590: Special Topics
Cr. arr.
Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area. Written approval of instructor and department chair on required form in advance of semester of enrollment.
Special Topics for Art History.

ART H 591: Independent Study
Cr. arr.
Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area. Written approval of instructor and department chair on required form in advance of semester of enrollment.
Independent Study in Art History.

ART H 592: Art History in Europe
(Dual-listed with ART H 492). (3-0) Cr. 3.
Prereq: Graduate classification, ART H 491 or equivalent, permission of instructor
International study abroad program in western Europe. Visits to design studios, art museums, and educational facilities. Related activities depending on specific area of study which may vary each time offered. Meets International Perspectives Requirement.

ART H 594: Women/Gender in Art
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: Graduate classification or permission of instructor
Issues of gender related to cultural environments from the Middle Ages to contemporary times in Europe and America. Feminist movement beginning in the 1970s and specifically gender issues in art that are becoming widespread in the artistic culture.

ART H 595: Art and Theory Since 1945
(3-0) Cr. 3.
Prereq: Graduate classification or permission of instructor
Visual arts and critical theory after 1945, including Abstract Expressionism, Pop Art, and Performance Art.

ART H 596: History of Photography
(3-0) Cr. 3.
Prereq: Graduate classification or permission of instructor
Survey of the evolution of photography and photojournalism from the 1830s to the present, seen from an art historical perspective, emphasizing causative factors, cultural influences, and major masters and schools.

ART H 597: Green Art: Earthworks and Beyond
(3-0) Cr. 3.
Prereq: Graduate classification or permission of instructor
Seminar covering aspects of art and design based on ecological principles, including earthworks, land-based art, recycled/reused objects, ecofeminism, ephemerality, and green design.

ART H 598: Selected Topics in Art History
(Dual-listed with ART H 498). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Specialized study in the history or criticism of art and/or design.

Astronomy and Astrophysics (ASTRO)

Courses primarily for undergraduates:

ASTRO 102: North Star Astronomy

Cr. 1. F.S.

An entirely web-based course covering topics in observing the sky and navigation by the stars for students with little or no previous experience. The course combines material on common naked-eye phenomena, such as daily and seasonal variations in the sky, with information on how these helped navigators determine where they are on Earth. The course "lectures" are on-line, interactive units with build in exercises, hands-on (offline) activities and layers of help. Graded homework and quizzes are administered via Blackboard Learn. Students who take Astro 120 may count credit in only one of Astro 102 or 103 toward graduation.

ASTRO 103: Evening Star

Cr. 1. F.S.

An entirely web-based course covering topics in celestial mechanics ("Rocket science!") for students with little or no previous experience. It combines the geography of the solar system with discussion of methods of traveling to the other planets. The course "lectures" are on-line, interactive units with built-in exercises, hands-on (offline) activities, and layers of help. Graded homework and quizzes are administered via Blackboard Learn. Students who take Astro 120 may count credit in only one of Astro 102 or 103 toward graduation.

ASTRO 106: Earth and Space Science for Elementary Education Majors

(Cross-listed with GEOL). (2-0) Cr. 2. F.S.

Prereq: Major in elementary or early childhood education.

Fundamental concepts of Earth and Space Science, including the solar system, weather and climate, water and soils, plate tectonics, and geologic hazards. Online course format.

ASTRO 106L: Earth and Space Science for Elementary Education Majors: Laboratory

(Cross-listed with GEOL). (0-2) Cr. 1. F.S.

Prereq: Restricted to elementary and early childhood education majors; to be taken concurrently with GEOL 106/ASTRO 106

Inquiry-based lab exploring fundamental concepts of Earth and Space Science, including the solar system, weather and climate, water and soils, plate tectonics, and geologic hazards. Must be taken concurrently with GEOL/ASTRO 106.

ASTRO 120: The Sky and the Solar System

(3-0) Cr. 3. F.S.SS.

For the nonscientist. A survey of our view of the universe, and the exploration of the solar system and beyond. The sky: constellations; motions of the Sun, Moon, and planets; seasons and the calendar; eclipses. The solar system: origin and evolution; characteristics of the Sun, planets, satellites, comets, meteorites, and asteroids. The detection and characterization of other solar systems, and the search for life in the universe. Extensive use of the planetarium is included. Students who take Astro 120 may count credit in only one of Astro 102 or 103 toward graduation.

ASTRO 125L: The Sky and the Solar System Laboratory

(0-2) Cr. 1. F.S.

Prereq: Concurrent or previous enrollment in ASTRO 120

Laboratory course to accompany Astro 120. Students carry out practical exercises involving naked eye and telescopic observing to explore and reinforce ideas covered in Astro 120. Activities based on a sky-simulation computer program and other weather-independent exercises are also included.

ASTRO 150: Stars, Galaxies, and Cosmology

(3-0) Cr. 3. F.S.

For the nonscientist. A survey of astronomy with a focus on the universe beyond our solar system. Basic observational astronomy and the history of astronomy. Stellar astronomy: motions, distances, sizes, spectra; types of stars; variability; binary systems. Stellar evolution: the birth, life, and death of stars, including supernovae, neutron stars, and black holes. The structure and evolution of the Milky Way Galaxy. Other galaxies, clusters of galaxies, quasars. Theories of the origin of the universe.

ASTRO 250: Astronomy Bizarre

(3-0) Cr. 3. S.

Prereq: ASTRO 120 or ASTRO 150

For the nonscientist. A small enrollment course examining new and exciting topics in modern astronomy. Galaxy and star formation. Black holes and pulsars. Colliding galaxies. Quasars. Dark Matter. Dark energy. Quasars. Cosmology, the Big Bang and the future of the universe. Prospects and searches for extraterrestrial life.

ASTRO 290: Independent Study

Cr. 1-4. Repeatable.

Prereq: Permission of instructor

ASTRO 342: Introduction to Solar System Astronomy
(3-0) Cr. 3. F.
Prereq: PHYS 222
An introduction to the physics of the Solar System and the planetary systems discovered around other stars. General characteristics of planetary systems: dynamics, thermodynamics, internal and surface structure of planets and minor bodies, physics of their atmosphere. Discovery techniques and characterization of extrasolar planets, and planetary systems formation models. "Grand tour" of the Solar System, using data and imagery from probes and telescopes that have visited these worlds. The origin and evolution of life on Earth, and the ongoing search for life in the Solar System and elsewhere in the universe.

ASTRO 344L: Astronomy Laboratory
(1-6) Cr. 3. F.
Prereq: PHYS 222
Experiments in optical astronomy. Observational techniques, ranging from stellar photometry to CCD imaging. Data processing and analysis techniques. Astronomical software packages and online databases and resources. Available instruments include a variety of small telescopes and astronomical CCD cameras.

ASTRO 346: Introduction to Astrophysics
(3-0) Cr. 3. S.
Prereq: PHYS 222
An exploration of the universe beyond our Solar System, with emphasis on the astrophysics of stars and galaxies. Observable properties of stars, physics of stellar atmospheres and interiors. Birth, evolution and death of stars, to understand the past and future of our Sun, the Milky Way galaxy and the other galaxies in the universe. Basic concepts of cosmology, dark matter and dark energy. Use of computer models to calculate the structure and evolution of stars and protostars, and to analyze actual astronomical data obtained by professional astronomers.

ASTRO 405: Astrophysical Cosmology
(Dual-listed with ASTRO 505). (3-0) Cr. 3. S.
Prereq: ASTRO 346 or permission of instructor
Introduction to modern cosmology and large-scale structure; mathematical and observational fundamentals associated with the origin, structure, and evolution of the Universe. Scale of the Universe, Hubble's Law, the cosmic microwave background, Big Bang nucleosynthesis, the origin of elements, dark energy and the accelerating universe, and dark matter. For senior undergraduates and graduate students in all areas of physics.

ASTRO 450: Undergraduate Research
Cr. 1-6. Repeatable. F.S.SS.
Prereq: Permission of instructor
Research under supervision of astronomy faculty.

ASTRO 450L: Undergraduate Research
Cr. 1-6. Repeatable. F.S.SS.
Prereq: ASTRO 344L and permission of instructor
Laboratory or observational project under supervision of astronomy faculty.

ASTRO 490: Independent Study
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: 6 credits in astronomy, permission of instructor
No more than 9 credits of Astro 490 may be counted toward graduation.

ASTRO 490H: Independent Study: Honors
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: 6 credits in astronomy, permission of instructor
No more than 9 credits of Astro 490 may be counted toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

ASTRO 505: Astrophysical Cosmology
(Dual-listed with ASTRO 405). (3-0) Cr. 3. S.
Prereq: ASTRO 346 or permission of instructor
Introduction to modern cosmology and large-scale structure; mathematical and observational fundamentals associated with the origin, structure, and evolution of the Universe. Scale of the Universe, Hubble's Law, the cosmic microwave background, Big Bang nucleosynthesis, the origin of elements, dark energy and the accelerating universe, and dark matter. For senior undergraduates and graduate students in all areas of physics.

ASTRO 510: Observational Astrophysics
(2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ASTRO 405 or ASTRO 505 or permission of instructor
Techniques in optical and near-IR astronomy, including spectroscopy and CCD photometry. Emphasis on projects involving proficiency in the use of research telescopes and modern instrumentation. Project topics range from photometric studies of pulsating and binary star systems to deep CCD imaging of faint nebulae and galaxies.

ASTRO 580: Stellar Astrophysics
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: ASTRO 405 or ASTRO 505 or permission of the instructor
The interior structure and atmospheric properties of stars: Stellar structure equations and constitutive relations: energy generation, energy transport by radiation and convection; equation of state, nuclear energy generation and nucleosynthesis. Numerical and analytic solutions to the equations of structure and evolution. Observational connections through the theory of radiative transfer. Line and continuum processes and sources of opacity. Non-LTE and statistical equilibrium. Line profiles. Interpretation of stellar spectra: temperature, pressure, and abundance determinations. Stellar evolution from formation to final phases.

ASTRO 582: High Energy Astrophysics
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: ASTRO 405 or ASTRO 505 or permission of the instructor
Interactions of high-energy particles, non-thermal radiation processes, spectral evolution of non-thermal systems, cosmic rays, active galactic nuclei, pulsars, neutrinos, measurement techniques for relativistic charged particles, high energy photons, and neutrinos.

ASTRO 584: Galactic Astronomy
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ASTRO 405 or ASTRO 505 or permission of instructor
Overall structure of our Galaxy and the interstellar medium. Physical processes in the interstellar medium (e.g., heating and cooling mechanisms, turbulence). Observational techniques for studying the interstellar medium. Kinematics and chemical evolution of the Galaxy.

ASTRO 586: Extragalactic Astronomy
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ASTRO 405 or ASTRO 505 or permission of the instructor
Galaxy evolution, dynamics of external galaxies, evolution and classification of galaxies, groups and clusters of galaxies, extragalactic radio sources, quasars, structure formation, cosmological models and their observational consequences.

ASTRO 590: Special topics
Cr. arr. Repeatable.

ASTRO 599: Creative Component
Cr. arr.
Prereq: Permission of instructor
Individually directed study of research-level problems for students electing the nonthesis M.S. option in astronomy.

Courses for graduate students:

ASTRO 650: Advanced Seminar
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest in astronomy and astrophysics. Offered on a satisfactory-fail basis only.

ASTRO 675: Advanced Stellar Astrophysics
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ASTRO 580 or permission of instructor
Advanced topics in stellar astrophysics. Dynamic and extended atmospheres, chromospheres, coronae, and stellar winds. MHD, stellar activity, and dynamo theory. Radiative transfer and the transition from extended atmospheres to the interstellar medium. Diffusive processes in stellar atmospheres and interiors. Techniques for quantitative analysis of planetary and stellar spectra including detailed modeling and spectrum synthesis. Evolution in interacting binaries. Nucleosynthesis II. Variable stars. Supernovae. Neutron stars and black holes.

ASTRO 699: Research
Cr. arr. Repeatable.

Athletic Training (A TR)

Courses primarily for undergraduates:

A TR 218: Orientation to Athletic Training Clinical Experience
(0-2) Cr. 0.5. F.
Pre-athletic training clinical experience designed to orientate students to the athletic training profession prior to enrolling in athletic training course sequence. Students will observe athletic trainers in various athletic training clinical sites. Open to pre-athletic training students only. Offered on a satisfactory-fail basis only.

A TR 219: Clinical Practicum in Athletic Training
(0-2) Cr. 1. F.
Athletic training clinical experiences designed to review human anatomical structures including origin, insertion, action, innervations of muscles. Students will gain experience with palpation of these structures to help identify location of anatomical landmarks. Students will also gain experience identifying bones, ligaments, and tendons. Open to athletic training students only.

A TR 220: Basic Athletic Training
(1-2) Cr. 2.
Prereq: BIOL 155 or BIOL 255 and BIOL 256
Introduction to methods of prevention and immediate care of athletic injuries. Basic information concerning health supervision of athletes, and some basic wrapping and strapping techniques for common injuries. Non A TR majors only.

A TR 221: Pre-Athletic Training Clinical Practicum
(0-3) Cr. 1. S.
Prereq: Credit or enrollment in A TR 222
Athletic training clinical observation experiences to accompany A TR 222. Utilize knowledge to evaluate, analyze and demonstrate appropriate taping, wrapping and basic skill techniques. Open to students interested in the athletic training option. Offered on a satisfactory-fail basis only.

A TR 222: Basic Athletic Training for Athletic Trainers
(2-2) Cr. 3. S.
Prereq: BIOL 255, BIOL 255L
Provides pre-athletic training students with the knowledge of the profession of a certified athletic trainer, factors associated with injury prevention, treatment, emergency care of athletic injuries, protective equipment, basic organization, administrative, and legal concepts in the athletic training setting. To be taken concurrently with A TR 221.

A TR 223: Clinical Practicum in Athletic Training
(0-3) Cr. 1. F.
Prereq: Permission of Athletic Training Program Director
Athletic training clinical experiences for athletic training students during pre-season intercollegiate football. Clinical experiences include: Professional Rescuer CPR, AED certification, emergency splinting and spineboarding, medical record keeping and HIPPA regulations, environmental conditions, prevention of injury screening strategies, athletic training room and education program policies and procedures, review of athletic taping techniques, acute injury management, mouthpiece formation, and anatomy review. Offered on a satisfactory-fail basis only.

A TR 224: Evaluation of Athletic Injuries I
(2-3) Cr. 3. F.
Prereq: Permission of athletic training program director
Sport injury assessment procedures and evaluation techniques for lower body injuries. Includes an overview of mechanisms of injury, general musculoskeletal disorders, and spine or neurological dysfunction. Designed for students in the athletic training major.

A TR 225: Athletic Injuries I Clinical Practicum
(0-3) Cr. 1. F.
Prereq: Permission of athletic training program director
Athletic training clinical experience to accompany A TR 224. Open to students in the athletic training major. Offered on a satisfactory-fail basis only.

A TR 226: Evaluation of Athletic Injuries II
(2-3) Cr. 3. S.
Prereq: Permission of athletic training program director
Sport injury assessment procedures and evaluation techniques for lower body injuries. Includes an overview of common illnesses of athletes and sport specific injuries. Designed for students in the athletic training major.

A TR 227: Athletic Injuries II Clinical Practicum
(0-3) Cr. 1. S.
Prereq: Permission of athletic training program director
Athletic training clinical experience to accompany A TR 226. Open to students in the athletic training major. Offered on a satisfactory-fail basis only.

A TR 240: Introduction to Taping, Equipment, and Bracing Techniques
(0-3) Cr. 1. S.
Prereq: Permission of athletic training program director
Basic information and laboratory instruction regarding basic taping techniques, athletic equipment fitting procedures, and the use and proper fitting of prophylactic braces. Open to students in the athletic training major. Offered on a satisfactory-fail basis only.

A TR 323: Therapeutic Modalities for Athletic Trainers
(2-2) Cr. 3. F.
Prereq: Permission of athletic training program director
Theory and technique of therapeutic modalities used in the management of injuries.

A TR 324: Therapeutic Modalities Clinical Practicum
(0-3) Cr. 1. F.
Prereq: Permission of athletic training program director
Athletic training clinical experience to accompany A TR 323. Open to students in athletic training major. Offered on a satisfactory-fail basis only.

A TR 326: Rehabilitation of Athletic Injuries
(2-2) Cr. 3. S.
Prereq: Permission of athletic training program director
Theory and practical application of rehabilitation principles used in the management of athletic injuries.

A TR 327: Rehabilitation of Athletic Injuries Clinical Practicum
(0-3) Cr. 1. S.
Prereq: Permission of athletic training program director
Athletic training clinical experience to accompany A TR 326. Open to students in the athletic training major. Offered on a satisfactory-fail basis only.

A TR 425: Organization and Administration of Athletic Training
(3-0) Cr. 3. F.
Prereq: Permission of athletic training program director, senior classification
Current administrative, professional, and legal issues pertaining to athletic training. Job search techniques and strategies including preparation of materials for athletic training students.

A TR 450: Medical Concerns for the Athletic Trainer
(3-0) Cr. 3. F.
Prereq: Permission of athletic training program director
Current medical issues and concerns, including pathology of illness and injury, dermatological conditions, exposure to allied health care professionals, and pharmacological indications in relation to the profession of athletic training and in patient/athlete care.

A TR 488: Evidence Based Practice in Athletic Training
Cr. 2. S.
Prereq: Permission of athletic training program director
Clinical experiences in application of athletic training techniques under supervision of certified athletic trainers. Participation in monthly research journal discussion. Offered on a satisfactory-fail basis only.

A TR 489: Review of Athletic Training Competencies and Clinical Proficiencies
Cr. 1. F.S.
Prereq: Senior classification, permission of athletic training program director
Preparation for professional endorsement and certification by review of required competencies and clinical proficiencies. Required for endorsement or approval to sit for Board of Certification Exam. Offered on a satisfactory-fail basis only.

Athletics (ATH)

Courses primarily for undergraduates:

ATH 101: Intercollegiate Athletics
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101B: Intercollegiate Athletics: Basketball (men)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101C: Intercollegiate Athletics: Basketball (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101D: Intercollegiate Athletics: Cross Country (men)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101E: Intercollegiate Athletics: Cross Country (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101F: Intercollegiate Athletics: Football (men)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101G: Intercollegiate Athletics: Golf (men)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101J: Intercollegiate Athletics: Gymnastics (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101K: Intercollegiate Athletics: Softball (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101M: Intercollegiate Athletics: Swimming/Diving (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101O: Intercollegiate Athletics: Tennis (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101P: Intercollegiate Athletics: Track and Field (men)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101Q: Intercollegiate Athletics: Track and Field (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101R: Intercollegiate Athletics: Volleyball (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101S: Intercollegiate Athletics: Wrestling (men)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101T: Intercollegiate Athletics: Golf (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101U: Intercollegiate Athletics: Soccer (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

Biochemistry, Biophysics, and Molecular Biology (BBMB)

Courses primarily for undergraduates:

BBMB 101: Introduction to Biochemistry
(1-0) Cr. 1. F.
Research activities, career opportunities in biochemistry and biophysics, and an introduction to the structure of biologically important compounds. For students majoring in biochemistry, agricultural biochemistry or biophysics or considering one of these majors.

BBMB 102: Introduction to Biochemistry Laboratory
(0-2) Cr. 1. S.
Prereq: Credit or enrollment in CHEM 177 and CHEM 177L or CHEM 201 and CHEM 201L
Topics in the scientific background of biochemistry, such as macromolecules, metabolism, and catalysis. Laboratory experimentation covers biochemical concepts and the study of bio-molecules including proteins, lipids and nucleic acids. A significant component is practice in scientific communication. For students majoring in biochemistry, agricultural biochemistry or biophysics or considering one of these majors.

BBMB 120: The Biochemistry of Beer

(Cross-listed with FS HN). (2-0) Cr. 2. F.

An introduction to the major classes of biomolecules, basic biochemical concepts, enzymology, metabolism and genetic engineering as they apply to the production and flavor of beer. All aspects of the biochemistry of beer will be covered, including the malting of barley, starch conversion, yeast fermentation and the chemical changes that occur during the aging of beer. Intended for non-majors. Natural science majors are limited to elective credit only.

BBMB 201: Chemical Principles in Biological Systems

(2-0) Cr. 2. S.

Prereq: Credit or enrollment in CHEM 332

Survey of chemical principles as they apply in biological systems including: water, organic chemistry of functional groups in biomolecules and biochemical cofactors, weak bonds and their contribution to biomolecular structure, oxidation-reduction reactions and redox potential, thermodynamic laws and bioenergetics, chemical equilibria and kinetics, inorganic chemistry in biological systems, data presentation. The subjects will be taught using molecules from biological systems as examples. Intended for majors in biochemistry, biophysics or agricultural biochemistry.

BBMB 221: Structure and Reactions in Biochemical Processes

(3-0) Cr. 3. F.S.

Prereq: CHEM 163, CHEM 167, or CHEM 177

Fundamentals necessary for an understanding of biochemical processes. Primarily for students in agriculture. Not acceptable for credit toward a major in biochemistry, biophysics, or agricultural biochemistry. Credit for both BBMB 221 and Chem 231 may not be applied toward graduation.

BBMB 301: Survey of Biochemistry

(3-0) Cr. 3. F.S.SS.

Prereq: CHEM 231 or CHEM 331

A survey of biochemistry: structure and function of amino acids, proteins, carbohydrates, lipids, and nucleic acids; enzymology; metabolism; biosynthesis; and selected topics. Not acceptable for credit toward a major in biochemistry, biophysics, or agricultural biochemistry.

BBMB 316: Principles of Biochemistry

(3-0) Cr. 3. F.

Prereq: CHEM 231 or CHEM 331; BIOL 212; BIOL 313 and BIOL 314 strongly recommended.

Understanding biological systems at the molecular level; chemistry of biological macromolecules, enzyme function and regulation, metabolic pathways; integration of metabolism in diverse living systems. For students in biology and related majors who do not require the more rigorous treatment of biochemistry found in BBMB 404/405. Not acceptable for credit toward a major in biochemistry, biophysics, or agricultural biochemistry.

BBMB 404: Biochemistry I

(3-0) Cr. 3. F.

Prereq: CHEM 332

A general overview for graduate and advanced undergraduate students in agricultural, biological, chemical and nutritional sciences. Chemistry of amino acids, proteins, carbohydrates, and lipids, vitamins; protein structure; enzymology; carbohydrate metabolism. Credit for both BBMB 420 and the BBMB 404 - 405 sequence may not be applied toward graduation.

BBMB 405: Biochemistry II

(3-0) Cr. 3. S.

Prereq: BBMB 404

A general overview for graduate and advanced undergraduate students in agricultural, biological, chemical, and nutritional sciences. Metabolism of carbohydrates, amino acids, nucleotides and lipids; formation, turnover, and molecular relationships among DNA, RNA, and proteins; genetic code; regulation of gene expression; selected topics in the molecular physiology of plants and animals. Credit for both BBMB 420 and the BBMB 404 - BBMB 405 sequence may not be applied toward graduation.

BBMB 411: Techniques in Biochemical Research

(2-8) Cr. 4. F.

Prereq: Credit or enrollment in BBMB 404 or BBMB 504 and BBMB 505; CHEM 211

Laboratory experimentation and techniques for studying biochemistry, including: chromatographic methods; electrophoresis; spectrophotometry; enzyme purification; enzyme kinetics; and characterization of carbohydrates, proteins, lipids, and nucleic acids. Scientific communication and technical writing are emphasized.

BBMB 420: Mammalian Biochemistry

(3-0) Cr. 3. F.

Prereq: CHEM 332, BIOL 314

Structure and function of proteins; enzymology; biological oxidation; chemistry and metabolism of carbohydrates, lipids, amino acids and nucleic acids; protein synthesis and the genetic code; relationship of biochemistry to selected animal diseases. Biochemistry of higher animals emphasized. Not acceptable for credit toward a major in agricultural biochemistry or biochemistry. Acceptable for credit toward a major in biophysics. Credit for both BBMB 420 and the BBMB 404 - 405 sequence may not be applied toward graduation.

BBMB 430: Procaryotic Diversity and Ecology

(Dual-listed with BBMB 530). (Cross-listed with MICRO). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: MICRO 302, MICRO 302L

Survey of the diverse groups of procaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

BBMB 440: Laboratory in Microbial Physiology, Diversity, and Genetics
(Cross-listed with MICRO). (2-6) Cr. 4. F.
Prereq: MICRO 302, MICRO 302L, CHEM 332, BIOL 313L
Fundamental techniques and theory for studying the cellular mechanisms, genetic processes and diversity of microbial life. Experimental techniques will include isolation and physiological characterization of bacteria that inhabit different environments as well as an emphasis on genetic and molecular techniques to understand antibiotic resistance processes and mechanisms. Also included are techniques for phylogenetic characterization, measuring gene expression, and genetic manipulation of bacteria. Essential components for the effective communication of scientific results are also emphasized.

BBMB 461: Molecular Biophysics
(Dual-listed with BBMB 561). (2-0) Cr. 2. S.
Prereq: Credit or enrollment in MATH 166 and CHEM 178 and PHYS 222 or PHYS 112.
Physical methods for the study of molecular structure and organization of biological materials. X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy. Registration for the graduate credit commits the student to graduate-level examinations, which differ from undergraduate-level examinations in the number and/or difficulty of questions.

BBMB 490: Independent Study
Cr. 1-3. Repeatable. F.S.SS.
Prereq: College of Agriculture: junior or senior classification and permission of instructor; College of Liberal Arts and Sciences: permission of instructor.
Independent study with a faculty mentor. No more than 9 credits of BBMB 490 may count toward graduation.

BBMB 490H: Independent Study, Honors
Cr. 1-3. Repeatable. F.S.SS.
Prereq: College of Agriculture: junior or senior classification and permission of instructor; College of Liberal Arts and Sciences: permission of instructor
Independent study with a faculty mentor. No more than 9 credits of BBMB 490 may count toward graduation.

BBMB 499: Undergraduate Research
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of faculty member with whom student proposes to work.
Independent research under faculty guidance.

Courses primarily for graduate students, open to qualified undergraduates:

BBMB 504: Amino Acids and Proteins
(2-0) Cr. 2. F.
Prereq: CHEM 332 or equivalent
Review of amino acids and proteins, including atomic interactions, thermodynamics, structure and properties of amino acids, post-translational modifications, protein expression, purification and analysis, protein secondary, tertiary and quaternary structure, protein folding, oxygen transport and hemoglobin, models for equilibrium binding, elementary reactions and enzyme kinetics, biosynthesis of amino acids: pathways and mechanisms.

BBMB 505: Bioenergetics and Metabolism
(2-0) Cr. 2. F.
Prereq: CHEM 211, CHEM 332; a previous course in biochemistry is strongly recommended
Examination of catabolic pathways involved in the oxidation of organic and inorganic molecules, and energy metabolism involving inputs from light or other non-light sources. Central metabolism and glycolysis, fermentation, aerobic and anaerobic respiration, photosynthesis.

BBMB 506: Membrane Biochemistry
(2-0) Cr. 2.
Prereq: CHEM 332 or equivalent
Analysis of the structure, function, and synthesis of membranes. Bacterial and eukaryotic membrane characteristics. Membrane transport and signaling mechanisms. Analysis of the structure and function of lipids and membrane proteins.

BBMB 507: Biochemistry of Nucleic Acids
(2-0) Cr. 2. S.
Prereq: CHEM 332 or equivalent
Analysis of the chemical structure, function, synthesis, and metabolism of nucleic acids. Chemical characterization of nucleotides, polynucleotides, DNA, and RNA. Analysis of transcription, translation, and the genetic code.

BBMB 510: Molecular Biology and Biochemistry of RNA
(2-0) Cr. 2. F.
Prereq: BIOL 313, BBMB 405, BBMB 502, BBMB 506 and 507 or Gen 409, or equivalent
Biochemical processes that define structure and function of nucleic acids. Emphasis on the molecular processes that take place during synthesis, processing, and function of different RNA species; review of recent advances in RNA research.

BBMB 530: Procaryotic Diversity and Ecology
(Dual-listed with BBMB 430). (Cross-listed with MICRO). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MICRO 302, MICRO 302L
Survey of the diverse groups of procaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

BBMB 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

BBMB 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

BBMB 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

BBMB 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

BBMB 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

BBMB 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

BBMB 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

BBMB 552: Biomolecular NMR Spectroscopy
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: CHEM 325 or permission of instructor
Advanced solution state Nuclear Magnetic Resonance spectroscopy as applied to biological systems. Topics include theoretical principles of NMR, practical aspects of experimental NMR, methodologies for protein structure determination, NMR relaxation, recent advances in NMR spectroscopy.

BBMB 561: Molecular Biophysics
(Dual-listed with BBMB 461). (2-0) Cr. 2. S.
Prereq: Credit or enrollment in MATH 166 and CHEM 178 and PHYS 222 or PHYS 112.
Physical methods for the study of molecular structure and organization of biological materials. X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy. Registration for the graduate credit commits the student to graduate-level examinations, which differ from undergraduate-level examinations in the number and/or difficulty of questions.

BBMB 561L: Laboratory in Molecular Biophysics
(1-3) Cr. 2. S.
Prereq: Credit or enrollment in BBMB 461/BBMB 561
Practice in methods of X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy as applied to macromolecules.

BBMB 569: Bioinformatics III (Structural Bioinformatics)
(Cross-listed with BCB, COM S, CPR E, GDCB). (3-0) Cr. 3. F.
Prereq: BCB 567, BBMB 316, GEN 409, STAT 430
Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution.

BBMB 590: Special Topics
Cr. arr.
By arrangement.

BBMB 593: Workshop in Biochemistry and Biophysics
Cr. 1. Repeatable. F.S.
Prereq: Permission and signature of course administrator required.
Workshops in selected topics in biochemistry and biophysics. Credit in this course does not meet the requirement for advanced graduate electives in Biochemistry. Spring only: BBMB Undergraduate Research Symposium participation. Scheduled class meetings are required in addition to attending the symposium.

Courses for graduate students:

BBMB 607: Plant Biochemistry
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Description of unique aspects of plant biochemistry including lipid metabolism, cell wall structure, secondary metabolism, phytoalexin biosynthesis, and plant defenses.

BBMB 615: Molecular Immunology
(Cross-listed with MICRO, V MPM). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function.

BBMB 622: Carbohydrate Chemistry
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: BBMB 404 or BBMB 504 and BBMB 505
Structure, occurrence, properties, function, and chemical and enzymatic modifications of monosaccharides, oligosaccharides, polysaccharides, and glycoproteins.

BBMB 632: Kinetics of Enzyme Action
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BBMB 504 and BBMB 505
Fundamental and advanced enzyme kinetics. Topics include integrated rate equations, methods for deriving initial-rate equations, inhibition, product effects, methods for verifying kinetic mechanisms, allostery, hysteresis, isotope effects, and complex kinetic mechanisms.

BBMB 642: Mechanisms of Enzymatic Catalysis
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: BBMB 404 or BBMB 420; or BBMB 504 and BBMB 505
The chemical basis of enzymatic catalysis with emphasis on mechanisms of substrate recognition, general acid-base catalysis and stereo-electronic factors.

BBMB 645: Molecular Signaling
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: BBMB 405 or BBMB 420; or BBMB 506 and BBMB 507
Molecular mechanisms of cellular signaling including receptor activation, desensitization and cross talk, signal transduction pathways, and nuclear receptors. Discussion includes a variety of cell surface receptors and their hormone; growth factor and extracellular matrix activators; protein kinases; caspase and transcription factor downstream signals; lipids, gases and cyclic nucleotides as regulators of cell signaling. Course content includes current literature, student and instructor presentations and research proposal writing.

BBMB 652: Protein Chemistry - Chemical Methods
(2-0) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: BBMB 404 or BBMB 504 and BBMB 505
First 8 weeks. Chemical reactions as a means of determining protein structure and biological function.

BBMB 653: Protein Chemistry - Physical Methods
(2-0) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: BBMB 404 or BBMB 504 and BBMB 505
Second 8 weeks. Protein structure determination as a means of understanding biological function.

BBMB 660: Membrane Biochemistry
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Protein and lipid constituents of biological membranes. Structure and topography of membrane proteins. Selected topics concerning the membrane proteins involved in diverse biochemical processes, such as energy transduction transport across membranes, neurotransmission and signal transduction.

BBMB 661: Current Topics in Neuroscience
(Cross-listed with GDCB, NEURO). (2-0) Cr. 2-3. Repeatable. Alt. S., offered even-numbered years.
Prereq: NEURO 556 (or comparable course) or permission of instructor
Topics may include molecular and cellular neuroscience, neurodevelopment, neuroplasticity, neurodegenerative diseases, cognitive neuroscience, sensory biology, neural integration, membrane biophysics, neuroethology, techniques in neurobiology and behavior.

BBMB 675: Nucleic Acid Structure and Function
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
In-depth discussion of nucleic acid properties, structures and structure/function relationships. Interactions between nucleic acids and proteins will be emphasized.

BBMB 676: Biochemistry of Gene Expression in Eucaryotes
(Cross-listed with MCDB). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: BBMB 404 and BBMB 504; and BBMB 506 and BBMB 507; or BBMB 405 or BBMB 505 and or GDCB 511
Analysis of the biochemical processes involved in expression of eucaryotic genes and the regulation thereof, including RNA polymerase, transcriptional regulatory proteins, enhancers and silencers, chromosome structure, termination, RNA processing, RNA transport, RNA turnover, small RNAs, translational regulation, protein turnover.

BBMB 681: Advanced Seminar
Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor
Student presentations.

BBMB 682: Departmental Seminar
Cr. R. F.S.
Prereq: Permission of instructor
Faculty, staff and invited guest research seminar.

BBMB 696: Research Seminar
(Cross-listed with AGRON, FOR, GDCB, HORT, PLBIO). Cr. 1. Repeatable.
Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

BBMB 698: Seminar in Molecular, Cellular, and Developmental Biology
(Cross-listed with GDCB, MCDB, MICRO, V MPM). (2-0) Cr. 1-2. Repeatable. F.S.
Student and faculty presentations.

BBMB 699: Research
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor

Bioinformatics and Computational Biology (BCB)

Courses primarily for undergraduates:

BCB 444: Bioinformatic Analysis
(Cross-listed with BCBIO, BIOL, COM S, CPR E, GEN). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

BCB 490: Independent Study
Cr. 1-5. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Permission of instructor

Courses primarily for graduate students, open to qualified undergraduates:

BCB 544: Fundamentals of Bioinformatics
(Cross-listed with COM S, CPR E, GDCB). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent
A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies.

BCB 567: Bioinformatics I (Bioinformatics Algorithms)
(Cross-listed with COM S, CPR E). (3-0) Cr. 3. F.
Prereq: COM S 228; COM S 330; credit or enrollment in BIOL 315, STAT 430
Biology as an information science. A review of the algorithmic principles that are driving the advances in bioinformatics and computational biology.

BCB 568: Bioinformatics II (Statistical Bioinformatics)
(Cross-listed with COM S, GDCB, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or (BIOL 315 and STAT 430), credit or enrollment in GEN 409
Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models.

BCB 569: Bioinformatics III (Structural Bioinformatics)
(Cross-listed with BBMB, COM S, CPR E, GDCB). (3-0) Cr. 3. F.
Prereq: BCB 567, BBMB 316, GEN 409, STAT 430
Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution.

BCB 570: Bioinformatics IV (Systems Biology)
(Cross-listed with COM S, CPR E, GDCB, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or COM S 311, COM S 228, GEN 409, STAT 430
Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration.

BCB 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor

BCB 593: Workshop in Bioinformatics and Computational Biology
(1-0) Cr. 1. Repeatable. F.S.
Current topics in bioinformatics and computational biology research. Lectures by off-campus experts. Students read background literature, attend preparatory seminars, attend all lectures, meet with lecturers.

BCB 598: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the program chair
Off-campus work periods for graduate students in the field of bioinformatics and computational biology.

BCB 599: Creative Component
Cr. arr.

Courses for graduate students:

BCB 660: Selected Topics in Bioinformatics and Computational Biology
(3-0) Cr. 1-4. Repeatable, maximum of 4 times. F.S.SS.
Prereq: Permission of Instructor
Topics of interest in the major research areas of computational molecular biology, including genomics, structural genomics, functional genomics, and computational systems biology.

BCB 690: Student Seminar in Bioinformatics and Computational Biology
Cr. 1. Repeatable. S.
Student research presentations.

BCB 691: Faculty Seminar in Bioinformatics and Computational Biology
(1-0) Cr. 1. Repeatable.
Faculty research series.

BCB 697: Graduate Research Rotation
Cr. arr. Repeatable. F.S.SS.
Graduate research projects performed under the supervision of selected faculty members in the Bioinformatics and Computational Biology major.

BCB 699: Research
Cr. arr. Repeatable.

Bioinformatics and Computational Biology (BCBIO)

Courses primarily for undergraduates:

BCBIO 110: BCBIO Orientation
(1-0) Cr. 0.5. F.
First 8 weeks. Orientation to the area of bioinformatics and computational biology. For students considering a major in BCBIO. Specializations and career opportunities. Offered on a satisfactory-fail basis only.

BCBIO 322: Introduction to Bioinformatics and Computational Biology
(Cross-listed with BIOL, GEN). (3-0) Cr. 3. F.
Prereq: BIOL 212
Genome sequencing, assembly, structural and functional annotation, and comparative genomics. Investigating these topics will develop skills in programming and scripting (Perl and/or Python), the use of biological databases, sequence alignment, similarity search, identification of sequence patterns, construction of phylogenetic trees, and comparative genomics.

BCBIO 401: Fundamentals of Bioinformatics and Computational Biology
(3-0) Cr. 3. F.
Prereq: BCBIO 322 and basic programming experience (e.g. COM S 207, COM S 227 or permission of instructor)
Application of computer science and engineering to molecular biology. String algorithms, sequence alignments, data structures, homology search methods, pattern recognition, fragment assembly, genome annotation, construction of bioinformatics databases, and gathering and distribution of biological information with the Internet.

BCBIO 402: Fundamentals of Systems Biology and Network Science
(3-0) Cr. 3. S.
Prereq: BIOL 212
Technologies: transcriptome, proteome, metabolome; Networks: Gene regulatory network, Protein-protein interaction network, Literature network; Theories: Graph theory, random network, scale-free network, evolving network, network robustness; Tools: Jmol, MeV, Cytoscape, Citespace.

BCBIO 442: Bioinformatics and Computational Biology Techniques
(0.2-0.5) Cr. 0.5. Repeatable, maximum of 2 credits. S.SS.
Prereq: BIOL 314 recommended
Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. Offered on a satisfactory-fail basis only.

BCBIO 442A: Bioinformatics and Computational Biology Techniques: Sequence Database Searching
(0.2-0.5) Cr. 0.5. Repeatable, maximum of 2 credits. S.SS.
Prereq: BIOL 314 recommended
Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. Offered on a satisfactory-fail basis only.

BCBIO 442B: Bioinformatics and Computational Biology: Protein Structure Databases, Visualization, and Prediction
(0.2-0.5) Cr. 0.5. Repeatable, maximum of 2 credits. S.SS.
Prereq: BIOL 314 recommended
Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. Offered on a satisfactory-fail basis only.

BCBIO 442C: Bioinformatics and Computational Biology Techniques: Phylogenetic Analysis
(0.2-0.5) Cr. 0.5. Repeatable, maximum of 2 credits. S.SS.
Prereq: BIOL 314 recommended
Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. Offered on a satisfactory-fail basis only.

BCBIO 442D: Bioinformatics and Computational Biology Techniques: Microarray Analysis
(0.2-0.5) Cr. 0.5. Repeatable, maximum of 2 credits. S.SS.
Prereq: BIOL 314 recommended
Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. Offered on a satisfactory-fail basis only.

BCBIO 444: Bioinformatic Analysis
(Cross-listed with BCB, BIOL, COM S, CPR E, GEN). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

BCBIO 490: Independent Study
Cr. 1-5. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: BCBIO 322, junior or senior classification, permission of instructor
Independent research projects for undergraduate students in bioinformatics and computational biology. Students in the College of Liberal Arts and Sciences may use no more than 9 credits of BCBIO 490 and 491 toward graduation.

BCBIO 491: Team Research Projects.
Cr. 1-5. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: BCBIO 322, junior or senior classification, permission of instructor
Research projects in bioinformatics and computational biology done by teams of students. Students in the College of Liberal Arts and Sciences may use no more than 9 credits of BCBIO 490 and 491 toward graduation.

Biological/Pre-Medical Illustration (BPM I)

Courses primarily for undergraduates:

BPM I 323: Scientific Illustration Principles and Techniques
(Cross-listed with ARTIS). (0-6) Cr. 3. Repeatable.
Prereq: 6 credits in art and design and 3 credits in biological sciences
Studio basics and professional techniques in black & white, continuous tone, and color. Emphasis on tools, materials, and rendering.

BPM I 326: Illustration and Illustration Software
(Cross-listed with ARTIS). (0-6) Cr. 3. Repeatable.
Prereq: ARTIS 323
Application of painting, drawing, and image making techniques to communication. Development of technical abilities using illustration software. Digital and print production techniques.

BPM I 327: Illustration as Communication
(Cross-listed with ARTIS). (0-6) Cr. 3.
Prereq: ARTIS 326
Studio problems in illustration emphasizing composition and communication. Problem solving methodologies.

BPM I 337: Application of Scientific Illustration Techniques
(Cross-listed with ARTIS). (0-6) Cr. 3. Repeatable, maximum of 6 credits. S.
Prereq: ARTIS 327
Rendering techniques applied to different types of biological and scientific subjects emphasizing communication. The use of traditional and digital media. Term project required.

BPM I 395: Field Illustration
Cr. 1-3. Repeatable, maximum of 6 credits. S.SS.
Prereq: Permission of instructor
A combination seminar and field trip course emphasizing nature interpretation, field sketching techniques and preparation of a final illustration based on field experience.

BPM I 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the program cooperative education coordinator, junior classification
Required of all cooperative education students. Students must register for these courses prior to commencing each work period.

BPM I 435I: Illustrating Nature I Sketching
(Cross-listed with IA LL). Cr. 2. SS.
Sketching plants, animals and terrain. Visual communication, development of a personal style, and integration of typographic and visual elements on a page will be emphasized.

BPM I 436I: Illustrating Nature II Photography
(Cross-listed with IA LL). Cr. 2. SS.
Beginning to intermediate technical and compositional aspects of color photography of natural areas and their plants and animals.

BPM I 490: Independent Study
Cr. 1-3. Repeatable, maximum of 3 credits.
Prereq: Written approval of instructor and advisory committee chair on required form in advance of semester of enrollment

BPM I 494: Special Topics in Illustration
Cr. 1-3. Repeatable.
Intensive exploration of illustration techniques in a studio or field setting.

BPM I 497: Illustration Internship
Cr. 1-6. Repeatable, maximum of 6 credits.
Prereq: Junior or senior classification in BPM I, written approval of supervising instructor and advisory committee chair on required form in advance of semester of enrollment
Offered on a satisfactory-fail basis only.

Biology (BIOL)

Courses primarily for undergraduates:

BIOL 101: Introductory Biology
(3-0) Cr. 3. F.S.SS.
Life considered at cellular, organism, and population levels. Function and diversity of the living world. Presentation of basic biological principles as well as topics and issues of current human interest. Does not satisfy biology major requirements.

BIOL 110: Introduction to Biology
Cr. 1. F.
Orientation to the scope of the biological sciences, and discussion of professional opportunities. Required of first year biology majors. Offered on a satisfactory-fail basis only.

BIOL 111: Opportunities in Biology
(1-0) Cr. 0.5. S.
Introduction to biological science disciplines and professional opportunities through faculty presentations which examine a variety of current research topics. Offered on a satisfactory-fail basis only.

BIOL 112: Transfer Student Orientation
Cr. R. F.S.
Orientation to opportunities in Biology. Review of degree requirements and other information needed by students that have not participated in the first year Biology orientation courses. Offered on a satisfactory-fail basis only.

BIOL 155: Human Biology
(3-0) Cr. 3. F.S.
A survey course of human biology, including principal structures and functions of the body systems and the diseases and disorders associated with them. Designed to meet general education requirements in natural science. Not recommended for those seeking a career in the allied health professions or for students majoring in life science. Does not satisfy biology major requirements.

BIOL 173: Environmental Biology
(Cross-listed with ENV S). (3-0) Cr. 3. F.S.
An introduction to the structure and function of natural systems at scales from the individual to the biosphere and the complex interactions between humans and their environment. Discussions of human population growth, biodiversity, sustainability, resource use, and pollution. Does not satisfy biology major requirements.

BIOL 201: Introduction to Environmental Issues
(Cross-listed with ENSCI, ENV S). (2-0) Cr. 2. F.
Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change.

BIOL 204: Biodiversity
(Cross-listed with ENV S). (4-0) Cr. 2. S.
Prereq: One course in life sciences
Survey of the major groups of organisms and biological systems. Definition, measurements, and patterns of distribution of organisms. Sources of information about biodiversity. Does not satisfy biology major requirements. Half semester course.

BIOL 211: Principles of Biology I
(3-0) Cr. 3. F.S.
Prereq: High school biology
Introduction to the nature of life, including the diversity of microbial, plant, and animal life; the nature of heredity; evolution; and principles of ecology. Intended for life science majors.

BIOL 211L: Principles of Biology Laboratory I
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in BIOL 211
Laboratory to accompany 211.

BIOL 212: Principles of Biology II
(3-0) Cr. 3. F.S.
Prereq: High School Biology; high school chemistry or credit or enrollment in CHEM 163 or CHEM 177
Introduction to the chemical, molecular, and cellular basis of life; form and function of microbial, plant, and animal life. Intended for life science majors.

BIOL 212L: Principles of Biology Laboratory II
(0-3) Cr. 1. F.S.
Prereq: credit or enrollment in BIOL 212
Laboratory to accompany 212.

BIOL 251: Biological Processes in the Environment
(Cross-listed with ENSCI). (3-0) Cr. 3. S.
Plant and microbial processes in environmental systems including their interactions with human activities.

BIOL 255: Fundamentals of Human Anatomy
(3-0) Cr. 3. F.
Prereq: High School Biology and Chemistry, or BIOL 101
An introduction to human anatomy, beginning with cells and tissues, surveying all body systems, relating form to function. Systems covered include: integumentary, bones and joints, muscles, nervous, sensory, endocrine, circulatory, lymphatic, respiratory, digestive, urinary, and reproductive. Pre-Medical students should consider Biol 351 for their anatomy background. Does not satisfy biology major requirements.

BIOL 255L: Fundamentals of Human Anatomy Laboratory
(0-3) Cr. 1. F.
Prereq: Credit or enrollment in BIOL 255
Investigation of human anatomy using models and dissections of preserved organs and model mammals. Pre-Medical students should consider 351 for their anatomy background. Does not satisfy biology major requirements.

BIOL 256: Fundamentals of Human Physiology
(3-0) Cr. 3. S.
Prereq: High School Biology and Chemistry, or BIOL 101, or BIOL 255 (recommended)
An introduction to human physiology, studying the function of all body systems. Systems covered include: integumentary, bones and joints, muscles, nervous, sensory, endocrine, circulatory, lymphatic and immune, respiratory, digestive, urinary, and reproductive. Pre-Medical students should consider 335 for their physiology background. Does not satisfy biology major requirements.

BIOL 256L: Fundamentals of Human Physiology Laboratory
(0-3) Cr. 1. S.
Prereq: Credit or enrollment in BIOL 256
Student-conducted experiments investigating concepts of human physiology with computer data acquisition and analysis. Interpretation of experimental results and preparation of lab reports. Pre-Medical students should consider 335 for their anatomy and physiology background. Does not satisfy biology major requirements.

BIOL 307: Women in Science and Engineering
(Cross-listed with W S). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: a 200 level course in science, engineering or women's studies; ENGL 250
The interrelationships of women and science and engineering examined from historical, sociological, philosophical, and biological perspectives. Factors contributing to under-representation; feminist critiques of science; examination of successful strategies. Does not satisfy biology major advanced credit requirements.
Meets U.S. Diversity Requirement

BIOL 312: Ecology
(Cross-listed with A ECL, ENSCI). (3-3) Cr. 4. F.SS.
Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L
Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats.

BIOL 313: Principles of Genetics
(Cross-listed with GEN). (3-0) Cr. 3. F.S.SS.
Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L
Introduction to the principles of transmission and molecular genetics of plants, animals, and bacteria. Recombination, structure and replication of DNA, gene expression, cloning, quantitative genetics, and population genetics. Students may receive graduation credit for no more than one of the following: Gen 260, Gen 313 and 313L, Gen 320, Biol 313 and 313L, and Agron 320.

BIOL 313L: Genetics Laboratory
(Cross-listed with GEN). (0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in BIOL 313
Laboratory to accompany 313. Students may receive graduation credit for no more than one of the following: Biol 313 and 313L, Gen 260, Gen 313, Gen 320, and Agron 320.

BIOL 314: Principles of Molecular Cell Biology
(3-0) Cr. 3. F.S.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L
Integration of elementary principles of metabolism, bioenergetics, cell structure, and cell function to develop a molecular view of how the cell works.

BIOL 315: Biological Evolution
(3-0) Cr. 3. F.S.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L.
The mechanisms of evolution. Topics in microevolution: population genetics, natural selection, genetic variation, and adaptation. Macroevolution: speciation, extinction, phylogeny, and major evolutionary patterns.

BIOL 322: Introduction to Bioinformatics and Computational Biology
(Cross-listed with BCBIO, GEN). (3-0) Cr. 3. F.
Prereq: BIOL 212
Genome sequencing, assembly, structural and functional annotation, and comparative genomics. Investigating these topics will develop skills in programming and scripting (Perl and/or Python), the use of biological databases, sequence alignment, similarity search, identification of sequence patterns, construction of phylogenetic trees, and comparative genomics.

BIOL 328: Molecular and Cellular Biology of Human Diseases
Cr. 3. F.
Prereq: BIOL 212
Survey of molecular, genetic, and cellular aspects of human diseases. Fundamental concepts of cell biology and how they are linked to the pathologies of different classes of human diseases. Recent scientific advances with an emphasis on new methods of diagnosis and treatment.

BIOL 334: Metabolic Physiology of Mammals
(3-0) Cr. 3. S.
Prereq: BIOL 211, BIOL 212
Introduction to physiology of metabolic function in mammals and other animals. Metabolic processes and their interactions with various subsystems, approached from an organismal perspective. Integration of cellular, gastrointestinal, cardiovascular, respiratory, and renal processes, relevant to their control and integration at the nervous and endocrine system levels. Functional aspects of organismal physiology, energy and water balances, physiology of rest exercise, and environmental stress. Students cannot receive credit for both BIOL 334 and BIOL 335.

BIOL 335: Principles of Human and Other Animal Physiology
(3-3) Cr. 4. F.
Prereq: BIOL 314
Introduction to systemic functions with emphasis on mammals. Students cannot receive credit for both BIOL 334 and BIOL 335.

BIOL 336: Ecological and Evolutionary Animal Physiology
Cr. 3.
Prereq: BIOL 211, BIOL 212
Study of mechanisms by which animals perform life-sustaining functions; the evolution and adaptive significance of physiology traits, the diversity of physiological mechanisms, and how physiology and ecology interact.

BIOL 344: Human Reproduction
(Cross-listed with W S). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 212
Biology of human reproduction, including reproductive systems, hormones, and endocrinology of pregnancy, presented from a clinically-oriented perspective. Reviews health-related conditions such as infertility, sexually-transmitted diseases, and complicated pregnancy.

BIOL 349: The Genome Perspective in Biology
(Cross-listed with GEN). (2-2) Cr. 3. S.
Prereq: GEN 313 or GEN 320
Analysis of genome, RNA, and protein data using computer technology to answer biological questions on topics ranging from microbial diversity to human health. An introduction for students in the life sciences to the fields of genomics, bioinformatics and systems.

BIOL 350: Comprehensive Human Anatomy
(3-0) Cr. 3. F.
Prereq: Credit in BIOL 211 and BIOL 212
Comprehensive survey of human anatomy, emphasizing structural and functional relationships of major organ systems. Compartmental study of normal anatomy; practical clinical application of anatomical regions.

BIOL 351: Comparative Chordate Anatomy
(3-4) Cr. 5. S.
Prereq: BIOL 212, junior classification
The evolution of chordates as reflected in the anatomy of extinct and living forms. Lecture topics include the history and diversity of chordates, comparisons of anatomic structures among major groups, and the adaptive significance of anatomic structures. Laboratory involves dissection of representative species.

BIOL 352: Vertebrate Histology
(3-3) Cr. 4. S.
Prereq: BIOL 212
Microscopic structure of vertebrate tissues and organs, with an introduction to histological techniques.

BIOL 353: Introductory Parasitology
(Cross-listed with MICRO, V PTH). (3-0) Cr. 3. S.
Prereq: BIOL 212
Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites.

BIOL 354: Animal Behavior
(3-0) Cr. 3. F.
Prereq: BIOL 212
Ethological and sociobiological approaches to animal behavior. Genetic and developmental aspects of behavior, biological rhythms, orientation (including navigation, migration), communication, and social behavior (mating, aggression, parental care).

BIOL 354L: Laboratory in Animal Behavior
(0-3) Cr. 1. F.
Prereq: Credit or enrollment in BIOL 354
Laboratory techniques for observation, description and analysis of animal activities; independent projects.

BIOL 355: Plants and People
(3-0) Cr. 3. S.
Prereq: Credit in BIOL 211 and BIOL 211L
Uses of plants and fungi by humans and the importance of plants in the past, present, and future. Discussion of fruits, vegetables, grains, herbs, spices, beverages, oils, fibers, wood, medicines, and drugs, in the context of their agricultural, cultural, and economic roles in modern societies. Emphasis on origins and worldwide diversity of culturally important plants, their characteristics, and uses.

BIOL 356: Dendrology
(Cross-listed with FOR). (2-4) Cr. 4. F.
Prereq: BIOL 211
Identification and ecology of North American woody plant species. Importance of woody plants in timber production and wildlife habitat. Natural disturbances, human impacts, management and restoration concerns for major North American forest regions will be addressed.

BIOL 364: Invertebrate Biology
Cr. 3-4. F.
Prereq: BIOL 211, 212
Emphasis on diversity, development, physiology, and behavior of invertebrate organisms- the "spineless wonders" of the world. Laboratory involves hands-on study and investigation of living invertebrates.

BIOL 365: Vertebrate Biology
(Cross-listed with A ECL). (3-2) Cr. 4. F.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L
Evolution, biology, and classification of fish, amphibians, reptiles, birds, and mammals. Emphasis on a comparative analysis of the structure and function of organ systems. Laboratory exercises concentrate on morphology and identification of orders of vertebrates.

BIOL 366: Plant Systematics
(2-4) Cr. 4. S.
Prereq: BIOL 211
Introduction to plant phylogenetic systematics, plant classification, survey of flowering plant families, and identification and field study of local plants.

BIOL 370: GIS for Ecology and Environmental Science
(Cross-listed with ENSCI). Cr. 1-6. Repeatable. F.S.
Prereq: Six credits in biological and /or physical sciences, and permission of instructor.
Introduction to geographic information systems (GIS) with emphasis on ecological and environmental applications. No prior GIS experience required. Guided, individualized study of topics based on student background and interest. For students with prior experience, topics and activities are selected to build upon any previous experience and minimize duplication to previous GIS coursework. Potential topics include: basic concepts of GIS, data structures, database management, spatial analysis, modeling and visualization of ecological and environmental data. Case studies in ecological and environmental applications using ArcGIS. Offered on a satisfactory-fail basis only.

BIOL 371: Ecological Methods
(Cross-listed with A ECL). (2-3) Cr. 3. S.
Prereq: A ECL 312; STAT 101 or STAT 104
Quantitative techniques used in management of natural resources with emphasis on inventory and manipulation of habitat and animal populations.

BIOL 381: Environmental Systems I: Introduction to Environmental Systems
(Dual-listed with EEOB 581). (Cross-listed with ENSCI, ENV S, MICRO). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

BIOL 382: Environmental Systems II: Analysis of Environmental Systems
(Dual-listed with EEOB 582). (Cross-listed with ENSCI). (2-2) Cr. 3. S.
Prereq: ENSCI 381
Continuation of EnSci 381. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

BIOL 393: North American Field Trips in Biology
Cr. 1-4. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Extended field trips, usually during break periods, to North American locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule.

BIOL 393A: North American Field Trips in Biology: Pre-trip Seminar
(1-0) Cr. 1. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Discussion of relevant biological and cultural topics during semester preceding extended field trips to North American locations of interest to biologists.

BIOL 393B: North American Field Trips in Biology: North American Field trip
Cr. 1-3. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Extended field trip under supervision of faculty member, usually during break periods, to North American locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule. Report required.

BIOL 394: International Field Trips in Biology
Cr. 1-4. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Extended field trips, usually during break periods, to international locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule.
Meets International Perspectives Requirement.

BIOL 394A: International Field Trips in Biology: Pre-trip Seminar
(1-0) Cr. 1. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Discussion of relevant biological and cultural topics during semester preceding extended field trip to international locations of interest to biologists.
Meets International Perspectives Requirement.

BIOL 394B: International Field Trips in Biology: Field Trip to International Location
Cr. 1-3. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Extended field trips, under supervision of faculty member, usually during break periods, to international locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule.
Meets International Perspectives Requirement.

BIOL 402: Introduction to Pathology
(Cross-listed with V PTH). (3-0) Cr. 3. S.
Prereq: BIOL 211 and BIOL 212 with labs
Introductory exploration of pathology as a medical discipline. This includes study of disease mechanisms via an introduction to general pathology topics (cell degeneration, necrosis, disturbances of growth, disturbances of blood flow, inflammation, neoplasia) and organ system-specific response to injury.

BIOL 414: Life History and Reproductive Strategies
(Dual-listed with EEOB 514). (3-0) Cr. 3. F.
Prereq: BIOL 315 or equivalent recommended.
Evolution of ecological adaptations at the individual, population, and species level. Emphasis is on evolutionary mechanisms and adaptive strategies related to life histories and reproduction; age and size at maturity; lifespan and senescense; offspring size/number trade-offs; sex and mating systems; sex determination and sex ratios.

BIOL 423: Developmental Biology
(3-0) Cr. 3. S.
Prereq: BIOL 313
Principles of embryogenesis and animal development. Establishment of body axes, organ and limb development, and specification of cell fates. Emphasis on cell signaling and the control of gene expression within the context of a developing organism. Medically relevant subjects will be discussed, including stem cells, cancer biology, fertilization, and cloning.

BIOL 423L: Developmental Biology Laboratory
(0-3) Cr. 1. S.
Prereq: Credit or enrollment in BIOL 423 or permission of the instructor.
Experiments and explorations illustrating fundamental principles of multicellular development.

BIOL 428: Topics in Cell Biology
(3-0) Cr. 3. S.
Prereq: BIOL 314
Selected topics on biological structure and function at the cellular level. Emphasis on dynamic nature and regulation of cellular organization and the integration of cellular processes (systems biology). Original research articles will demonstrate interdisciplinary research strategies and how scientific investigation leads to knowledge and understanding of cell biology.

BIOL 430: Principles of Plant Physiology
(3-0) Cr. 3.
Prereq: BIOL 313 or GEN 320; BIOL 314 or BBMB 301; CHEM 231 or CHEM 332; PHYS 106, PHYS 115, or PHYS 111
An overview of classical and current concepts, principles, and approaches regarding the basic mechanisms of plant function underlying growth, development, and survival of plants. Topics covered include environmental and developmental signals, plant hormone action, signal transduction, mineral nutrition, water relations, metabolism, and photosynthesis.

BIOL 434: Endocrinology
(Dual-listed with EEOB 534). (3-0) Cr. 3. S.
Prereq: BIOL 211, BIOL 212
Chemical integration of vertebrate organisms. The structure, development, and evolution of the endocrine glands and the function and structure of their hormones.

BIOL 436: Neurobiology
(3-0) Cr. 3. F.
Prereq: BIOL 212
Basic principles of brain function and development. Signaling of nerve cells, synaptic transmission, structure/function of ion channels and receptors, memory and synaptic plasticity, movement and central control, sensation and sensory processing, construction of neural circuits, early brain development, complex brain functions in health and disease.

BIOL 439: Environmental Physiology
(Dual-listed with EEOB 539). Cr. 3-4. Alt. S., offered even-numbered years.
Prereq: BIOL 335; physics recommended
Physiological adaptations to the environment with an emphasis on vertebrates.

BIOL 444: Bioinformatic Analysis
(Cross-listed with BCB, BCBIO, COM S, CPR E, GEN). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

BIOL 451: Plant Evolution and Phylogeny
(Dual-listed with EEOB 551). (3-3) Cr. 4. F.
Prereq: BIOL 315 or equivalent.
Survey of land plant evolution; phylogenetic comparison of anatomical, reproductive, and life history specializations. Relationships among bryophytes, lycophytes, pteridophytes, gymnosperms, and angiosperms emphasizing significant evolutionary changes documented by paleobotanical, morphological, and molecular studies.

BIOL 454: Plant Anatomy
(3-3) Cr. 4. F.
Prereq: BIOL 212L; BIOL 366 recommended
Characteristics of cell and tissue types in vascular plants. Anatomy of developing and mature stems, roots, and leaves, including secondary (woody) growth. Introduction to the special anatomy of flowers and seeds.

BIOL 455: Bryophyte and Lichen Biodiversity
(Dual-listed with EEOB 555). Cr. 3.
Prereq: BIOL 211, BIOL 211L
Introduction to the biology and ecology of mosses, liverworts, and lichens. Emphasis on identification and diversity of local representatives of these three groups of organisms. Required field trips and service-learning.

BIOL 456: Principles of Mycology
(Cross-listed with MICRO). (2-3) Cr. 3. F.
Prereq: 10 credits in biological sciences
Morphology, diversity and ecology of fungi; their relation to agriculture and industry and human health.

BIOL 457: Herpetology
(Cross-listed with A ECL). (2-0) Cr. 2. F.
Prereq: BIOL 351 or BIOL 365
Biology, ecology, and evolution of amphibians (salamanders, frogs, caecilians) and reptiles (lizards, snakes, tuatara, turtles, crocodilians). Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of amphibians and reptiles in ecosystems, and conservation. Laboratory focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

BIOL 457L: Herpetology Laboratory
(Cross-listed with A ECL). (0-3) Cr. 1. F.
Prereq: BIOL 351 or BIOL/A ECL 365; concurrent registration in BIOL 457 or A ECL 457
Laboratory to accompany Biology/Animal Ecology 457. Focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

BIOL 458: Ornithology
(Cross-listed with A ECL). (2-0) Cr. 2. S.
Prereq: A ECL 365 or BIOL 351
Biology, evolution, ecology and taxonomy of birds. Emphasis on structure, physiology, behavior, communication, navigation, reproduction, and conservation.

BIOL 458L: Ornithology Laboratory
(Cross-listed with A ECL). (0-3) Cr. 1. S.
Prereq: BIOL 351 or AECL/BIOL 365. Concurrent enrollment in AECL/BIOL 458 is required.
Laboratory complements lecture topics with emphasis on external anatomy, identification and distribution of Midwest birds, and field trips.

BIOL 459: Mammalogy
(Dual-listed with EEOB 559). (Cross-listed with A ECL). (2-0) Cr. 2. S.
Prereq: BIOL 351 or A ECL 365
Biology, ecology, and evolution of mammals. Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of mammals in ecosystems, and conservation.

BIOL 459L: Mammalogy Laboratory
(Cross-listed with A ECL). (0-3) Cr. 1. S.
Prereq: BIOL 351 or BIOL/AECL 365; concurrent enrollment in AECL 459 or BIOL 459 required.
Laboratory focus on identification, survey methods, distribution, habits, and habitats of mammals. Several field trips.

BIOL 462: Evolutionary Genetics
(Cross-listed with GEN). (3-0) Cr. 3. F.
Prereq: BIOL 315
The genetic basis of evolutionary processes in higher organisms. The role of genetic variation in adaptation, natural selection, adaptive processes, and the influence of random processes on evolutionary change.

BIOL 464: Wetland Ecology
(Dual-listed with EEOB 564). (Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: 15 credits in biological sciences.
Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands.

BIOL 471: Introductory Conservation Biology
Cr. 3.
Prereq: BIOL 312
Examination of conservation issues from a population and community perspective. The role of genetics, demography, and environment in determining population viability, habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology.

BIOL 472: Community Ecology
(3-0) Cr. 3. S.
Prereq: BIOL 312
The effect of interspecific interactions on the structure and dynamics of natural and managed communities; including concepts of guild structure and trophic web dynamics and their importance to the productivity, diversity, stability, and sustainability of communities. The implications of interspecifc interactions in the management of wild species will be emphasized with illustrative case histories of interactions between plants, invertebrates, and vertebrates.

BIOL 474: Plant Ecology
(3-0) Cr. 3. S.
Prereq: BIOL 312
Principles of plant population and community ecology.

BIOL 476: Functional Ecology
(Dual-listed with EEOB 576). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312
The nature of adaptations to physical and biotic environments. Biophysical, biomechanical, and physiological bases of the structure, form, growth, distribution, and abundance of organisms.

BIOL 480: Studies in Marine Biology
Cr. 1-8. Repeatable.
Courses taken at Gulf Coast Research Laboratory and other marine biological stations are transferred to Iowa State University under this number.

BIOL 481: Summer Field Studies
Cr. 1-8. Repeatable.
Courses taken at summer biological field stations are transferred to Iowa State University under this number. See www.biology.iastate.edu for links to field stations located in different biomes: coastal, Great Lakes, taiga, deciduous forests, deserts, Rocky Mountains.

BIOL 482: Tropical Biology
Cr. 1-4. Repeatable, maximum of 8 credits.
Prereq: One year of college biology; knowledge of Spanish desirable but not required
Students registering for courses taught by the Organization for Tropical Studies will receive credit for this ISU course when requesting a transfer of credits.

BIOL 484: Ecosystem Ecology
(Cross-listed with ENSCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Combined 12 credits in biology, chemistry, and physics.
Introduction of the study of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations for ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues.

BIOL 486: Aquatic Ecology
(Dual-listed with EEOB 586). (Cross-listed with A ECL, ENSCI). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

BIOL 486L: Aquatic Ecology Laboratory
(Dual-listed with EEOB 586L). (Cross-listed with A ECL, ENSCI). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

BIOL 487: Microbial Ecology
(Dual-listed with EEOB 587). (Cross-listed with ENSCI, MICRO). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

BIOL 488: Identification of Aquatic Organisms
(0-3) Cr. 1. F.S.
On-line taxonomic and identification exercises to accompany 486. Instruction and practice in the identification of algae, aquatic macrophytes, zooplankton, and benthos.

BIOL 489: Population Ecology
(Dual-listed with EEOB 589). (Cross-listed with A ECL). (2-2) Cr. 3. F.
Prereq: BIOL 312, STAT 101 or STAT 104, a course in calculus, or graduate standing
Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation.

BIOL 490: Independent Study
Cr. 1. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Permission of instructor.
Independent study opportunities for undergraduate students in the biological sciences. No more than 9 credits in Biol 490 may be counted toward graduation and, of those, only 2 credits may be applied toward the Biology advanced course requirement.

BIOL 491: Undergraduate Teaching Experience
Cr. 1-2. Repeatable.
Prereq: Permission of supervising staff
For students registering to be undergraduate teaching assistants. Offered on a satisfactory-fail basis only. A maximum of 2 credits of BIOL 491 may be applied toward the Biology advanced course requirement.

BIOL 492: Preparing for Graduate School in the Biological Sciences
(1-0) Cr. 1. F.
Prereq: For life science majors; Minimum requirement: sophomore standing.
For students considering pursuing a graduate degree in the biological sciences. Professional development topics including the defining of academic and career areas of interest, finding and evaluating appropriate programs of graduate study, the graduate school application process, and developing a curriculum vita. Exploration of learning opportunities at field stations, research internships, and independent research activities.

BIOL 494: Biology Internship
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 8 credits in biology and permission of instructor
Professional experiences in biological sciences. Intended for Biology majors. No more than 9 credits in BIOL 494 may be counted toward graduation and, of those, only 6 credits may be applied toward the Biology advanced course requirement.

BIOL 495: Undergraduate Seminar
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Content varies from year to year and may include detailed discussion of special topics in biology, current issues in biology, or careers in biology.

BIOL 498: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the Biology Program cooperative education coordinator
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

BIOL 499: Undergraduate Research Experience
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Permission of instructor.
Research opportunities for undergraduate students in the biological sciences. Intended for Biology majors. No more than 9 credits in Biol 499 may be counted toward graduation and, of those, only 6 credits may be applied toward the Biology advanced course requirement.

Biomedical Engineering (B M E)

Courses primarily for undergraduates:

B M E 220: Introduction to Biomedical Engineering
(Cross-listed with CH E). (3-0) Cr. 3. S.
Prereq: BIOL 212, ENGR 160 or equiv, MATH 166, CHEM 167 or CHEM 178, PHYS 222
Engineering analysis of basic biology and engineering problems associated with living systems and health care delivery. The course will illustrate biomedical engineering applications in such areas as: biotechnology, biomechanics, biomaterials and tissue engineering, and biosignal and image processing, and will introduce the basic life sciences and engineering concepts associated with these topics.

B M E 341: BioMEMs and Nanotechnology
(3-0) Cr. 3.
Prereq: B M E 220
Overview of Micro-Electro-Mechanical-System (MEMS) technologies for bioengineering, fundamentals of microfluidic device design, fabrication, and characterization, survey of microfluidic functional building blocks for lab-on-a-chip applications including mixers, valves, channels, and chambers. Topics of nanotechnology in bioengineering, nanoscale building block technologies for bioengineering including self-assembling, surface chemical treatment, nano-imprinting, nano-particles, nano-tubes, nano-wires, and stimuli-responsive biomaterials.

B M E 341L: BioMEMS and Nanotechnology Laboratory
(0-3) Cr. 1.
Prereq: B M E 220, concurrent enrollment in B M E 341
Introductory laboratory course accompanying B M E 341. Design, fabrication, and characterization of BioMEMS lab-on-a-chip devices and nanoscale techniques for bioengineering. Student group projects.

B M E 352: Molecular, Cellular and Tissue Biomechanics
(3-0) Cr. 3.
Prereq: B M E 220, E M 324, MAT E 273
Introduction to the anatomy of the musculoskeletal system and connective tissue. Range of movement, joint dislocation, bone deformity and fracture. Application of continuum mechanics to both living and non-living systems. Laws of motion, free-body diagrams and simple force analysis of musculoskeletal system. Biomechanical response of soft and hard tissues with emphasis on microstructure and mechanical properties. Applications to bioengineering design.

B M E 428: Image Processing with Biomedical Applications
(3-0) Cr. 3.
Prereq: E E 324
Review of signal processing, linear algebra, probability. Image sampling and quantization. Image transforms, image enhancement, image denoising/restoration. Tomographic reconstruction, segmentation and registration, recognition and shape analysis and applications in Computer Aided disease Detection (CAD).

B M E 440: Biomedical Applications of Chemical Engineering
(Cross-listed with CH E). (3-0) Cr. 3.
Prereq: CH E 210, MATH 266, PHYS 222
Applications of material and energy balances, transport phenomena, chemical reaction engineering, and thermodynamics to problems in biomedical engineering and applied physiology; survey of biomedical engineering; biomaterials; biomedical imaging.

B M E 450: Biosensing
(Cross-listed with E E). (3-0) Cr. 3.
Prereq: B M E 220
Overview of biosensors and bioanalytical challenges; designing for performance including various analytical problems, ion-selective membranes, characteristics of enzymes and basics of bioaffinity sensing; fundamentals of bioselective layers including depositing films and membranes, surfaces for immobilization and bioselective agents; survey of different biosensing technologies including electroanalytical, biomembrane, optical, and acoustic-wave based sensors.

B M E 450L: Biosensing Laboratory
(Cross-listed with E E). (0-3) Cr. 1.
Prereq: B M E 220, concurrent enrollment in B M E 450
Laboratory course accompanying B M E 450. Design, fabrication, and characterization of various electrical, chemical, polymer, optical and acoustic sensors.

B M E 456: Biomaterials
(Cross-listed with MAT E). (3-0) Cr. 3. F.
Prereq: MAT E 216 or MAT E 273 or MAT E 392
Presentation of the basic chemical and physical properties of biomaterials, including metals, ceramics, and polymers, as they are related to their manipulation by the engineer for incorporation into living systems. Role of microstructure properties in the choice of biomaterials and design of artificial organs, implants, and prostheses.

B M E 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, AER E, CPR E, E E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

B M E 490: Independent Study
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: permission of chair for the bioengineering minor
Investigation of biomedical engineering topics of special interest to student and supervising faculty member with a final written report.

Biomedical Sciences (B M S)

Courses primarily for professional curriculum students:

B M S 329: Anatomy and Physiology of Domestic Animals
(3-0) Cr. 3. S.
Prereq: BIOL 212, BIOL 212L
Survey of body systems of domestic animals. Provides a medical science orientation particularly useful to students in a preveterinary medicine curriculum.

B M S 330: Principles of Morphology I
(Dual-listed with B M S 530). (4-6) Cr. 6. F.
Prereq: 10 credits in biological science and permission of the instructor
Anatomy of the dog and cat: from basics to clinical application.

B M S 331: Principles of Morphology II
(Dual-listed with B M S 531). (2-6) Cr. 4. S.
Prereq: First-year classification in veterinary medicine. B M S 330
Comparative and topographic anatomy of horse, ruminants, pig, and chicken.

B M S 333: Biomedical Sciences I
(Dual-listed with B M S 533). (5-3) Cr. 6. F.
Prereq: First-year classification in veterinary medicine
Microscopic anatomy and physiology of cells, tissues, cardiovascular system, respiratory system, and urinary system.

B M S 334: Biomedical Sciences II
(Dual-listed with B M S 534). (5-3) Cr. 6. S.
Prereq: First-year classification in veterinary medicine
Microscopic anatomy of the immune system and integument. Microscopic anatomy and physiology of the digestive system, endocrine system, and reproductive system.

B M S 335: Molecular and Cellular Basis of Disease
(1-0) Cr. 1. F.
Descriptions of molecular and cellular biology especially as it pertains to veterinary medicine. Discussions of cellular components, cellular functions and anomalies thereof. Emphasis placed on divergences relevant to companion animals and livestock.

B M S 336: Veterinary Nutrition
(2-0) Cr. 2. F.
Introduce basic biochemical aspects of metabolism and function of energy, protein, fat, minerals and vitamins in the diet. Determine nutrient requirements of food animals, pets, and horses under various physiological states. Understand fate of various nutrients in simple stomached animals, ruminants, and cecal fermenters. Discuss clinical nutrition problems specific to each species.

B M S 337: Neuroanatomy
(Dual-listed with B M S 537). (2-2) Cr. 3. S.
Prereq: First-year classification in veterinary medicine
Neuroanatomy of domestic animals.

B M S 339: Clinical Foundations I
(Cross-listed with V C S). (0-2) Cr. 1. F.
Prereq: First-year classification in veterinary medicine
Canine physical examination; basic behavior, animal handling and restraint; medical record keeping.

B M S 345: Case Study I
(0-2) Cr. 1. F.
Prereq: First-year classification in veterinary medicine
Clinical applications of basic sciences taught concurrently in the fall semester of the first year curriculum in veterinary medicine.

B M S 346: Case Study II
(0-1) Cr. 1. S.
Prereq: First-year classification in veterinary medicine
Clinical applications of basic sciences taught concurrently in the spring semester of the first year curriculum in veterinary medicine.

B M S 354: General Pharmacology
(Dual-listed with B M S 554). (Cross-listed with TOX). (3-0) Cr. 3. S.
Prereq: B M S 549 and B M S 552; BBMB 404, BBMB 405
General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems.

B M S 401: Intro to Aquatic Animal Medicine
(Cross-listed with A ECL). (1-2) Cr. 1. S.
8 week course. Introductory course with focus on fin fish production, health and medicine. Course content will help define future roles for veterinarians, producers, and service providers. Emphasis will be placed on anatomy, pathology, infectious diseases, nutrition, regulatory constraints in production, food safety, and current research. Field trip to aquaculture facility.

B M S 403: Behavior of Domestic Animals
(1-0) Cr. 1. Alt. S., offered even-numbered years.
Prereq: Classification in veterinary medicine
Normal and abnormal behavior of domestic animals.

B M S 443: Pharmacology and Therapeutics
(Dual-listed with B M S 543). (3-0) Cr. 3. F.
Prereq: B M S 354
Pharmacology and therapeutic uses of fluids, antimicrobial and antiparasitic drugs, clinical use of veterinary drugs, and adverse drug reactions.

B M S 447: Principles of Anatomy
(Dual-listed with B M S 547). (2.5-6) Cr. 4. F.
Prereq: Instructor permission required for undergraduate students.
Examination of gross anatomy and neuroanatomy of human and dog. Laboratories will include cadaveric and virtual dissection, clinical case studies, and problem based learning.

B M S 490: Independent Study
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 490H: Independent Study, Honors
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 496: International Preceptorship
(0-40) Cr. 1-12. Repeatable. S.
Prereq: Second-year classification in veterinary medicine
International Preceptorships and Study Abroad Group programs. This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities.

Courses primarily for graduate students, open to qualified undergraduates:

B M S 501: Selected Research Methods in Biomedical Sciences
(0-8) Cr. 3. F.S.SS.
Prereq: Graduate classification, permission of a BMS faculty member
Experience in biomedical techniques in selected BMS laboratories that include but is not limited to cytochemical methods, molecular biological techniques, extracellular and intracellular unit recording, microiontophoresis, microinjection, spectrophoto-fluorometric analysis of chemicals, use of radioisotopes, radioimmunoassay, Ca2+ imaging, confocal microscopy, fluorescence microscopy, and immunocytochemistry.

B M S 502: Methods in Biomedical Sciences
(0-6) Cr. 3. S.
Provides laboratory experience in the application of methods in biomedical sciences, including animal physiology and pharmacology laboratory techniques; human physiology recordings and urinalysis; pharmacokinetics; basic techniques in analytical laboratory; basic pathology, immunology, bacteriology, and virology laboratory techniques.

B M S 530: Principles of Morphology I
(Dual-listed with B M S 330). (4-6) Cr. 6. F.
Prereq: 10 credits in biological science and permission of the instructor
Anatomy of the dog and cat: from basics to clinical application.

B M S 531: Principles of Morphology II
(Dual-listed with B M S 331). (2-6) Cr. 4. S.
Prereq: First-year classification in veterinary medicine. B M S 330
Comparative and topographic anatomy of horse, ruminants, pig, and chicken.

B M S 533: Biomedical Sciences I
(Dual-listed with B M S 333). (5-3) Cr. 6. F.
Prereq: First-year classification in veterinary medicine or graduate student status
Microscopic anatomy and physiology of cells, tissues, cardiovascular system, respiratory system, and urinary system.

B M S 534: Biomedical Sciences II
(Dual-listed with B M S 334). (5-3) Cr. 6. S.
Prereq: First-year classification in veterinary medicine or graduate student status
Microscopic anatomy of the immune system and integument.
Microscopic anatomy and physiology of the digestive system, endocrine system, and reproductive system.

B M S 537: Neuroanatomy
(Dual-listed with B M S 337). (2-2) Cr. 3. S.
Prereq: 10 credits in biological science and permission of the instructor
Neuroanatomy of domestic animals.

B M S 538: Principles of Physiology
(4-0) Cr. 4. F.
Principles of neurophysiology, endocrine and reproductive physiology, muscle physiology, cardiovascular, respiratory, renal, and digestive physiology, and regulation of body fluid.

B M S 539: Principles of Pharmacology
(4-0) Cr. 4. S.
General principles of drug actions; drug disposition; drug acting or, cardiovascular, respiratory, renal, gastrointestinal, and endocrine systems; anti-inflammatory and antibiotic drug; anti-cancer drugs; anesthetics CNS stimulants; lifestyle drugs; drug addiction, abuse and dependence; drugs in sport; drugs for obesity; biopharmaceuticals and gene therapy; drug development.

B M S 542: Introduction to Molecular Biology Techniques
(Cross-listed with EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

B M S 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

B M S 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

B M S 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

B M S 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

B M S 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

B M S 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

B M S 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

B M S 543: Pharmacology and Therapeutics
(Dual-listed with B M S 443). (3-0) Cr. 3. F.
Prereq: B M S 354
Pharmacology and therapeutic uses of fluids, antimicrobial and antiparasitic drugs, clinical use of veterinary drugs, and adverse drug reactions.

B M S 547: Principles of Anatomy
(Dual-listed with B M S 447). (2.5-6) Cr. 4. F.
Prereq: Instructor permission required for undergraduate students.
Examination of gross anatomy and neuroanatomy of human and dog. Laboratories will include cadaveric and virtual dissection, clinical case studies, and problem based learning.

B M S 554: General Pharmacology
(Dual-listed with B M S 354). (Cross-listed with TOX). (3-0) Cr. 3. S.
Prereq: B M S 549 and B M S 552; BBMB 404, BBMB 405
General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems.

B M S 556: Cellular, Molecular and Developmental Neuroscience
(Cross-listed with GDCB, NEURO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 335 or BIOL 436; physics recommended
Fundamental principles of neuroscience including cellular and molecular neuroscience, nervous system development, sensory, motor and regulatory systems.

B M S 575: Cell Biology
(Cross-listed with TOX). (3-0) Cr. 3. F.
Prereq: 10 credits in biological science and permission of instructor
A multi-instructor course covering major topics in cell structure and function, including: universal features of prokaryotic and eukaryotic cells, types of utilization and conversion of energy, genetic control of cell shape and functionality, internal organization of cells, communication between cells and their environment, development of multicellular systems. Students have to write a term paper.

B M S 590: Special Topics
Cr. 1-7. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 590A: Anatomy
Cr. 1-7. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 590B: Physiology
Cr. 1-7. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 590C: Pharmacology
Cr. 1-7. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 590D: Cell biology
Cr. 1-7. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 599: Creative Component
Cr. 1-3. F.S.SS.
Prereq: Enrollment in BMS graduate program, and permission of instructor.
Creative component for non-thesis Master of Science degree.

Courses for graduate students:

B M S 688: Research Review
Cr. 1. Repeatable. F.S.
Prereq: Enrollment in BMS graduate program.
A forum for B M S students to gain experience in the critical exchange of ideas through oral presentation and discussion of scientific information.

B M S 690: Advanced Topics
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 690A: Anatomy
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 690B: Physiology
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 690C: Pharmacology
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 690D: Cell biology
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 698: Seminar
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in BMS graduate program.

B M S 698A: Seminar: Attendance
Cr. R. Repeatable. F.S.
Prereq: Enrollment in BMS graduate program.

B M S 698B: Seminar: Attendance and Presentation
(1-0) Cr. 1. Repeatable. F.S.SS.
Prereq: Enrollment in B M S graduate program.
Attendance and presentation required. Offered on a satisfactory-fail basis only.

B M S 698C: Seminar: Attendance and Report
Cr. 1. Repeatable. F.S.
Prereq: Enrollment in BMS graduate program.
Attendance to all B M S seminars and written reports are required.

B M S 699: Research
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in BMS graduate program.

B M S 699A: Research: Anatomy
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in BMS graduate program.

B M S 699B: Research: Physiology
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in BMS graduate program.

B M S 699C: Research: Pharmacology
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in BMS graduate program.

B M S 699D: Research: Cell biology
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in BMS graduate program.

Biorenewable Chemicals (BR C)

Courses primarily for graduate students, open to qualified undergraduates:

BR C 506: The Evolving Chemical Industry
(1-0) Cr. 1.
An overview of the chemical industry including structure and its evolution. Discussion of the dynamics of recent introduction of biorenewable chemicals to the chemical industry.

BR C 507: Technology-Led Entrepreneurship in Biorenewables
(Cross-listed with BRT). (1-0) Cr. 1. S.
Prereq: Graduate Standing or Permission of Instructor.
Develop an understanding of the relationship between discovery research entrepreneurship and innovation in biorenewables. Understand critical techno-commercial analyses and intellectual property. Learn critical skills needed to found a company, including how to define key assets, write a business plan, leverage local resources, and secure funding.

BR C 590: Special Topics
(2-0) Cr. 2.
Special topics in biorenewable chemicals.

BR C 590K: Special Topics: K-12 Science Education.
(2-0) Cr. 2. F.SS.
Understanding of Discovery Research for sixth through 12th grade science teachers. Design, methods and analysis of research associated with biorenewable energy systems. Science teachers will be introduced to the value of scientific inquiry, elements of engineering design, 21st century careers in science, technology, engineering and math (STEM) and how high school students need to be prepared for these careers.

Courses for graduate students:

BR C 688: Catalysis and Catalytic Processes
(Cross-listed with CH E). (3-0) Cr. 3.
Prereq: CH E 382
Principles and applications of heterogeneous and homogeneous catalysis. Adsorption. Reaction kinetics and mass transfer effects. Catalyst characterization. Industrial catalytic processes.

Biorenewable Resources and Technology (BRT)

Courses primarily for graduate students, open to qualified undergraduates:

BRT 501: Fundamentals of Biorenewable Resources
(3-0) Cr. 3. S.
Prereq: Previous coursework in introductory physics and chemistry is recommended.
Introduction to the science and engineering of converting biorenewable resources into bioenergy and biobased products. Survey of biorenewable resource base and properties; description of biofuels and biobased products; production of biorenewable resources; processing technologies for fuels, chemicals, materials, and energy; environmental impacts; technoeconomic analysis of production and processing; and biofuels policy.

BRT 506C: Biobased Products Seminar: Research Presentations
(1-0) Cr. 1. F.S.
Research presentations throughout the semester as part of the course seminar series and during the course. Research Poster Symposium at the end of the semester. Typically taken in the last semester(s) when completing degree program. Offered on a satisfactory-fail basis only.

BRT 507: Technology-Led Entrepreneurship in Biorenewables
(Cross-listed with BR C). (1-0) Cr. 1. S.
Prereq: Graduate Standing or Permission of Instructor.
Develop an understanding of the relationship between discovery research entrepreneurship and innovation in biorenewables. Understand critical techno-commercial analyses and intellectual property. Learn critical skills needed to found a company, including how to define key assets, write a business plan, leverage local resources, and secure funding.

BRT 511: Bioprocessing and Bioproducts
(3-0) Cr. 3. F.
Prereq: A E 216 or equivalent, MATH 160 or MATH 165, one of CHEM 167 or higher, BIOL 173 or BIOL 211 or higher or BRT 501, senior or graduate classification
Sustainability, cleaner production. Taxonomy, kinetics, metabolism, aerobic and anaerobic fermentation. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis. Term paper for graduate level only.

BRT 515: Biorenewables Law and Policy
(Cross-listed with POL S). (3-0) Cr. 3. F.
Evaluation of the biorenewables field as it relates to the areas of law and policy. Primary emphasis on the following topics: concerns that motivated the development and expansion of the biorenewables field, a history of the interactions between biorenewable pathways. U.S. law and policy and controversies that have arisen from these interactions and their effects.

BRT 516: International Biorenewables Law & Policy
(Cross-listed with POL S). (3-0) Cr. 3. S.
Evaluation of the international biorenewables field as it relates to the areas of law and policy. Primary emphasis on the following topics: concerns that motivated the development and expansion of the field by adopting countries, a history of the interactions between biorenewable pathways. Law and policy in adopting countries and international controversies that have arisen from these interactions and their effects.

BRT 535: Thermochemical Processing of Biomass
(Cross-listed with M E). (3-0) Cr. 3. S.
Prereq: Undergraduate course work in thermodynamics and transport phenomena
Introduction to thermal and catalytic processes for the conversion of biomass to biofuels and other biobased products. Topics include gasification, fast pyrolysis, hydrothermal processing, syngas to synfuels, and bio-oil upgrading. Application of thermodynamics, heat transfer, and fluid dynamics to bioenergy and biofuels.

BRT 540: Bioprocessing and Bioproducts
(Cross-listed with C E, FS HN). (3-0) Cr. 3. F.
Prereq: C E 326 or equivalent, MATH 160 or MATH 165, CHEM 167 or higher, BIOL 173 or BIOL 211 or higher, senior or graduate classification
Sustainability, cleaner production. Taxonomy, kinetics, metabolism, microbial cultivation, aerobic and anaerobic fermentation. Antibiotics, food supplements, fermented foods, vitamin production. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis.

BRT 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Investigation/study of an approved barrier area(s) topic on an individual basis. Course content and requirements designed and developed in consultation with the student's major professor/instructor to determine barrier areas covered, but in all cases a formal report should be written.

BRT 592L: Biorenewable Resources Laboratory
(0-3) Cr. 1. F.S.SS.
Prereq: Graduate student status. Undergraduates with instructor approval
An introduction to hands-on experimental laboratory techniques including laboratory safety, calibration, proper usage of chemistry apparatus, chemicals, analytical equipment, and fundamental techniques to ensure successful research.

Courses for graduate students:

BRT 611: Advanced Food Processing
(Cross-listed with FS HN). (3-0) Cr. 3. F.
Prereq: FS HN 311, or FS HN 471/472 or equivalent, or FS HN 511.
Recent advances in the science and technology of food processing and preservation; examples include both thermal and non-thermal processes, including cold plasma, nanotechnology, food packaging, and extrusion. Advances in extraction and separation technologies, waste management, by-product utilization, biorenewables and sustainability in food processing industry will also be discussed. Students to research on select topics and present.

BRT 699: Research
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of student's major professor

Business Administration (BUSAD)

Courses primarily for undergraduates:

BUSAD 102: Business Learning Team Orientation
(1-0) Cr. 1. F.S.
A required orientation for all College of Business Students involved with a Business Learning Team. Review of college and university requirements, transfer credits, academic planning, university policies and deadlines and registration procedures. Includes a consideration of various business majors and careers, tools for success in college including writing skills and presentations from employers, alumni and current students. Only one of BusAd 101, 102, or 103X may be counted towards graduation.

BUSAD 103: Orientation
(1-0) Cr. 1. F.S.
A required orientation for all College of Business students. Review of college and university requirements, transfer credits, academic planning, university policies and deadlines, and registration procedures. Includes group advising for course selection and registration. Only one of BUSAD 101, 102, or 103 may be counted toward graduation.

BUSAD 203: Business Careers and Employment Preparation
(1-0) Cr. 1.
Prereq: BUSAD 101 or 102
Careers in business and issues relevant to the workplace. Discussion of diversity and ethics issues in the workplace. Developing and implementing a professional job search, functioning professionally in the workplace setting, resume and profession correspondence, interviewing, evaluating offers, business etiquette, networking and transitioning from student to employee.

BUSAD 250: Introduction to Business
(3-0) Cr. 3.
Prereq: COM S 113X
Introduction to the functional areas of business and how the functional areas are integrated for the purpose of implementing business strategy. Introduces students to decision making tools (spreadsheets and databases) that are integral to business decision making. Includes application exercises to all functional areas of business.

BUSAD 291: Experiential Learning
Cr. 1-3. Repeatable.
Prereq: Written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 291A: Experiential Learning: Domestic Internship.
Cr. 1-3. Repeatable.
Prereq: Written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 291B: Experiential Learning: International Internship.
Cr. 1-3. Repeatable.
Prereq: Written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 291C: Experiential Learning: Domestic Travel and Study.
Cr. 1-3. Repeatable.
Prereq: Written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised travel and study experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 291D: Experiential Learning: International Travel and Study.
Cr. 1-3. Repeatable.
Prereq: Written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised travel and study experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 292: Entrepreneurship & Innovation Learning Community (EILC) Seminar
(1-0) Cr. 1.
Prereq: Current member of or have applied to be a member of Entrepreneurship and Innovation Learning Community (see www.isupjcenter.org/ELC for more information)
Topics related to entrepreneurship and entrepreneurial thinking. Presentations by entrepreneurs and faculty, field trips, business concept development.

BUSAD 398: Cooperative Education
Cr. R. Repeatable, maximum of 3 times.
Prereq: Permission of department
Required of all cooperative education students engaged in full-time internship/co-op. Students must register for this course prior to commencing each work period. No more than three credits may be taken in addition to BusAd 398 during any given semester. Offered on a satisfactory-fail basis only.

BUSAD 490: Independent Study
Cr. 1-3. Repeatable.
Prereq: Professional program in Business; permission of instructor; for 490H: Admission to the Business Honors Program

BUSAD 490A: Independent Study: International Business
Cr. 1-3. Repeatable.
Prereq: Professional program in Business; permission of instructor

BUSAD 490E: Independent Study: Entrepreneurship
Cr. 1-3. Repeatable.
Prereq: senior classification, permission of instructor

BUSAD 490G: Independent Study: General
Cr. 1-3. Repeatable.
Prereq: Professional program in Business; permission of instructor
Independent Study.

BUSAD 490H: Independent Study: Honors
Cr. 1-3. Repeatable.
Prereq: Admission to the Business Honors Program

BUSAD 491: Professional Experiential Learning
Cr. 1-3. Repeatable.
Prereq: Professional program, 12 credits from College of Business; written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 491A: Professional Experiential Learning: Domestic Internship
Cr. 1-3. Repeatable.
Prereq: Professional program, 12 credits from College of Business; written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 491B: Professional Experiential Learning: International Internship
Cr. 1-3. Repeatable.
Prereq: Professional program, 12 credits from College of Business; written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 491C: Professional Experiential Learning: Domestic Travel and Study
Cr. 1-3. Repeatable.
Prereq: Professional program, 12 credits from College of Business; written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised travel and study in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 491D: Professional Experiential Learning: International Travel and Study
Cr. 1-3. Repeatable.
Prereq: Professional program, 12 credits from College of Business; written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised travel and study in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 491E: Professional Experiential Learning: Other Experiential Learning Experience
Cr. 1-3. Repeatable.
Prereq: Professional program, 12 credits from College of Business; written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline.

Courses primarily for graduate students, open to qualified undergraduates:

BUSAD 501: Strategic Management
(Cross-listed with STB). (2-0) Cr. 2.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Critical analysis of current practice and case studies in strategic management with an emphasis on integrative decision making. Strategy formulation and implementation will be investigated in the context of complex business environments.

BUSAD 502: Quantitative Business Analysis and Decision Making
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission
Introduction to the sources and statistical analysis of data as well as optimization models for use in making business decisions. Data collection, descriptive and inferential statistics including hypothesis testing, analysis of variance, multiple regression, linear programming and simulation.

BUSAD 503: Information Systems
(Cross-listed with STB). (2-0) Cr. 2.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Introduction to a broad variety of information systems (IS) topics, including current and emerging developments in information technology (IT), IT strategy in the context of corporate strategy, and IS planning and development of enterprise architectures. Cases, reading, and discussions highlight the techniques and tactics used by managers to cope with strategic issues within an increasingly technical and data-driven competitive environment.

BUSAD 504: Marketing and Logistics
(Cross-listed with STB). (3-0) Cr. 3.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Integration of the business functions concerned with the marketing and movement of goods along the supply chain with the primary goal of creating value for the ultimate customer. Coordination of marketing, production, and logistics activities within the firm and with outside suppliers and customers in the supply chain.

BUSAD 507: Organizational Behavior
(Cross-listed with STB). (2-0) Cr. 2.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Understanding human behavior in organizations, and the nature of organizations from a managerial perspective. Special emphasis on how individual differences, such as perceptions, personality, and motivation, influence individual and group behavior in organizations and on how behavior can be influenced by job design, leadership, groups, and the structure of organizations.

BUSAD 508: Accounting and Finance
(Cross-listed with STB). (3-0) Cr. 3.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Survey of fundamental topics in accounting and finance. Financial statement reporting and analysis for agriculture firms, corporate governance issues related to financial reporting, (e.g., Sarbanes-Oxley). Basic tools and techniques used in financial management, including stock and bond valuation. How to assess and use capital budgeting methods to evaluate proposed firm investments.

BUSAD 509: Seed Trade, Policy and Regulation
(Cross-listed with STB). (3-0) Cr. 3.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Cultural, financial, economic, political, legal/regulatory environments shaping an organization's international business strategy. Topics include entry (and repatriation) of people, firms, goods, services, and capital. Special attention to the institutions of seed regulation and policy. Ethical issues facing managers operating in an international context.

BUSAD 590: Special Topics in Business
(3-0) Cr. 3. Repeatable.
Prereq: Enrollment in MBA program or departmental permission.
A special topics course covering contemporary issues in business. Topics vary by semester.

BUSAD 591: Professional Experiential Learning
Cr. 1-3. Repeatable.
Prereq: Graduate standing; written approval of supervising instructor and department chair on required form prior to the learning experience
Academically supervised travel and/or work experiences in a business related discipline.

BUSAD 592: MBA Professional Skills Development
Cr. R.
Prereq: Admission to Full-time MBA Program
Provides first-year MBA students with tools necessary to develop and implement a successful internship and career search, and to develop professional skills critical for success in the competitive business environment. Topics include career search strategy, resume and cover letter development, interviewing, strategic networking, salary negotiation, impression management, team skills development, presentation skills development, and business etiquette. Required for all full-time MBA students. Offered on a satisfactory-fail basis only.

BUSAD 594: MBA Professional Skills Development II
Cr. R.
Prereq: BUSAD 592
A second course designed to improve the professional skills of first-year MBA students. Emphasis on building effective communications and networking skills. Students will participate in professional workshops, company visits, executive speaker seminars, service learning projects, business case competitions, and related activities. Offered on a satisfactory-fail basis only.

BUSAD 598: Cooperative Education
Cr. R.
Prereq: Permission of instructor
Professional work experience. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

BUSAD 599: Creative Component
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599A: Creative Component: Accounting
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599C: Creative Component: Finance
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599E: Creative Component: Management
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599F: Creative Component: Marketing
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599I: Creative Component: Agribusiness
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599J: Creative Component: General Business
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599K: Creative Component: Management Information Systems
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599M: Creative Component: Supply Chain Management
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

Courses for graduate students:

BUSAD 644: Business Research Methods
(3-0) Cr. 3. F.
Prereq: In PhD program in the College of Business or consent of instructor
A survey of the wide variety of research methods used in business. Methods will be presented and discussed with emphasis on applicability in different research situations.

BUSAD 699: Research
Cr. 3-6. Repeatable. F.S.SS.
Prereq: Graduate classification, permission of major professor
Research.

Chemical Engineering (CH E)

Courses primarily for undergraduates:

CH E 104: Chemical Engineering Learning Community
Cr. R. F.
Prereq: Enrollment in Chemical Engineering Learning Team
(1-0) Curriculum in career planning and academic course support for Freshmen learning team.

CH E 160: Chemical Engineering Problems with Computer Applications Laboratory
(2-2) Cr. 3. F.S.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Formulation and solution of engineering problems. Significant figures. Use of SI units. Graphing and curve-fitting. Flowcharting. Introduction to material balances, engineering economics, and design. Use of spreadsheet programs to solve and present engineering problems. Solution of engineering problems using computer programming languages. Chemical Engineering examples.

CH E 202: Chemical Engineering Seminar
(1-0) Cr. 1. F.
Prereq: Sophomore classification in chemical engineering; credit or enrollment in CH E 210.
Professionalism in the context of the engineering/technical workplace. Introduction to chemical engineering career opportunities. Process and workplace safety. Development and demonstration of key workplace competencies: teamwork, professionalism and ethical responsibility, ability to engage in life-long learning, and knowledge of contemporary issues. Resumes; professional portfolios; preparation for internship experiences.

CH E 204: Chemical Engineering Continuing Learning Community
Cr. R.
Prereq: Corequisite-enrollment in Chemical Engineering Learning Team
Curriculum and career planning, academic course support for learning community.

CH E 205: Chemical Engineering Progress Assessment
Cr. R. F.S.
Prereq: CHEM 178, MATH 166; credit or enrollment in CH E 160, CH E 210
Assessment of proficiency in general chemistry, calculus (including infinite series and applications of derivatives and integrals), and material balances, and an ability to use the principles of science and mathematics to identify, formulate, and solve engineering problems. Offered on a satisfactory-fail basis only.

CH E 210: Material and Energy Balances
(3-0) Cr. 3. F.S.
Prereq: Chem 178, Math 166, CH E 160
Introduction to chemical processes. Physical behavior of gases, liquids, and solids. Application of material and energy balances to chemical engineering equipment and processes.

CH E 220: Introduction to Biomedical Engineering
(Cross-listed with B M E). (3-0) Cr. 3. S.
Prereq: BIOL 212, ENGR 160 or equiv, MATH 166, CHEM 167 or CHEM 178, PHYS 222
Engineering analysis of basic biology and engineering problems associated with living systems and health care delivery. The course will illustrate biomedical engineering applications in such areas as: biotechnology, biomechanics, biomaterials and tissue engineering, and biosignal and image processing, and will introduce the basic life sciences and engineering concepts associated with these topics.

CH E 310: Computational Methods in Chemical Engineering
(3-0) Cr. 3. F.S.
Prereq: CH E 160, CH E 205, CH E 210, MATH 265
Numerical methods for solving systems of linear and nonlinear equations, ordinary differential equations, numerical differentiation and integration, and nonlinear regression using chemical engineering examples.

CH E 325: Chemical Engineering Laboratory I
(0-4) Cr. 2. F.S.
Prereq: CH E 357, CH E 381; credit or enrollment in CH E 382; credit or enrollment in ENGL 314 or ENGL 309 or ENGL 312 or JL MC 347
Experiments covering fundamental material and energy balances, momentum and energy transport operations, and thermodynamics. Computer applications.

CH E 356: Transport Phenomena I
(3-0) Cr. 3. F.S.
Prereq: CH E 205, CH E 210, PHYS 221, credit or enrollment in MATH 267
Momentum and mechanical energy balances. Incompressible and compressible fluid flow. Applications to fluid drag, piping system design, filtration, packed beds and settling.

CH E 357: Transport Phenomena II
(3-0) Cr. 3. F.S.
Prereq: Credit or enrollment in CH E 310; CH E 356
Conduction and diffusion, convective heat and mass transfer, boiling and condensation, radiation, and design of heat exchange equipment. Introduction to diffusion.

CH E 358: Separations
(3-0) Cr. 3. F.S.
Prereq: CH E 310, CH E 357
Diffusion and mass transfer in fluids. Analysis and design of continuous contacting and multistage separation processes. Binary and multicomponent distillation, absorption, extraction, evaporation, membrane processes, and simultaneous heat and mass transfer.

CH E 381: Chemical Engineering Thermodynamics
(3-0) Cr. 3. F.S.
Prereq: Credit or enrollment in CH E 310; MATH 267, PHYS 222, CHEM 325
Application of thermodynamic principles to chemical engineering problems. Thermodynamic properties of fluids, phase equilibria, and chemical reaction equilibria.

CH E 382: Chemical Reaction Engineering
(3-0) Cr. 3. F.S.
Prereq: CH E 310; CH E 381, credit or enrollment in CH E 357
Kinetics of chemical reactions. Design of homogeneous and heterogeneous chemical reactors.

CH E 391: Foreign Study Orientation
(3-0) Cr. 3. S.
Prereq: CH E 357 and CH E 381
Offered on a satisfactory-fail basis only. Credit for graduation allowable only upon completion of Ch E 392.
Meets International Perspectives Requirement.

CH E 392: Foreign Study Program
Cr. 4. SS.
Prereq: CH E 391
Study of chemical engineering including laboratories and lectures at collaborating international universities. Comparative study of U.S. and international manufacturing facilities. Expenses required.
Meets International Perspectives Requirement.

CH E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

CH E 398: Cooperative Education
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

CH E 406: Environmental Chemodynamics
(Dual-listed with CH E 506). (3-0) Cr. 3.
Prereq: CH E 381, credit or enrollment in CH E 358
Examines the mechanisms and rates of chemical transport across air, water, and soil interfaces. Applications of transport and thermodynamic fundamentals to movement of chemicals in the environment.

CH E 408: Surface and Colloid Chemistry
(Dual-listed with CH E 508). (3-0) Cr. 3.
Prereq: CH E 381 or equivalent
Examines the factors underlying interfacial phenomena, with an emphasis on the thermodynamics of surfaces, structural aspects, and electrical phenomena. Application areas include emulsification, foaming, detergency, sedimentation, fluidization, nucleation, wetting, adhesion, flotation, and electrophoresis.

CH E 415: Biochemical Engineering
(Dual-listed with CH E 515). (3-0) Cr. 3.
Prereq: CH E 357, CH E 382 recommended, CHEM 331
Application of basic chemical engineering principles in biochemical and biological process industries such as enzyme technology and fermentation.

CH E 420: Chemical Process Safety
(3-0) Cr. 3. F.S.
Prereq: CH E 357, CH E 381; junior classification
Application of transport phenomena, thermodynamics, and chemical kinetics to the study of safety, health, and loss prevention. Government regulations, industrial hygiene, relief sizing, runaway reactions, toxic release, and dispersion models will be used. Fires, explosions, risk assessment, hazard identification, case studies, accident investigations, and design considerations will be studied.

CH E 421: Process Control
(3-0) Cr. 3. F.S.
Prereq: CH E 358, CH E 382, Math 267
Control of industrial chemical processes. Device applications and limitations. Dynamics of chemical process components and process control systems.

CH E 426: Chemical Engineering Laboratory II
(0-4) Cr. 2. F.S.
Prereq: CH E 325, CH E 358, CH E 382
Experiments in heat and mass transfer, staged operations, chemical reactor performance, unit processes. Computer applications. Only one of Ch E 426 or 427 may count toward graduation.

CH E 427: Biological Engineering Laboratory
(0-4) Cr. 2. S.
Prereq: CH E 325, CH E 358, CH E 382; BBMB 301 or BBMB 404
Experiments on biological applications in chemical engineering. Only one of CH E 426 or CH E 427 may count toward graduation.

CH E 430: Process and Plant Design
(2-4) Cr. 4. F.S.
Prereq: CH E 358, CH E 382
Synthesis of chemical engineering processes, equipment and plants. Cost estimation and feasibility analysis.

CH E 440: Biomedical Applications of Chemical Engineering
(Dual-listed with CH E 540). (Cross-listed with B M E). (3-0) Cr. 3.
Prereq: CH E 210, MATH 266, PHYS 222
Applications of material and energy balances, transport phenomena, chemical reaction engineering, and thermodynamics to problems in biomedical engineering and applied physiology; survey of biomedical engineering; biomaterials; biomedical imaging.

CH E 447: Polymers and Polymer Engineering
(Dual-listed with CH E 547). (3-0) Cr. 3.
Prereq: CH E 382 and CHEM 331 or MAT E 351
Chemistry of polymers, addition and condensation polymerization. Physical and mechanical properties, polymer rheology, production methods. Applications of polymers in the chemical industry.

CH E 490: Undergraduate Research/Independent Study
(0-18) Cr. 1-6. Repeatable, maximum of 6 credits.
Prereq: Permission of Department
Investigation of topics of special interest to student and faculty with a final written report or presentation. Election of course and topic must be approved in advance by Department with completion of Study Proposal. No more than 6 credits of ChE 490 may be counted towards technical electives.

CH E 490H: Undergraduate Research/Independent Study, Honors
(0-18) Cr. 1-6. Repeatable, maximum of 6 credits.
Prereq: Permission of Department
Investigation of topics of special interest to student and faculty with a final written report or presentation. Election of course and topic must be approved in advance by Department with completion of Study Proposal. No more than 6 credits of ChE 490 may be counted towards technical electives.

Courses primarily for graduate students, open to qualified undergraduates:

CH E 506: Environmental Chemodynamics
(Dual-listed with CH E 406). (3-0) Cr. 3.
Prereq: CH E 381, credit or enrollment in CH E 358
Examines the mechanisms and rates of chemical transport across air, water, and soil interfaces. Applications of transport and thermodynamic fundamentals to movement of chemicals in the environment.

CH E 508: Surface and Colloid Chemistry
(Dual-listed with CH E 408). (3-0) Cr. 3.
Prereq: CH E 381 or equivalent
Examines the factors underlying interfacial phenomena, with an emphasis on the thermodynamics of surfaces, structural aspects, and electrical phenomena. Application areas include emulsification, foaming, detergency, sedimentation, fluidization, nucleation, wetting, adhesion, flotation, and electrophoresis.

CH E 515: Biochemical Engineering
(Dual-listed with CH E 415). (3-0) Cr. 3.
Prereq: CH E 357, CH E 382 recommended, CHEM 331
Application of basic chemical engineering principles in biochemical and biological process industries such as enzyme technology and fermentation.

CH E 540: Biomedical Applications of Chemical Engineering
(Dual-listed with CH E 440). (3-0) Cr. 3.
Prereq: CH E 210, MATH 266, PHYS 222
Applications of material and energy balances, transport phenomena, chemical reaction engineering, and thermodynamics to problems in biomedical engineering and applied physiology; survey of biomedical engineering; biomaterials; biomedical imaging.

CH E 542: Polymeric Biomaterials
(3-0) Cr. 3.
Prereq: CHEM 331 or a polymers class
Polymeric biomaterials, overview of biomaterial requirements, different classes of polymers used as biomaterials, specific bioapplications of polymers.

CH E 545: Analytical and Numerical Methods
(3-0) Cr. 3. F.
Prereq: CH E 358, MATH 267
Analysis of equipment and processes by analytic and/or numerical solution of descriptive differential equations. Operational and series techniques, boundary value problems, numerical interpolation and approximation, integration techniques.

CH E 547: Polymers and Polymer Engineering
(Dual-listed with CH E 447). (3-0) Cr. 3.
Prereq: CH E 382 and CHEM 331 or MAT E 351
Chemistry of polymers, addition and condensation polymerization. Physical and mechanical properties, polymer rheology, production methods. Applications of polymers in the chemical industry.

CH E 554: Integrated Transport Phenomena
(4-0) Cr. 4. F.
Prereq: CH E 357, CH E 381, Math 267, credit or enrollment in CH E 545
Conservation equations governing diffusive and convective transport of momentum, thermal energy and chemical species. Transport during laminar flow in conduits, boundary layer flow, creeping flow. Heat and mass transport coupled with chemical reactions and phase change. Scaling and approximation methods for mathematical solution of transport models. Diffusive fluxes; conservation equations for heat and mass transfer; scaling and approximation techniques; fundamentals of fluid mechanics; unidirectional flow; creeping flow; laminar flow at high Reynolds number; forced-convection heat and mass transfer in confined and unconfined laminar flows.

CH E 562: Bioseparations
(3-0) Cr. 3.
Prereq: CH E 357 or advanced standing in a science major
Principles and techniques for separation and recovery of biologically-produced molecules, especially proteins. Relationship between the chemistry of biological molecules and efficient separation and preservation of biological activity. Includes centrifugation and filtration, membrane processing, extraction, precipitation and crystallization, chromatography, and electrophoresis.

CH E 572: Turbulence
(Cross-listed with AER E). (3-0) Cr. 3.
Prereq: AER E 541 or M E 538
Qualitative features of turbulence. Statistical representation of turbulent velocity fields: averages, moments, correlations, length and time scales and the energy cascade. Averaged equations of motion, closure requirements, Reynolds averaged models. Homogeneous shear flows, free shear flows, boundary layers. Numerical simulation of turbulence: DNS, LES, DES.

CH E 583: Advanced Thermodynamics
(3-0) Cr. 3. F.
Prereq: CH E 381
Application of thermodynamic principles to chemical engineering problems. Thermodynamic properties of non-ideal fluids and solutions; phase and chemical-reaction equilibria/stability.

CH E 587: Advanced Chemical Reactor Design
(3-0) Cr. 3. S.
Prereq: CH E 382
Analysis of complex reactions and kinetics. Fixed bed, fluidized bed, and other industrial reactors. Analysis and design of non-ideal flow mixing, and residence times. Heterogeneous reactors.

CH E 590: Independent Study
Cr. 2-6. Repeatable.
Investigation of an approved topic on an individual basis.

CH E 595: Special Topics
Cr. 2-3. Repeatable.

CH E 595A: Special Topics: Separations
Cr. 2-3. Repeatable.

CH E 595B: Special Topics: Advanced Control Theory
Cr. 2-3. Repeatable.

CH E 595C: Special Topics: Crystallization
Cr. 2-3. Repeatable.

CH E 595D: Special Topics: Thermodynamics
Cr. 2-3. Repeatable.

CH E 595E: Special Topics: Protein Engineering/Bioseparations
Cr. 2-3. Repeatable.

CH E 595F: Special Topics: Biological Engineering
Cr. 2-3. Repeatable.

CH E 595G: Special Topics: Materials and Biomaterials
Cr. 2-3. Repeatable.

CH E 595H: Special Topics: Surfaces
Cr. 2-3. Repeatable.

CH E 595I: Special Topics: Combinatorial Design
Cr. 2-3. Repeatable.

CH E 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

CH E 601: Seminar
Cr. R. Repeatable. F.S.
Offered on a satisfactory-fail basis only.

CH E 625: Metabolic Engineering
(3-0) Cr. 3.
Prereq: CH E 382, CHEM 331
Principles of metabolic engineering. Emphasis on emerging examples in biorenewables and plant metabolic engineering. Overview of biochemical pathways, determination of flux distributions by stoichiometric and labeling techniques; kinetics and thermodynamics of metabolic networks; metabolic control analysis; genetic engineering for overexpression, deregulation, or inhibition of enzymes; directed evolution; application of bioinformatics, genomics, and proteomics.

CH E 632: Multiphase Flow
(Cross-listed with M E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M E 538
Single particle, mutliparticle and two-phase fluid flow phenomena (gas-solid, liquid-solid and gas-liquid mixtures); particle interactions, transport phenomena, wall effects; bubbles, equations of multiphase flow. Dense phase (fluidized and packed beds) and ducted flows; momentum, heat and mass transfer. Computer solutions.

CH E 642: Principles and Applications of Molecular Simulation
(3-0) Cr. 3.
Prereq: CH E 545
Principles of statistical physics. General features of molecular simulations including Monte Carlo (MC) methods, molecular mechanics (MM), and molecular dynamics (MD). Overview of intermolecular and interatomic potentials. Evaluation of phase equilibria, free energies, and surface/interfacial properties. Coarse-grained methods.

CH E 652: Advanced Transport
(3-0) Cr. 3.
Prereq: CH E 552 and CH E 553
Advanced topics in momentum transport, fluid mechanics, and mass transport including study of recent literature.

CH E 688: Catalysis and Catalytic Processes
(Cross-listed with BR C). (3-0) Cr. 3.
Prereq: CH E 382
Principles and applications of heterogeneous and homogeneous catalysis. Adsorption. Reaction kinetics and mass transfer effects. Catalyst characterization. Industrial catalytic processes.

CH E 692: Independent Study
Cr. 2-6. Repeatable.
Investigation of an approved topic on an individual basis. Election of course and topic must be approved in advance by Program of Study Committee.

CH E 695: Advanced Topics
Cr. arr. Repeatable.

CH E 695A: Advanced Topics: Separations
Cr. arr. Repeatable.

CH E 695B: Advanced Topics: Advanced Statistical Modeling and Control
Cr. arr. Repeatable.

CH E 695C: Advanced Topics: Crystallization
Cr. arr. Repeatable.

CH E 695D: Advanced Topics: Thermodynamics
Cr. arr. Repeatable.

CH E 695E: Advanced Topics: Protein Engineering/Bioseparations
Cr. arr. Repeatable.

CH E 695F: Advanced Topics: Biological Engineering
Cr. arr. Repeatable.

CH E 695G: Advanced Topics: Materials and Biomaterials
Cr. arr. Repeatable.

CH E 695H: Advanced Topics: Surfaces
Cr. arr. Repeatable.

CH E 695I: Advanced Topics: Combinatorial Design
Cr. arr. Repeatable.

CH E 695J: Advanced Topics: Polymeric and Nanostructured Materials
Cr. arr. Repeatable.

CH E 695K: Advanced Topics: Biomaterials and Tissue Engineering
Cr. arr. Repeatable.

CH E 695L: Advanced Topics: Catalysis, Reaction Engineering, and Renewable Energy
Cr. arr. Repeatable.

CH E 697: Engineering Internship
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of major professor, graduate classification
One semester and one summer maximum per academic year professional work period.

CH E 698: Chemical Engineering Teaching Practicum
(1-0) Cr. 1. F.
Prereq: Graduate student classification and permission of instructor
Discussions intended to foster the development of graduate students as teaching assistants and future chemical engineering instructors. Topics include classroom and laboratory instruction, grading, and developing a teaching philosophy. Offered on a satisfactory-fail basis only.

CH E 698A: Chemical Engineering Teaching Practicum: Teaching Practicum
(1-0) Cr. 1. F.
Prereq: Graduate student classification and permission of instructor
Discussions intended to foster the development of graduate students as teaching assistants and future chemical engineering instructors. Topics include classroom and laboratory instruction, grading, and developing a teaching philosophy. Offered on a satisfactory-fail basis only.

CH E 698B: Chemical Engineering Teaching Practicum: Teaching Experience
(1-0) Cr. 1. Repeatable. F.S.SS.
Prereq: CH E 698A
Participation in the instruction of a CH E course under the mentorship of a CBE faculty member. Typical activities may include lecture preparation and delivery, laboratory instruction, design of assessments, problem-solving sessions, office hours, and grading. Offered on a satisfactory-fail basis only.

CH E 699: Research
Cr. arr. Repeatable.
Advanced topic for thesis/dissertation.

Chemistry (CHEM)

Courses primarily for undergraduates:

CHEM 050: Preparation for College Chemistry
(3-0) Cr. 0. F.S.
Prereq: 1 year high school algebra
An in-depth active learning experience designed to impart the fundamental concepts and principles of chemistry, with an emphasis on mathematics skills and logical thinking. For students intending to enroll in general chemistry and who have not taken high school chemistry or who have not had a high school college preparatory chemistry course who need a review of chemical problem solving and chemical concepts. Credit for Chem 50 does not count toward graduation.

CHEM 101: Chemistry Learning Community Orientation
(1-0) Cr. 1. F.S.
Prereq: Member of the Chemistry Learning Community.
Integration of first year and transfer students into the chemistry program. Introduction and overview of degree requirements and support services on campus, assistance with transition to college and community life, and team-building and leadership activities. Offered on a satisfactory-fail basis only.

CHEM 101A: Chemistry Learning Community Orientation: On-Campus Orientation
(1-0) Cr. 1. F.
Prereq: Member of the Chemistry Learning Community.
Integration of first year and transfer students into the chemistry program. Introduction and overview of degree requirements and support services on campus, assistance with transition to college and community life, and team-building and leadership activities. Offered on a satisfactory-fail basis only.

CHEM 101B: Chemistry Learning Community Orientation: Professional Development Opportunities
(1-0) Cr. 1. S.
Prereq: Member of the Chemistry Learning Community.
Integration of first year and transfer students into the chemistry program. Introduction and overview of degree requirements and support services on campus, assistance with transition to college and community life, and team-building and leadership activities. Offered on a satisfactory-fail basis only.

CHEM 102L: Physical Sciences for Elementary Education
(Cross-listed with PHYS). (1-4) Cr. 3. F.S.
Prereq: MATH 195 or MATH 140
Physical science principles for future elementary teachers. Emphasis on experiments that address current elementary science education standards and that are appropriate for their future students to do, such as measurements of mass, length, time, light from atoms, charge and current, motion due to forces, energy and work, heat, waves, optics, building bridges and making musical instruments, studying states of matter and chemical reactions.

CHEM 110: Cutting-Edge Chemistry: Research and Career Opportunities
(1-0) Cr. 1. F.
Overview of careers in chemistry: industrial, governmental, and academic careers; literature and compound search instruction; professional ethics; and an introduction to joining a research lab. For students majoring or minoring in chemistry or chemistry-related fields. Offered on a satisfactory-fail basis only.

CHEM 160: Chemistry in Modern Society
(3-0) Cr. 3. F.S.
Aspects of chemistry visible to a non-scientist in our society. A survey of selected areas of chemistry with emphasis on the interface between chemistry and other fields of human activity.

CHEM 163: College Chemistry
(4-0) Cr. 4. F.S.SS.
Prereq: 1 year of high school algebra and geometry and Chem 50 or 1 year of high school chemistry; and credit or enrollment in CHEM 163L
A general survey of chemistry with an emphasis on conceptual problems for those who are not physical and biological science or engineering majors. Nomenclature, chemical reactions, stoichiometry, atomic structure, periodic properties, chemical bonding, states of matter, solutions, thermochemistry, acid-base theory, oxidation-reduction reactions, basic chemical kinetics, and chemical equilibrium. Only one of Chem 163, 167, 177, or 201 may count toward graduation.

CHEM 163L: Laboratory in College Chemistry
(0-3) Cr. 1. F.S.SS.
Prereq: Credit or enrollment for credit in CHEM 163
Laboratory to accompany CHEM 163. Must be taken with CHEM 163. Only one of Chem 163L, CHEM 167L, and CHEM 177L may count toward graduation.

CHEM 167: General Chemistry for Engineering Students
(4-0) Cr. 4. F.S.
Prereq: 1 year of high school chemistry or CHEM 50 and Math 143 pre-calculus or high school equivalent.
Principles of chemistry and properties of matter explained in terms of modern chemical theory with emphasis on topics of general interest to the engineer. Only one of Chem 163, 167, 177, or 201 may count toward graduation.

CHEM 167L: Laboratory in General Chemistry for Engineering
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment for credit in CHEM 167
Laboratory to accompany 167. Only one of Chem 163L, 167L, and 177L may count toward graduation.

CHEM 177: General Chemistry I

(4-0) Cr. 4. F.S.SS.

Prereq: MATH 140 or high school equivalent, and CHEM 50 or 1 year high school chemistry, and credit or enrollment in CHEM 177L. Chemistry and biochemistry majors may consider taking CHEM 201

The first semester of a two semester sequence which explores chemistry at a greater depth and with more emphasis on concepts, problems, and calculations than 163. Recommended for physical and biological science majors, chemical engineering majors, and all others intending to take 300-level chemistry courses. Principles and quantitative relationships, stoichiometry, chemical equilibrium, acid-base chemistry, thermochemistry, rates and mechanism of reactions, changes of state, solution behavior, atomic structure, periodic relationships, chemical bonding. Only one of Chem 163, 167, 177, or 201 may count toward graduation.

CHEM 177L: Laboratory in General Chemistry I

(0-3) Cr. 1. F.S.SS.

Prereq: Credit or enrollment for credit in CHEM 177

Laboratory to accompany 177. 177L must be taken with 177. Only one of Chem 163L, 167L, and 177L may count toward graduation.

CHEM 177N: Laboratory in General Chemistry I

(0-3) Cr. 1. F.

Prereq: Credit or enrollment for credit in CHEM 177. For chemistry and biochemistry majors

Laboratory to accompany CHEM 177. CHEM 177N must be taken with CHEM 177. Only one of Chem 163L, CHEM 167L, and CHEM 177N may count toward graduation.

CHEM 178: General Chemistry II

(3-0) Cr. 3. F.S.SS.

Prereq: CHEM 177, CHEM 177L

Continuation of 177. Recommended for physical or biological science majors, chemical engineering majors, and all others intending to take 300-level chemistry courses.

CHEM 178L: Laboratory in College Chemistry II

(0-3) Cr. 1. F.S.SS.

Prereq: CHEM 177L and credit or enrollment for credit in CHEM 178

Laboratory to accompany 178. 178L is not a necessary co-requisite with 178.

CHEM 201: Advanced General Chemistry

(5-0) Cr. 5. F.

Prereq: Co-enrollment in MATH 165 or credit, one year of high school chemistry, and one year high school physics or advanced chemistry. Co-enrollment in CHEM 201L.

A one-semester course in general chemistry designed to give students an in-depth, broad-based view of modern chemistry, and, in part, to facilitate participation in independent undergraduate research. Topics include stoichiometry, atomic and molecular structure, chemical bonding, kinetics, chemical equilibria, and thermodynamics. Discussion of current trends in various chemical disciplines, which may be given by guest experts in chemistry, biochemistry, and chemical engineering, will help the student appreciate the scope of the chemical sciences and how research is carried out. Only one of Chem 163, 167, 177, or 201 may count toward graduation.

CHEM 201L: Laboratory in Advanced General Chemistry

(0-3) Cr. 1. F.

Prereq: Credit or enrollment for credit in CHEM 201

Laboratory to accompany 201. Introductory lab experience in synthesis and analysis to prepare students for research activities. 201L must be taken with 201. Only one of 163L, 167L, 177L, 177N or 201L may count toward graduation.

CHEM 211: Quantitative and Environmental Analysis

(2-0) Cr. 2. F.S.

Prereq: CHEM 163 and CHEM 163L, CHEM 201 and CHEM 201L; or credit or enrollment in CHEM 178; and concurrent enrollment in CHEM 211L

Theory and practice of elementary volumetric, chromatographic, electrochemical and spectrometric methods of analysis. Chemical equilibrium, sampling, and data evaluation. Emphasis on environmental analytical chemistry; the same methods are widely used in biological and materials sciences as well.

CHEM 211L: Quantitative and Environmental Analysis Laboratory

(0-6) Cr. 2. F.S.

Prereq: Credit or enrollment for credit in CHEM 211

Introductory laboratory experience in volumetric, spectrometric, electrochemical and chromatographic methods of chemical analysis.

CHEM 231: Elementary Organic Chemistry
(3-0) Cr. 3. F.S.SS.
Prereq: CHEM 163, CHEM 163L, or CHEM 177, CHEM 177L; credit or enrollment in CHEM 231L
A survey of modern organic chemistry including nomenclature, structure and bonding, and reactions of hydrocarbons and important classes of natural and synthetic organic compounds. For students desiring only an elementary course in organic chemistry. Students in physical or biological sciences and premedical or preveterinary curricula should take the full year sequence 331 and 332 (with the accompanying laboratories 331L and 332L). Only one of Chem 231 and 331 or BBMB 221 may count toward graduation.

CHEM 231L: Laboratory in Elementary Organic Chemistry
(0-3) Cr. 1. F.S.SS.
Prereq: Credit or enrollment for credit in CHEM 231; CHEM 163L or CHEM 177L
Laboratory to accompany 231. 231L must be taken with 231. Only one of Chem 231L and 331L may count toward graduation.

CHEM 298: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the Department cooperative education coordinator; sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

CHEM 299: Undergraduate Research (for Freshmen and Sophomores)
Cr. arr. Repeatable, maximum of 6 credits.
Prereq: Permission of staff member with whom student proposes to work

CHEM 301: Inorganic Chemistry
(2-0) Cr. 2. S.
Prereq: CHEM 324
Atomic and molecular structure and bonding principles; molecular shapes and symmetry; acids and bases; solid-state structures and properties; inorganic chemistry of H, B, C.

CHEM 316: Instrumental Methods of Chemical Analysis
(2-0) Cr. 2. F.
Prereq: CHEM 211, CHEM 211L, Math 166, and concurrent enrollment in CHEM 316L; PHYS 222 recommended
Quantitative and qualitative instrumental analysis. Operational theory of instruments, atomic and molecular absorption and emission spectroscopy, electroanalysis, mass spectrometry, liquid and gas chromatography, electrophoresis, literature of chemical analysis.

CHEM 316L: Instrumental Analysis Laboratory
(0-6) Cr. 2. F.
Prereq: Credit or enrollment in CHEM 316
Advanced laboratory experience in UV-visible spectrophotometry, atomic absorption and emission spectrometry, electrochemistry, gas and liquid chromatography, electrophoresis, mass spectrometry, and other instrumental methods.

CHEM 321L: Laboratory in Physical Chemistry
(1-3) Cr. 2. S.
Prereq: Credit or enrollment in CHEM 324 or CHEM 325.
Error analysis; use of computers for interfacing to experiments and for data analysis; thermodynamics, infrared and optical spectroscopy, lasers. Not applicable towards the B.S. degree in Chemistry. Only one of Chem 321L and 322L may count toward graduation.

CHEM 322L: Laboratory in Physical Chemistry
(1-6) Cr. 3. S.
Prereq: CHEM 324 or CHEM 325.
Error analysis; use of computers for interfacing to experiments and for data analysis; thermodynamics, surface science, infrared and optical spectroscopy, lasers. Only one of Chem 321L and 322L may count toward graduation.

CHEM 324: Introductory Quantum Mechanics
(3-0) Cr. 3. F.S.
Prereq: CHEM 178, MATH 166; PHYS 222 recommended.
Quantum mechanics, atomic and molecular structure, spectroscopy, kinetic theory of gases, chemical kinetics.

CHEM 325: Chemical Thermodynamics
(3-0) Cr. 3. F.S.
Prereq: CHEM 178, MATH 166; PHYS 222 recommended
Classical thermodynamics 1st, 2nd, and 3rd laws with applications to gases and interfacial systems, multicomponent, multiphase equilibrium of reacting systems, surface chemistry, and electrochemical cells. Students taking a two-semester physical chemistry sequence are advised to take 324 first; in the spring semester, a molecular-based section of this course, stressing statistical thermodynamics, is offered for which knowledge of 324 is useful.

CHEM 331: Organic Chemistry I
(3-0) Cr. 3. F.S.SS.
Prereq: CHEM 178 or CHEM 201, enrollment in CHEM 331L highly recommended
The first half of a two semester sequence. Modern organic chemistry including nomenclature, synthesis, structure and bonding, reaction mechanisms. For students majoring in physical and biological sciences, premedical and pre-veterinary curricula, chemistry and biochemistry. Students desiring only one semester of organic chemistry should take 231 and 231L, not 331. Only one of Chem 231 and 331 may count toward graduation.

CHEM 331L: Laboratory in Organic Chemistry I
(0-3) Cr. 1. F.S.SS.
Prereq: CHEM 177L; credit or enrollment for credit in CHEM 331
Laboratory to accompany 331. Chemistry and biochemistry majors are encouraged to take 333L. Only one of Chem 231L and 331L may count toward graduation.

CHEM 332: Organic Chemistry II
(3-0) Cr. 3. F.S.SS.
Prereq: CHEM 331; enrollment in CHEM 332L highly recommended
Continuation of 331. Modern organic chemistry including nomenclature, synthesis, structure and bonding, reaction mechanisms, natural products, carbohydrates and proteins. For students majoring in physical and biological sciences, premedical and pre-veterinary curricula, chemistry and biochemistry.

CHEM 332L: Laboratory in Organic Chemistry II
(0-3) Cr. 1. F.S.SS.
Prereq: CHEM 331L; credit or enrollment for credit in CHEM 332
Laboratory to accompany 332. Chemistry and biochemistry majors are encouraged to take 334L.

CHEM 333L: Laboratory in Organic Chemistry I (for Chemistry and Biochemistry Majors)
(0-6) Cr. 2. F.
Prereq: Credit or enrollment for credit in CHEM 331
Laboratory to accompany 331 for chemistry and biochemistry majors.

CHEM 334L: Laboratory in Organic Chemistry II (for Chemistry and Biochemistry Majors)
(0-6) Cr. 2. S.
Prereq: CHEM 333L, credit or enrollment for credit in CHEM 332
Laboratory to accompany 332 for chemistry and biochemistry majors.

CHEM 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the Department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

CHEM 399: Undergraduate Research
Cr. arr.
Prereq: Permission of instructor with whom student proposes to work and junior or senior classification
Undergraduate research. No more than six total credits of Chem 399 and Chem 499 may count toward graduation. Credits earned in 399/499/490 may only be use to meet one of the advanced course requirements for the B.S. degree.

CHEM 401L: Inorganic Chemistry Laboratory
(0-3) Cr. 1. S.
Prereq: CHEM 402
Preparation and characterization of inorganic and organometallic compounds by modern techniques. For students majoring in chemistry or biochemistry.

CHEM 402: Advanced Inorganic Chemistry
(3-0) Cr. 3. F.
Prereq: CHEM 301; CHEM 331 recommended
Chemistry of the d and f metals. Structure, bonding, electronic spectra, and reaction mechanisms. Aspects of organometallic solid state and bioinorganic chemistry.

CHEM 490: Independent Study
Cr. arr.
Prereq: Completion of 6 credits in chemistry at the 300 level or higher and permission of instructor
No more than 9 credits of Chem 490 may count toward graduation.

CHEM 498: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the Department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

CHEM 499: Senior Research
Cr. 2-3. Repeatable, maximum of 6 credits.
Prereq: Permission of instructor with whom student proposes to work; B average in all chemistry, physics, and mathematics courses
Research in chosen area of chemistry, with final written report as senior thesis. This course should be elected for two consecutive semesters. For students majoring in chemistry. No more than six total credits for Chem 399 and 499 may count toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

CHEM 501L: Inorganic Preparations
(0-3) Cr. 1. F.
Prereq: CHEM 402
Preparation and characterization of inorganic and organometallic compounds by modern research techniques.

CHEM 502: Advanced Inorganic Chemistry
(3-0) Cr. 3. F.
Prereq: CHEM 402; CHEM 331 recommended
Chemistry of the main group (s, p) and transition (d, f) metals. Structure, bonding, electronic spectra, and reaction mechanisms. Aspects of organometallic, solid state, bioinorganic, and nano chemistry.

CHEM 505: Physical Inorganic Chemistry
(3-0) Cr. 3. F.
Prereq: CHEM 402 or CHEM 502 and CHEM 324
Elementary group theory and molecular orbital theory applied to inorganic chemistry. Spectroscopic methods of characterization of inorganic compounds and organometallic compounds.

CHEM 511: Advanced Analytical Chemistry
(3-0) Cr. 3. F.
Prereq: CHEM 316 and CHEM 316L
General methods of quantitative inorganic and organic analysis. Aqueous and nonaqueous titrimetry; selective reagents; sampling and sample dissolution; modern instrumentation; sensors; atomic and molecular microscopy; bioanalytical methods; data evaluation; chemometrics; and analytical literature.

CHEM 512: Electrochemical Methods of Analysis
(3-0) Cr. 3. F.
Prereq: CHEM 316 and CHEM 316L; Recommended but not Required CHEM 324, and CHEM 322L
Principles of convective-diffusional mass transport in electroanalysis. Applications of potentiometry, voltammetry, and coulometry. Introduction to heterogeneous and homogeneous kinetics in electroanalysis. Analog and digital circuitry. Interfacing.

CHEM 513: Analytical Molecular and Atomic Spectroscopy
(3-0) Cr. 3. S.
Prereq: CHEM 316 and CHEM 316L, CHEM 324, CHEM 322L
Introduction to physical optics and design of photometric instruments. Principles of absorption, emission, fluorescence, and Raman spectroscopy. Error and precision of optical methods. Ultraviolet, visible, and infrared methods of qualitative and quantitative organic and inorganic analysis.

CHEM 516: Analytical Separations
(3-0) Cr. 3. F.
Prereq: CHEM 316 and CHEM 316L, CHEM 324, CHEM 322L
Principles and examples of inorganic and organic separation methods applied to analytical chemistry. Solvent extraction, volatilization, ion exchange, liquid and gas chromatography, and electrophoresis.

CHEM 531: Organic Synthesis I
(2-0) Cr. 2. S.
Prereq: CHEM 332
Survey of organic functional group transformations.

CHEM 532: Organic Synthesis II
(2-0) Cr. 2. F.
Prereq: CHEM 531
Synthesis of complex organic compounds including natural products.

CHEM 537: Physical Organic Chemistry I
(3-0) Cr. 3. F.
Prereq: CHEM 332
Survey of reactive intermediates including cations, anions, carbenes, and radicals.

CHEM 538: Physical Organic Chemistry II
(3-0) Cr. 3. S.
Prereq: CHEM 537
Molecular structure, stereochemistry, introduction to reaction mechanisms, thermodynamic and kinetic data, linear free energy relationships, isotope effects, orbital symmetry.

CHEM 550: Safety in the Chemical Laboratory
(1-0) Cr. 1. S.
Prereq: CHEM 332L
Introduction to laboratory safety and chemical hygiene. Use of engineering controls and personal protective equipment. Chemical storage and waste disposal practices. Handling hazardous chemicals. Radiation safety and laser safety. Offered on a satisfactory-fail basis only.

CHEM 555: Teaching College Chemistry
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: Graduate or senior classification.
Methods of instruction, strategies and techniques for effective teaching and learning along with practice teaching in undergraduate chemistry recitation and laboratory courses. Cooperative learning, guided-inquiry, learning cycles, conceptual change, models and modeling, concept maps, visualization, computer simulations, web-based delivery systems, and learning theories.

CHEM 561: Fundamentals of Quantum Mechanics
(4-0) Cr. 4. F.
Prereq: CHEM 324
Schroedinger equation and exact solutions; square wells and barriers; harmonic oscillator; the hydrogen atom; atomic orbitals; operators including angular momenta; time-independent and time-dependent perturbation theory; Schroedinger and Heisenberg representations; unitary operators; interaction picture, density matrix.

CHEM 562: Fundamentals of Atomic and Molecular Quantum Mechanics
(3-0) Cr. 3. S.
Prereq: CHEM 561, credit or enrollment in CHEM 583
Variational method, many electron atoms; addition of angular momentum, self-consistent field method for open and closed shells, linear combinations of atomic orbitals, origin of chemical bonding, many-electron diatomic and polyatomic molecules, treatments of electron correlation, approximation methods.

CHEM 563: Statistical Mechanics
(3-0) Cr. 3. S.
Prereq: CHEM 325
Microscopic and macroscopic properties, laws of thermodynamics, ensembles and distribution functions, applications to gases, solids, and chemical equilibrium.

CHEM 564: Molecular Spectroscopy and Structure
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: CHEM 505 or CHEM 562
Maxwell's field equations, interaction of light with matter including time-dependent perturbation theory, microwave, vibrational (infra-red, Raman) and electronic spectroscopies, symmetry derived selection rules, special lineshapes and introduction to nonlinear and coherent laser spectroscopies.

CHEM 571: Solid-State Chemistry
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: CHEM 301, CHEM 324
Structural principles, synthetic strategies, analytical methods, and chemical bonding issues applied to solids. Atomic packings and networks, short-range vs. long-range order, defects; phase diagrams, reactive fluxes, chemical transport; diffraction, spectroscopy; energy bands and their bonding interpretations.

CHEM 572: Spectrometric Identification of Organic Compounds
(2-3) Cr. 3. F.
Prereq: CHEM 332
Principles of infrared, ultraviolet, nuclear magnetic resonance, and mass spectroscopy as applied to organic chemistry.

CHEM 573: Nanochemistry
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: CHEM 301, CHEM 324
Synthesis, characterization, properties and applications of nanoscale materials (≈ 0.5-500 nm), relationship with molecular, meso and bulk compounds. Chemistry of solid surfaces, zero-, one- and two-dimensional (0D, 1D, 2D) nanostructures , semiconductor quantum dots, plasmonic nanoparticles, carbon nanomaterials, porous nanomaterials, potential health and safety impacts.

CHEM 574: Organometallic Chemistry of the Transition Metals
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: CHEM 301, CHEM 332
Transition metal complexes with ligands such as cyclopentadienyl, olefins, acetylenes, benzenes, and carbon monoxide. Coverage of structure, bonding, reactivity, fundamental mechanisms, and homogeneous catalysis.

CHEM 576: Surface Chemistry
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: CHEM 324
Gas-surface interactions and techniques of characterization. Idealized surface lattices, surface tension, Wulff plots, work function, adsorbate-adsorbate interactions, 2D phase diagrams, diffusion, thin film growth, adsorption and desorption mechanisms/energetics/kinetics, adsorption isotherms, vacuum techniques, electron- and ion-based spectroscopies for surface analysis (including AES, FIM, XPS, UPS, EXAFS, EELS, SIMS, LEED and STM).

CHEM 577: Mass Spectrometry
(3-0) Cr. 3. S.
Basic physics, instrumentation, chemical and biological applications of mass spectrometry.

CHEM 578: Chemical Kinetics and Mechanisms
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: CHEM 324
Rates and mechanisms; reversible, consecutive, and competing reactions; chain mechanisms; kinetic isotope effects; very rapid reactions; acid-base catalysis, theories of unimolecular reactions; transition state and Marcus theories.

CHEM 579: Introduction to Research in Chemistry
Cr. R. F.
Introduction to the various areas of research in chemistry at Iowa State University.

CHEM 580: Introduction to Computational Quantum Chemistry
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CHEM 324
Basic principles of quantum mechanics, schrodinger equation. Hartree-Fock/molecular orbital theory, introduction to group theory, introduction to modern methods of computational chemistry; applications include molecular structure, potential energy surfaces and their relation to chemical reactions; molecular spectroscopy, photochemistry, solvent effects and surface chemistry.

CHEM 583: Chemical Group Theory
(1-0) Cr. 1. F.
Prereq: CHEM 324
Basic concepts and theorems, representation theory; point groups, molecular orbitals, molecular states, molecular vibrations, rotation group and angular momenta; space groups and crystals; permutation group, antisymmetry, and spin states.

CHEM 599: Nonthesis Research
Cr. arr.
Prereq: Permission of instructor concerned

Courses for graduate students:

CHEM 600: Seminar in Inorganic Chemistry
(1-0) Cr. 1. Repeatable, maximum of 3 times. F.S.
Prereq: Permission of instructor

CHEM 601: Selected Topics in Inorganic Chemistry
(2-0) Cr. 1-2. F.S.
Prereq: Permission of instructor
Topics such as molecular structure and bonding; organometallic compounds; physical techniques of structure determination; nonaqueous solutions; Zintl phases; transition-metal oxides; free-radical reactions; electron transfer reactions; metal-metal bonding; and bioinorganic chemistry of nucleic acids.

CHEM 611: Seminar in Analytical Chemistry
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor

CHEM 619: Special Topics in Analytical Chemistry
(2-0) Cr. 1-2. Repeatable. F.S.
Prereq: Permission of instructor
Raman spectroscopy, sensors, spectroelectrochemistry, capillary electrophoresis, analytical plasmas, chemometrics and bioanalytical chemistry.

CHEM 631: Seminar in Organic Chemistry
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor

CHEM 632: Selected Topics in Organic Chemistry
(2-0) Cr. 1-2. Repeatable. F.S.
Prereq: CHEM 537
Topics of current interest in organic chemistry such as spectroscopy, physical organic chemistry, photochemistry, organometallic chemistry, mechanisms of oxidations and reductions, modern organic synthesis, reactive intermediates, bioorganic chemistry, and polymers.

CHEM 660: Seminar in Physical Chemistry
(1-0) Cr. 1. Repeatable. S.
Prereq: Permission of instructor

CHEM 667: Special Topics in Physical Chemistry
(2-0) Cr. 1-2. F.S.
Prereq: Permission of instructor
Advanced and recent developments in physical chemistry are selected for each offering.

CHEM 699: Research
Cr. arr. Repeatable.
Prereq: Permission of instructor

Chinese (CHIN)

Courses primarily for undergraduates:

CHIN 101: Elementary Mandarin Chinese I
(4-0) Cr. 4. F.
Introduction to spoken and written colloquial Mandarin through pinyin and simplified characters.

CHIN 102: Elementary Mandarin Chinese II
(4-0) Cr. 4. S.
Prereq: CHIN 101
Introduction to spoken and written colloquial Mandarin through pinyin and simplified characters.
Meets International Perspectives Requirement.

CHIN 201: Intermediate Mandarin Chinese I
(4-0) Cr. 4. F.
Prereq: CHIN 102
Development of speaking, writing, reading, and listening skills. Review and expansion of grammar skills, intensification of character acquisition. Meets International Perspectives Requirement.

CHIN 202: Intermediate Mandarin Chinese II
(4-0) Cr. 4. S.
Prereq: CHIN 201
Development of speaking, writing, reading, and listening skills. Review and expansion of grammar skills, intensification of character acquisition. Meets International Perspectives Requirement.

CHIN 272: Introduction to Chinese Culture
(3-0) Cr. 3. S.
Interdisciplinary introduction to Chinese society and culture from earliest times to the present. Topics include ancient literature, philosophy, religion, art, architecture, customs, transition to a modern society, social changes, urban life, popular culture, and contemporary values and ideas. Meets International Perspectives Requirement.

CHIN 301: Advanced Mandarin Chinese I
(3-0) Cr. 3. F.
Prereq: CHIN 202 or equivalent
Continuing development of speaking, writing, reading, and listening skills beyond intermediate level. Expansion of cultural literacy through a variety of texts from the humanities, social sciences, mass media and business. Meets International Perspectives Requirement.

CHIN 302: Advanced Mandarin Chinese II
(3-0) Cr. 3. S.
Prereq: CHIN 301 or equivalent
Continuing development of speaking, writing, reading, and listening skills beyond intermediate level. Expansion of cultural literacy through a variety of texts from the humanities, social sciences, mass media and business. Meets International Perspectives Requirement.

CHIN 304: Chinese for Global Professionals
(4-0) Cr. 4. S.
Prereq: CHIN 202 or equivalent
Introduction to professional language and culture in China and Chinese-speaking regions in Asia. Development of all four language skills, focusing on practical applications in the professional contexts. Development of global awareness and cross-cultural understanding. Preparation for internships.
Meets International Perspectives Requirement.

CHIN 370: Chinese Literature in English Translation
(3-0) Cr. 3. Repeatable. F.
Prereq: ENGL 150 or equivalent
Topics may include traditional prose, poetry, novel and drama; twentieth-century fiction and film. All readings and class discussions in English. Meets International Perspectives Requirement.

CHIN 375: China Today
(3-2) Cr. 3-4. Repeatable. S.
Prereq: ENGL 250 or equivalent
Focusing on contemporary society, culture, literature and the arts. All readings, discussions, and papers in English. Topics vary from year to year.
Meets International Perspectives Requirement.

CHIN 403: Seminar in Chinese Language and Culture
(3-0) Cr. 3.
Prereq: CHIN 302 or equivalent
Critical understanding of authentic texts at the advanced level through reading, translation, and/or application in professional contexts; consolidation of existing language skills, in-depth analysis of cultural issues, and development of professional language proficiency. Taught in Chinese.
Meets International Perspectives Requirement.

CHIN 403A: Seminar in Chinese Language and Culture: Translating Contemporary Chinese Texts
(3-0) Cr. 3.
Prereq: CHIN 302
Critical understanding of authentic texts at the advanced level through reading, translation, and/or application in professional contexts; consolidation of existing language skills, in-depth analysis of cultural issues, and development of professional language proficiency. Taught in Chinese.
Meets International Perspectives Requirement.

CHIN 403B: Seminar in Chinese Language and Culture: Topics on Business and Professions
(3-0) Cr. 3.
Prereq: CHIN 302 or equivalent
Critical understanding of authentic texts at the advanced level through reading, translation, and/or application in professional contexts; consolidation of existing language skills, in-depth analysis of cultural issues, and development of professional language proficiency. Taught in Chinese.
Meets International Perspectives Requirement.

CHIN 403C: Seminar in Chinese Language and Culture: Reading Chinese Texts
(3-0) Cr. 3.
Prereq: CHIN 302 or equivalent
Critical understanding of authentic texts at the advanced level through reading, translation, and/or application in professional contexts; consolidation of existing language skills, in-depth analysis of cultural issues, and development of professional language proficiency. Taught in Chinese.
Meets International Perspectives Requirement.

CHIN 490: Independent Study
Cr. 1-6. Repeatable.
Prereq: 6 credits in Chinese and permission of department chair
Designed to meet student needs in areas beyond current course offerings or to accommodate the desire to integrate a study of literature or language with special issues in major fields.

Civil Engineering (C E)

Courses primarily for undergraduates:

C E 105: Introduction to the Civil Engineering Profession
(1-0) Cr. 1. F.S.
Overview of the nature and scope of the civil engineering profession. Exploration of the various specialty areas within civil engineering. Bloom's Taxonomy and creativity. Departmental rules, student services operations, degree requirements, educational objectives, program of study planning, career options, and student organizations.

C E 111: Fundamentals of Surveying I
(2-3) Cr. 3. F.S.
Prereq: C E 160, credit or enrollment in ENGR 170 or C E 170, MATH 165
Introduction to error theory. Fundamentals of observing distances, elevations, and angles. Traversing. Irregular areas. Circular and parabolic curves. Earthwork including mass diagrams. Construction staking. Computer applications and introduction to photogrammetry, geographic information systems and global positioning systems technology.

C E 120: Civil Engineering Learning Community
Cr. R. Repeatable.
Integration of first-year students into the Civil Engineering program. Assignments and activities involving teamwork, academic preparation, study skills, and preparation for entry into the Civil Engineering profession. Completed both individually and in learning teams under the direction of faculty and peer mentors. Offered on a satisfactory-fail basis only.

C E 160: Engineering Problems with Computational Laboratory
(2-2) Cr. 3. F.S.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Formulation of engineering problems using spreadsheets and Visual Basic for Application for solution. Presenting results using word processing, tables, and graphs. Introduction to engineering economics and statics. Civil engineering examples.

C E 170: Graphics for Civil Engineering
(0-4) Cr. 2. F.S.
Fundamental graphics. Introduction to computer aided drafting and modeling. Civil engineering applications.

C E 206: Engineering Economic Analysis and Professional Issues in Civil Engineering
(3-0) Cr. 3. F.S.
Prereq: MATH 166, ENGL 250; C E 105; ECON 101 recommended
Engineering/managerial analysis of the economic aspects of project proposals. Alternative sources of funds; time value of money; expenditure of capital funds and methods of evaluating alternative projects. Professionalism, licensure, liability, ethics, leadership, social responsibility, creative and critical thinking, and applications/impacts of regulations in civil engineering.

C E 306: Project Management for Civil Engineers
(2-3) Cr. 3. F.S.
Prereq: C E 206
Project management, including work breakdown structures, cost estimating, scheduling, and project control. Civil engineering project life cycle, including planning, design, construction, and maintenance processes. Techniques in interpretation of contract documents, plan reading, and in estimating quantities.

C E 326: Principles of Environmental Engineering
(2-2) Cr. 3. F.S.
Prereq: CHEM 177 or CHEM 178, MATH 166, credit or enrollment in E M 378
Introduction to environmental problems, water quality indicators and requirements, potable water quality and quantity objectives, water sources and treatment methods; water pollution control objectives and treatment methods; survey of solid and hazardous waste management and air pollution control.

C E 332: Structural Analysis I

(2-2) Cr. 3. F.S.

Prereq: E M 324

Loads, shear, moment, and deflected shape diagrams for beams and framed structures. Deformation calculations. Approximate methods. Application of consistent deformation methods to continuous beams and frames. Application of displacement or slope deflection methods to continuous beams and frames without sway. Influence lines for determinate and indeterminate structures. Computer applications to analyze beams and frames. Validation of computer results.

C E 333: Structural Steel Design I

(2-2) Cr. 3. F.S.

Prereq: C E 332, E M 327

AISC design methods for structural steel buildings. Design of steel tension members. Design of steel members for flexure. Design of members for compression. Beam-Column member design. Introduction to steel building systems. Steel moment frames and concentrically braced frames. Design of commonly used connections in steel buildings.

C E 334: Reinforced Concrete Design I

(2-2) Cr. 3. F.S.

Prereq: C E 332, E M 327

ACI design methods for structural concrete members. Emphasis on the analysis and design for flexure of singly reinforced and doubly reinforced sections, T-section, one-way slabs, short columns, and isolated footings. Analysis and design for shear, and serviceability. Bond, anchorage, and development of reinforcement.

C E 355: Principles of Transportation Engineering

(3-0) Cr. 3. F.S.

Prereq: C E 111

Introduction to planning, design, and operations of transportation facilities. Road user, vehicle and roadway characteristics. Technological, economic and environmental factors. Asset management, transportation planning, capacity analysis, traffic control, geometric design, traffic safety.

C E 360: Geotechnical Engineering

(2-3) Cr. 3. F.S.

Prereq: E M 324, credit or enrollment in GEOL 201

Introduction to geotechnical engineering and testing. Identification and classification tests, soil water systems, principles of settlement, stresses in soils, and shear strength testing; slope stability, retaining walls, bearing capacity.

C E 372: Engineering Hydrology and Hydraulics

(3-0) Cr. 3. F.S.

Prereq: E M 378, a course in statistics from the approved department list

The hydrologic cycle: precipitation, infiltration, runoff, evapotranspiration, groundwater, and streamflow. Hydrograph analysis, flood routing, frequency analysis and urban hydrology. Applied hydraulics including pipe and channel flow with design applications in culverts, pumping, water distribution, storm and sanitary sewer systems. Design project required.

C E 382: Design of Concretes

(2-3) Cr. 3. F.S.

Prereq: E M 274

Physical and chemical properties of bituminous, portland, and other cements; aggregate properties and blending; mix design and testing of concretes; admixtures, mixing, handling, placing and curing; principles of pavement thickness design.

C E 383: Design of Portland Cement Concrete

(0-2) Cr. 1. F.S.

Prereq: E M 274

For Con E students only. Physical and chemical properties of portland cement and p.c. concrete. Mix design and testing of p.c. concrete. Credit for both C E 382 and C E 383 may not be applied for graduation.

C E 388: Sustainable Engineering and International Development

(Cross-listed with A B E, E E). (2-2) Cr. 3. F.

Prereq: Junior classification in engineering

Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report.

Meets International Perspectives Requirement.

C E 396: Summer Internship

Cr. R. Repeatable. SS.

Prereq: Permission of department and Engineering Career Services

Summer professional work period. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

C E 398: Cooperative Education (Co-op)

Cr. R. Repeatable. F.S.

Prereq: Permission of department and Engineering Career Services

Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

C E 403: Program and Outcome Assessment
Cr. R. F.S.
Prereq: Verification of undergraduate application for graduation by the end of the first week of class. Permission of instructor for students who are scheduled for summer graduation
Assessment of C E Curriculum and educational objectives. Assessments to be reviewed by the CE Department to incorporate potential improvements. Offered on a satisfactory-fail basis only.

C E 417: Land Surveying
(2-3) Cr. 3. S.
Prereq: C E 111
Legal principles affecting the determination of land boundaries, public domain survey systems. Locating sequential and simultaneous conveyances. Record research, plat preparation, and land description. Study of selected court cases.

C E 420: Environmental Engineering Chemistry
(Dual-listed with C E 520). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: C E 326, CHEM 178
Principles of chemical and physical phenomena applicable to the treatment of water and wastewater and natural waters; including chemical equilbria, reaction kinetics, acid-base equilibria, chemical precipitation, redox reactions, and mass transfer principles. Individual laboratory practicals and group projects required.

C E 421: Environmental Biotechnology
(Dual-listed with C E 521). (2-2) Cr. 3. F.
Prereq: C E 326
Fundamentals of biochemical and microbial processes applied to environmental engineering processes, role of microorganisms in wastewater treatment and bioremediation, bioenergetics and kinetics, metabolism of xenobiotic compounds, waterborne pathogens and parasites, and disinfection. Term paper and oral presentation.

C E 424: Air Pollution
(Dual-listed with C E 524). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 424A: Air Polution: Air quality and effects of pollutants
(Dual-listed with C E 524A). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 424B: Air Pollution: Climate change and causes
(Dual-listed with C E 524B). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 424C: Air Pollution: Transportation Air Quality
(Dual-listed with C E 524C). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

C E 424D: Air Pollution: Off-gas treatment technology
(Dual-listed with C E 524D). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

C E 424E: Air Pollution: Agricultural sources of pollution
(Dual-listed with C E 524E). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 428: Water and Wastewater Treatment Plant Design
(2-2) Cr. 3. S.
Prereq: C E 326
Physical, chemical and biological processes for the treatment of water and wastewater including coagulation and flocculation, sedimentation, filtration, adsorption, chemical oxidation/disinfection, fixed film and suspended growth biological processes and sludge management.

C E 440: Bioprocessing and Bioproducts
(Dual-listed with C E 540). (Cross-listed with FS HN). (3-0) Cr. 3. F.
Prereq: C E 326 or equivalent, MATH 160 or MATH 165, CHEM 167 or higher, BIOL 173 or BIOL 211 or higher, senior or graduate classification
Sustainability, cleaner production. Taxonomy, kinetics, metabolism, microbial cultivation, aerobic and anaerobic fermentation. Antibiotics, food supplements, fermented foods, vitamin production. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis.

C E 446: Bridge Design
(Dual-listed with C E 546). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: C E 333, C E 334
Bridge design in structural steel and reinforced concrete. Application of AASHTO Bridge Design Specifications. Analysis techniques for complex structures. Preliminary designs include investigating alternative structural systems and materials. Final designs include preparation of design calculations and sketches.

C E 448: Building Design
(Dual-listed with C E 548). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: C E 333, C E 334
Building design in structural steel and reinforced concrete. Investigation of structural behavior. Gravity and lateral load resisting systems. Application of current building codes and design specifications. In-depth analysis of gravity and wind loads on buildings. Review of building designs. Preliminary designs include investigating alternative structural systems. Approximate methods of structural analysis for gravity and lateral loads. Final designs include preparation of design calculations and sketches.

C E 449: Structural Health Monitoring
(Dual-listed with C E 549). (Cross-listed with MAT E). (3-0) Cr. 3.
Prereq: Senior classification in Engineering or permission of instructor
Introductory and advanced topics in structural health monitoring (SHM) of aeronautical, civil, and mechanical systems. Topics include sensors, signal processing in time and frequency domains, data acquisition and transmission systems, design of integrated SHM solutions, nodestructive evaluation techniques, feature extraction methods, and cutting edge research in the field of SHM. Graduate students will have a supervisory role to assist students in 449 and an additional design project or more in-depth analysis and design.

C E 451: Urban Transportation Planning Models
(Dual-listed with C E 551). (3-0) Cr. 3. F.
Prereq: C E 355, STAT 101 or STAT 105
Urban transportation planning context and process. Project planning and programming. Congestion, mitigation, and air quality issues. Transportation data sources. Travel demand and network modeling. Use of popular travel demand software and applications of geographic information systems.

C E 453: Highway Design
(2-2) Cr. 3. F.S.
Prereq: C E 306, C E 355
Introduction to highway planning and design. Design, construction, and maintenance of highway facilities. Level-of-service, stopping sight distance, highway alignment, earthwork and pavement design. Design project, oral reports and written reports. Computer applications.

C E 460: Foundation Engineering
(3-0) Cr. 3. F.S.
Prereq: C E 360
Fundamentals of foundation engineering. Exploration, sampling, and in-situ tests. Shallow and deep foundations. Settlement and bearing capacity analyses. Stability of excavations and earth retaining structures.

C E 467: Geomaterials Stabilization
(Dual-listed with C E 567). (2-2) Cr. 3. S.
Prereq: C E 360, C E 382 or C E 383
Soil and aggregate physical, chemical and biological stabilization procedures. Stabilization analysis and design. Ground modification and compaction methods. Geosynthetics application and design.

C E 473: Groundwater Hydrology
(Dual-listed with C E 573). (3-0) Cr. 3. F.
Prereq: C E 372
Principles of groundwater flow, hydraulics of wells, superposition, slug and pumping tests, streamlines and flownets, and regional groundwater flow. Contaminant transport. Computer modeling. Design project. Extra assignments required for graduate students.

C E 483: Pavement Analysis and Design
(Dual-listed with C E 583). (3-0) Cr. 3. S.
Prereq: C E 360 and C E 382
Analysis, behavior, performance, and structural design of pavement systems. Topics include climate factors, rehabilitation, life cycle design economics, material and system response, pavement foundations and traffic loadings. Development of models for and analysis of pavement systems. Use of transfer functions relating pavement response to pavement performance. Evaluation and application of current and evolving pavement design practices and procedures. Mechanistic-based pavement design techniques and concepts. Analysis of the effects of maintenance activities on pavement performance and economic evaluation of pavement systems.

C E 484: Advanced Design of Concretes
(Dual-listed with C E 584). (2-2) Cr. 3.
Prereq: C E 382
Asphalt binder characterization, fundamentals of asphalt rheology, asphalt materials behavior under loading and temperature effects. High-strength, light-weight, fiber-reinforced, and self-consolidating portland cement concretes, mix design, properties, advanced performance testing. A term project is required for graduate level only.

C E 485: Civil Engineering Design
(2-2) Cr. 3. F.S.
Prereq: C E 306, C E 326, C E 333 or C E 334, C E 355, C E 360, C E 372, C E 382, SP CM 212. Course enrollment limited to final graduating semester.
The civil engineering design process, interacting with the client, identification of the engineering problems, development of a technical proposal, identification of design criteria, cost estimating, planning and scheduling, codes and standards, development of feasible alternatives, selection of best alternative, and oral presentation.

C E 488: Sustainable Horizontal Civil Infrastructure Systems
(Dual-listed with C E 588). (3-0) Cr. 3. F.
Prereq: Junior or higher classification in engineering of science
Sustainable planning, life cycle analysis, appropriate engineering design, and overall rating assessment of horizontal civil infrastructure (i.e., versus 'vertical building') systems, including highway, bridge, airport, rail, and port facilities. Course readings and final project/design report.

C E 490: Independent Study
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Independent study in any phase of civil engineering. Pre-enrollment contract required. No more than 6 credits of C E 490 may be counted towards engineering topics electives.

C E 490H: Independent Study: Honors
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Independent study in any phase of civil engineering. Pre-enrollment contract required. No more than 6 credits of C E 490H may be counted towards engineering topics electives.

Courses primarily for graduate students, open to qualified undergraduates:

C E 501: Preconstruction Project Engineering and Management
(3-0) Cr. 3.
Prereq: Credit or enrollment in CON E 422 or C E 306
Application of engineering and management control techniques to construction project development from conceptualization to notice to proceed. Emphasis is on managing complex projects using 5-dimensional project management theory.

C E 502: Construction Project Engineering and Management
(3-0) Cr. 3.
Prereq: Credit or enrollment in CON E 422
Application of engineering and management control techniques to complex construction projects. Construction project control techniques, stochastic estimating and scheduling, equipment selection and utilization, project administration, construction process simulation, Quality Management, and productivity improvement programs.

C E 503: Construction Finance and Business Management
(3-0) Cr. 3.
Prereq: Credit or enrollment in CON E 422
Fundamental theories and applied methods for financial management of construction companies. Construction accounting, cash flow analysis, financial planning and management, and risk analysis. Case studies.

C E 505: Design of Construction Systems
(3-0) Cr. 3.
Prereq: C E 334, C E 360, CON E 322 and CON E 340
Advanced design of concrete formwork and falsework systems. Design for excavation and marine construction including temporary retaining structures and cofferdams. Aggregate production operations, including blasting, crushing, and conveying systems. Rigging system design.

C E 506: Case Histories in Construction Documents
(3-0) Cr. 3.
Prereq: CON E 221, credit or enrollment in CON E 422
Study of cases involving disputes, claims, and responsibilities encountered by management in construction contract documents. Analysis of methods of resolving differences among the owner, architect, engineer, and construction contractor for a project.

C E 510: Information Technologies for Construction
(3-0) Cr. 3.
Prereq: CON E 422, ENGR 160 or C E 160 or equivalent
Information technologies including microcomputer based systems, management information systems, automation technologies, computer-aided design, and expert systems and their application in the construction industry. Overview of systems acquisition, communications, and networking.

C E 520: Environmental Engineering Chemistry
(Dual-listed with C E 420). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: C E 326, CHEM 178
Principles of chemical and physical phenomena applicable to the treatment of water and wastewater and natural waters; including chemical equilbria, reaction kinetics, acid-base equilibria, chemical precipitation, redox reactions, and mass transfer principles. Individual laboratory practicals and group projects required.

C E 521: Environmental Biotechnology
(Dual-listed with C E 421). (Cross-listed with ENSCI). (2-2) Cr. 3. F.
Prereq: C E 326
Fundamentals of biochemical and microbial processes applied to environmental engineering processes, role of microorganisms in wastewater treatment and bioremediation, bioenergetics and kinetics, metabolism of xenobiotic compounds, waterborne pathogens and parasites, and disinfection. Term paper and oral presentation.

C E 522: Water Pollution Control Processes
(Cross-listed with ENSCI). (2-2) Cr. 3.
Prereq: C E 521
Fundamentals of biochemical processes, aerobic growth in a single CSTR, multiple events in complex systems, and techniques for evaluating kinetic parameters; unit processes of activated sludge system, attached growth systems, stabilization and aerated lagoon systems, biosolids digestion and disposal, nutrient removal, and anaerobic treatment systems.

C E 523: Physical-Chemical Treatment Process
(Cross-listed with ENSCI). (2-2) Cr. 3.
Prereq: C E 520
Material and energy balances. Principles and design of physical-chemical unit processes; including screening, coagulation, flocculation, chemical precipitation, sedimentation, filtration, lime softening and stabilization, oxidation, adsorption, membrane processes, ion exchange and disinfection; recovery of resources from residuals and sludges; laboratory exercises and demonstrations; case studies in mineral processing and secondary industries.

C E 524: Air Pollution
(Dual-listed with C E 424). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 524A: Air Polution: Air quality and effects of pollutants
(Dual-listed with C E 424A). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 524B: Air Pollution: Climate change and causes
(Dual-listed with C E 424B). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 524C: Air Pollution: Transportation Air Quality
(Dual-listed with C E 424C). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

C E 524D: Air Pollution: Off-gas treatment technology
(Dual-listed with C E 424D). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

C E 524E: Air Pollution: Agricultural sources of pollution
(Dual-listed with C E 424E). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 528: Solid and Hazardous Waste Management
(Cross-listed with ENSCI). (3-0) Cr. 3.
Prereq: C E 326 or background courses in both environmental chemistry and microbiology; junior or higher standing
Evaluation, characterization, assessment, planning and design of solid and hazardous waste management systems, regulatory requirements, material characterization and collection, minimization and recycling, energy and materials recovery, composting, off-gas treatment, incineration, stabilization, and landfill design. Design of treatment and disposal systems, including physical, chemical, and biological treatment, solidification, incineration, secure landfill design, and final disposal site closure plus restoration.

C E 532: Structural Analysis II
(3-0) Cr. 3. F.
Prereq: C E 332
Analysis of indeterminate structural problems by the consistent deformation and generalized direct displacement methods. Direct stiffness method for 2-D frames, grids, 3-D frames. Special topics for the stiffness method.

C E 533: Structural Steel Design II
(3-0) Cr. 3.
Prereq: C E 333
Theoretical background and development of AISC Specification equations. In-depth analysis and design of tension members, columns, beams, beam-columns, and plate girders. Emphasis on Load and Resistance Factor Design. Elastic and inelastic buckling of members and member elements. Investigation of amplification factors for members subject to combined bending and axial load and to combined bending and torsion. Effective Length Method and Direct Analysis Method of design. Approximate Second-Order Analysis. Biaxial bending. Torsion and combined bendin and torsion of W-shapes.

C E 534: Reinforced Concrete Design II

(2-2) Cr. 3.

Prereq: C E 334

Advanced topics in reinforced concrete analysis and design. Moment-curvature and load-deflection behavior. Design of reinforced concrete long columns, two-way floor slabs, and isolated and combined footings. Design and behavior considerations for torsion, biaxial bending, and structural joints. Strut-and-tie modeling.

C E 535: Prestressed Concrete Structures

(3-0) Cr. 3.

Prereq: C E 334

Design of prestressed concrete structures, review of hardware, stress calculations, prestress losses, section proportioning, flexural design, shear design, deflections, and statically indeterminate structures.

C E 540: Bioprocessing and Bioproducts

(Dual-listed with C E 440). (Cross-listed with BRT, FS HN). (3-0) Cr. 3. F.

Prereq: C E 326 or equivalent, MATH 160 or MATH 165, CHEM 167 or higher, BIOL 173 or BIOL 211 or higher, senior or graduate classification

Sustainability, cleaner production. Taxonomy, kinetics, metabolism, microbial cultivation, aerobic and anaerobic fermentation. Antibiotics, food supplements, fermented foods, vitamin production. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis.

C E 541: Dynamic Analysis of Structures

(3-0) Cr. 3.

Prereq: E M 345 and credit or enrollment in C E 532

Single and multi-degree-of-freedom systems. Free and forced vibrations. Linear and nonlinear response. Modal analysis. Response spectra. Seismic analysis.

C E 542: Structural Analysis by Finite Elements

(3-0) Cr. 3.

Prereq: C E 532

Use of the finite element method for the analysis of complex structural configurations. Plane stress, solid, Axisymmetric and plate elements. Numerical integration. Use of general purpose finite element programs.

C E 545: Seismic Design

(3-0) Cr. 3.

Prereq: C E 333, C E 334

Seismic hazard in the United States. Engineering characteristics of ground motions. Structural damage in past earthquakes. Capacity design philosophy for seismic resistant design. Conceptual design of structures. Capacity design process including design of structural members.

C E 546: Bridge Design

(Dual-listed with C E 446). (2-2) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: C E 333, C E 334

Bridge design in structural steel and reinforced concrete. Application of AASHTO Bridge Design Specifications. Analysis techniques for complex structures. Preliminary designs include investigating alternative structural systems and materials. Final designs include preparation of design calculations and sketches.

C E 547: Analysis and Design of Plate and Slab Structures

(3-0) Cr. 3.

Prereq: C E 334, E M 514, MATH 266

Bending and buckling of thin plate components in structures utilizing classical and energy methods. Analysis of shell roofs by membrane and bending theories.

C E 548: Building Design

(Dual-listed with C E 448). (2-2) Cr. 3. Alt. S., offered even-numbered years.

Prereq: C E 333, C E 334

Building design in structural steel and reinforced concrete. Investigation of structural behavior. Gravity and lateral load resisting systems. Application of current building codes and design specifications. In-depth analysis of gravity and wind loads on buildings. Review of building designs. Preliminary designs include investigating alternative structural systems. Approximate methods of structural analysis for gravity and lateral loads. Final designs include preparation of design calculations and sketches.

C E 549: Structural Health Monitoring

(Dual-listed with C E 449). (Cross-listed with M S E). (3-0) Cr. 3.

Prereq: Senior classification in Engineering or permission of instructor

Introductory and advanced topics in structural health monitoring (SHM) of aeronautical, civil, and mechanical systems. Topics include sensors, signal processing in time and frequency domains, data acquisition and transmission systems, design of integrated SHM solutions, nodestructive evaluation techniques, feature extraction methods, and cutting edge research in the field of SHM. Graduate students will have a supervisory role to assist students in 449 and an additional design project or more in-depth analysis and design.

C E 551: Urban Transportation Planning Models

(Dual-listed with C E 451). (3-0) Cr. 3. F.

Prereq: C E 355, STAT 101 or STAT 105

Urban transportation planning context and process. Project planning and programming. Congestion, mitigation, and air quality issues. Transportation data sources. Travel demand and network modeling. Use of popular travel demand software and applications of geographic information systems.

C E 552: Traffic Safety, Operations, and Maintenance
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: C E 355
Engineering aspects of highway traffic safety. Reduction of crash incidence and severity through highway design and traffic control. Accident analysis. Safety in highway design, maintenance, and operation.

C E 553: Traffic Engineering
(3-0) Cr. 3. F.
Prereq: C E 355
Driver, pedestrian, and vehicular characteristics. Traffic characteristics; highway capacity; traffic studies and analyses. Principles of traffic control for improved highway traffic service. Application of appropriate computing software and tools.

C E 556: Transportation Data Analysis
(3-0) Cr. 3.
Prereq: C E 355, a Statistics course at the 300 level or higher
Analysis of transportation data, identification of data sources and limitations. Static and dynamic data elements such as infrastructure characteristics, flow and operations-related data elements. Spatial and temporal extents data for planning, design, operations, and management of transportation systems. Summarizing, analyzing, modeling, and interpreting data. Use of information technologies for highways, transit, and aviation systems.

C E 557: Transportation Systems Analysis
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: C E 355, 3 credits in statistics or probability
Travel studies and analysis of data. Transportation systems forecasts and analyses. Statewide, regional, and local transportation system planning. Network level systems planning and operations. Optimization of systems.

C E 558: Transportation Systems Development and Management
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: C E 355
Study of designated problems in traffic engineering, transportation planning, and development. Forecasting and evaluation of social, economic, and environmental impacts of proposed solutions; considerations of alternatives. Formulation of recommendations and publication of a report. Presentation of recommendations in the host community.

C E 559: Transportation Infrastructure/Asset Management
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: C E 355
Engineering management techniques for maintaining and managing infrastructure assets. Systematic approach to management through value engineering, engineering economics, and life cycle cost analysis. Selection and scheduling of maintenance activities. Analysis of network-wide resource needs. Project level analysis.

C E 560: Fundamentals of Soil Mechanics
(3-0) Cr. 3.
Prereq: C E 360
Nature of soil deposits, seepage, settlement and secondary compression, consolidation theories and analysis, failure theories, stress paths, introduction to critical state soil mechanics, constitutive models, soil strength under various drainage conditions, liquefaction of soil, pore pressure parameters, selection of soil parameters.

C E 561: Applied Foundation Engineering
(3-0) Cr. 3.
Prereq: C E 460
Analysis and design of shallow and deep foundations, lateral earth pressure theories and retaining structures, field investigations, in-situ testing, and foundations on problematic soils. Foundation engineering reports.

C E 562: Site Evaluations for Civil Engineering Projects
(2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: C E 360
Identification and mapping of engineering soils from airphotos, maps, and soil surveys. Planning subsurface investigations, geomaterials prospecting, geotechnical hazards, geomorphology, in situ testing and sampling, geophysical site characterization, instrumentation and monitoring, interpretation of engineering parameter values for design.

C E 563: Experimental Methods in Geo-Engineering
(2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: C E 360
Principles of geo-engineering laboratory testing including the conduct, analysis, and interpretation of permeability, consolidation, triaxial, direct and ring shear, and direct simple shear tests. Issues regarding laboratory testing versus field testing and acquisition, transport, storage, and preparation of samples for geotechnical testing. Field and laboratory geotechnical monitoring techniques, including the measurements of deformation, strain, total stress and pore water pressure.

C E 564: Application of Numerical Methods to Geotechnical Design
(3-0) Cr. 3.
Prereq: C E 560
Application of numerical methods to analysis and design of foundations, underground structures, and soil-structure interaction. Application of slope stability software. Layered soils, bearing capacity and settlement for complex geometries, wave equation for piles, and foundation vibrations.

C E 565: Fundamentals of Geomaterials Behavior
(2-3) Cr. 3. S.
Prereq: C E 382
Atoms and molecules, crystal chemistry, clay minerals, structure of solids, phase transformations and phase equilibria. Surfaces and interfacial phenomena, colloid chemistry, mechanical properties. Applications to soils and civil engineering materials. Overview of state-of-the-art instrumental techniques for analysis of the physicochemical properties of soils and civil engineering materials.

C E 567: Geomaterials Stabilization
(Dual-listed with C E 467). (2-2) Cr. 3. S.
Prereq: C E 360, C E 382 or C E 383
Soil and aggregate physical, chemical and biological stabilization procedures. Stabilization analysis and design. Ground modification and compaction methods. Geosynthetics application and design.

C E 568: Dynamics of Soils and Foundations
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: C E 360, E M 345
Dynamic soil properties and their measurement. Foundation dynamics and soil-structure interaction. Sources and characteristics of dynamic loads. Vibration of single- and multi-degree-of-freedom systems. Vibration of continuous systems; 1D, 2D, and 3D analyses, wave propagation. Liquefaction concepts and analysis methods. Introduction to geotechnical earthquake engineering.

C E 569: Ground Improvement
(3-0) Cr. 3.
Prereq: C E 360
Classification of ground improvement methods. Dynamic compaction, vibrocompaction, preloading using fill surcharge, vacuum or a combination of both and prefabricated vertical drains, vibro replacement or stone columns, dynamic replacement, sand compaction piles, geotextile confined columns, rigid inclusion, column supported embankment, microbial methods, particulate and chemical grouting, lime and cement columns, jet grouting, and deep cement mixing.

C E 570: Applied Hydraulic Design
(2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: C E 372
Flow characteristics in natural and constructed channels; principles of hydraulic design of culverts, bridge waterway openings, spillways, hydraulic gates and gated structures, pumping stations, and miscellaneous water control structures; pipe networks, mathematical modeling. Design project.

C E 571: Surface Water Hydrology
(Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: C E 372
Analysis of hydrologic data including precipitation, infiltration, evapotranspiration, direct runoff and streamflow; theory and use of frequency analysis; theory of streamflow and reservoir routing; use of deterministic and statistical hydrologic models. Fundamentals of surface water quality modeling, point and non-point sources of contamination. Design project.

C E 572: Analysis and Modeling Aquatic Environments
(Cross-listed with ENSCI). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: C E 372
Principles of surface water flows and mixing. Introduction to hydrologic transport and water quality simulation in natural water systems. Advection, diffusion and dispersion, chemical and biologic kinetics, and water quality dynamics. Applications to temperature, dissolved oxygen, primary productivity, and other water quality problems in rivers, lakes and reservoirs. Deterministic vs. stochastic models.

C E 573: Groundwater Hydrology
(Dual-listed with C E 473). (3-0) Cr. 3. F.
Prereq: C E 372
Principles of groundwater flow, hydraulics of wells, superposition, slug and pumping tests, streamlines and flownets, and regional groundwater flow. Contaminant transport. Computer modeling. Design project. Extra assignments required for graduate students.

C E 576: Environmental Flows
(3-0) Cr. 3.
Prereq: E M 378 or equivalent
Analysis and applications of flows in civil engineering, environmental engineering, and water resources. Primary topics include conservation laws, laminar flow, turbulence, mixing, diffusion, dispersion, water waves, and boundary layers. Associated applications include particle settling, transfer at air-water and water-sediment boundaries, flow and friction in pipes and open channels, contaminant transport, waves in lakes, jets, plumes, and salt wedges.

C E 581: Geotechnical and Materials Engineering Seminar
Cr. R. Repeatable.
Prereq: Graduate classification
(1-0) Students and outside/invited speakers give weekly presentations about the ongoing research work and Geotechnical and Materials Engineering issues. Offered on a satisfactory-fail basis only.

C E 583: Pavement Analysis and Design
(Dual-listed with C E 483). (3-0) Cr. 3. S.
Prereq: C E 360 and C E 382
Analysis, behavior, performance, and structural design of pavement systems. Topics include climate factors, rehabilitation, life cycle design economics, material and system response, pavement foundations and traffic loadings. Development of models for and analysis of pavement systems. Use of transfer functions relating pavement response to pavement performance. Evaluation and application of current and evolving pavement design practices and procedures. Mechanistic-based pavement design techniques and concepts. Analysis of the effects of maintenance activities on pavement performance and economic evaluation of pavement systems.

C E 584: Advanced Design of Concretes
(Dual-listed with C E 484). (2-2) Cr. 3.
Prereq: C E 382
Asphalt binder characterization, fundamentals of asphalt rheology, asphalt materials behavior under loading and temperature effects. High-strength, light-weight, fiber-reinforced, and self-consolidating portland cement concretes, mix design, properties, advanced performance testing. A term project is required for graduate level only.

C E 586: Advanced Asphalt Materials
(2-3) Cr. 3.
Prereq: C E 382
Advanced asphalt concrete (SUPERPAVE) mix designs. Aggregates. Admixtures. Production and construction, quality control and inspection. Nondestructive testing. Pavement thickness design. Materials engineering reports.

C E 587: Advanced Portland Cement Concretes
(2-3) Cr. 3.
Prereq: C E 382 or C E 383
Hydraulic cements, aggregates, admixtures, and mix design; concrete production, quality control, early-age properties and durability. Concrete distress examination, identification, prevention, and nondestructive testing; advanced concrete technology, high-strength and high performance concrete.

C E 588: Sustainable Horizontal Civil Infrastructure Systems
(Dual-listed with C E 488). (3-0) Cr. 3. F.
Prereq: Junior or higher classification in engineering of science
Sustainable planning, life cycle analysis, appropriate engineering design, and overall rating assessment of horizontal civil infrastructure (i.e., versus 'vertical building') systems, including highway, bridge, airport, rail, and port facilities. Course readings and final project/design report.

C E 590: Special Topics
Cr. 1-5. Repeatable. F.S.SS.
Pre-enrollment contract required.

C E 591: Seminar in Environmental Engineering
Cr. R. Repeatable. F.S.
Prereq: Graduate classification
(1-0) Contemporary environmental engineering issues. Outside speakers. Review of ongoing research in environmental engineering. Offered on a satisfactory-fail basis only.

C E 594: Special Topics in Construction Engineering and Management
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594A: Special Topics Construction Engineering and Mgt.: Planning and Scheduling
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594B: Special Topics Construction Engineering and Mgt.: Computer Applications for Planning and Scheduling
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594C: Special Topics Construction Engineering and Mgt.: Cost Estimating
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594D: Special Topics Construction Engineering and Mgt.: Computer Applications for Cost Estimating

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594E: Special Topics Construction Engineering and Mgt.: Project Controls

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594F: Special Topics Construction Engineering and Mgt.: Computer Applications for Project Controls

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594G: Special Topics Construction Engr and Mgt: Integration of Planning, Scheduling and Project Controls

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594J: Special Topics Construction Engineering and Mgt.: Trenchless Technologies

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594K: Special Topics Construction Engineering and Mgt.: Electrical and Mechanical Construction

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594L: Special Topics Construction Engineering and Mgt.: Advanced Building Construction Topics

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594M: Special Topics Construction Engineering and Mgt.: Design Build Construction

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594N: Special Topics Construction Engineering and Mgt.: Industrial Construction

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594O: Special Topics Construction Engineering and Mgt.: Highway and Heavy Construction

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594P: Special Topics Construction Engineering and Mgt.: Advanced Technologies

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594Q: Special Topics Construction Engineering and Mgt.: Construction Quality Control

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594R: Special Topics Construction Engineering and Mgt.: Risk Management
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594S: Special Topics Construction Engineering and Mgt.: Building Information Modeling
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 595: Research Methods in Construction Engineering and Management
(1-0) Cr. 1.
Prereq: Credit or enrollment in C E 501, C E 502, C E 503, or C E 505
Assigned readings and reports on research methods to solve construction engineering and management problems such as alternative project delivery methods, asset management, data mining, construction procurement, robotics, project controls, automation, construction visualization, etc. Identification of research methods and priorities, selection and development of research design, and critique of research in construction engineering and management.

C E 595A: Research Methods Seminar in Construction Engineering and Management: Qualitative Methods
(1-0) Cr. 1.
Prereq: Credit or enrollment in C E 501, C E 502, C E 503, or C E 505
Assigned readings and reports on research methods to assess and solve qualitative construction engineering and management problems.

C E 595B: Research Methods Seminar in Construction Engineering and Management: Quantitative Methods
(1-0) Cr. 1.
Prereq: Credit or enrollment in C E 501, C E 502, C E 503, or C E 505
Assigned readings and reports on research methods to assess and solve quantitative construction engineering and management problems.

C E 595C: Research Methods Seminar in Construction Engineering and Management: Technical Reporting
(1-0) Cr. 1.
Prereq: Credit or enrollment in C E 501, C E 502, C E 503, or C E 505
Assigned readings and reports on research methods for planning and preparation of technical reports with construction engineering and management projects.

C E 596: Special Topics in Transportation Engineering
Cr. arr. Repeatable.
Prereq: C E 355

C E 596B: Special Topics in Transportation Engineering: Geographic Information Systems in Transportation
Cr. arr. Repeatable.
Prereq: C E 355

C E 596C: Special Topics in Transportation Engineering: Hazardous Materials Transportation
Cr. arr. Repeatable.
Prereq: C E 355

C E 596D: Special Topics in Transportation Engineering: Transportation and Public Works
Cr. arr. Repeatable.
Prereq: C E 355

C E 596E: Special Topics in Transportation Engineering: Sustainable Transportation
Cr. arr. Repeatable.
Prereq: C E 355

C E 596F: Special Topics in Transportation Engineering: Freight Transportation
Cr. arr. Repeatable.
Prereq: C E 355

C E 599: Creative Component
Cr. 1-3. Repeatable.
Pre-enrollment contract required. Advanced topic for creative component report in lieu of thesis.

Courses for graduate students:

C E 622: Advanced Topics in Environmental Engineering
(2-0) Cr. 2. Repeatable.
Prereq: Permission of environmental engineering graduate faculty
Advanced concepts in environmental engineering. Emphasis for a particular offering will be selected from the following topics:.

C E 622A: Advanced Topics in Environmental Engineering: Water Pollution Control
(2-0) Cr. 2. Repeatable.
Prereq: Permission of environmental engineering graduate faculty
Advanced concepts in environmental engineering. Emphasis for a particular offering will be selected from the following topics:.

C E 622B: Advanced Topics in Environmental Engineering: Water Treatment
(2-0) Cr. 2. Repeatable.
Prereq: Permission of environmental engineering graduate faculty
Advanced concepts in environmental engineering. Emphasis for a particular offering will be selected from the following topics:.

C E 622C: Advanced Topics in Environmental Engineering: Solid and Hazardous Waste
(2-0) Cr. 2. Repeatable.
Prereq: Permission of environmental engineering graduate faculty
Advanced concepts in environmental engineering. Emphasis for a particular offering will be selected from the following topics:.

C E 622D: Advanced Topics in Environmental Engineering: Water Resources
(2-0) Cr. 2. Repeatable.
Prereq: Permission of environmental engineering graduate faculty
Advanced concepts in environmental engineering. Emphasis for a particular offering will be selected from the following topics:.

C E 622E: Advanced Topics in Environmental Engineering: Instrumental Methods for Environmental Analyses
(2-0) Cr. 2. Repeatable.
Prereq: Permission of environmental engineering graduate faculty
Advanced concepts in environmental engineering.

C E 650: Advanced Topics in Transportation Engineering
(3-0) Cr. 3. Repeatable.
Prereq: Permission of Transportation Engineering graduate faculty

C E 650A: Advanced Topics in Transportation Engineering: Highway Design
(3-0) Cr. 3. Repeatable.
Prereq: Permission of Transportation Engineering graduate faculty

C E 650B: Advanced Topics in Transportation Engineering: Traffic Operations
(3-0) Cr. 3. Repeatable.
Prereq: Permission of Transportation Engineering graduate faculty

C E 650C: Advanced Topics in Transportation Engineering: Data Analysis
(3-0) Cr. 3. Repeatable.
Prereq: Permission of Transportation Engineering graduate faculty
Topics in transportation engineering related to data analysis.

C E 690: Advanced Topics
Cr. 1-3. Repeatable. F.S.SS.
Pre-enrollment contract required.

C E 697: Engineering Internship
Cr. R. Repeatable.
Prereq: Permission of coop advisor, graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

C E 699: Research
Cr. 1-30. Repeatable.
Prereq: Pre-enrollment contract required
Advanced topic for thesis/dissertation.

Classical Studies (CL ST)

Courses primarily for undergraduates:

CL ST 201: Technical Terminologies in the Professions
(3-0) Cr. 3. F.S.
Essential vocabulary and concepts in English that are derived from Latin and Ancient Greek. Formation and usage of technical terminology. Cultural influence of the classical languages. Analysis of technical writing.

CL ST 273: Greek and Roman Mythology
(3-0) Cr. 3. F.SS.
Survey of the legends, myths of the classical world with emphasis on the principal gods, and heroes, and their relation to ancient social, psychological, and religious practices; some attention may be given to important modern theories.
Meets International Perspectives Requirement.

CL ST 273H: Greek and Roman Mythology: Honors
(4-0) Cr. 4. F.SS.
Survey of the legends, myths of the classical world with emphasis on the principal gods, and heroes, and their relation to ancient social, psychological, and religious practices; some attention may be given to important modern theories.
Meets International Perspectives Requirement.

CL ST 275: The Ancient City
(3-0) Cr. 3. F.S.
Examination of ancient urban life, including historical context, physical space, material culture, religion, literature, and art; examination of civic identity (the "polis"). Contrast between the concepts of urban and rural. Examples drawn from specific ancient cities; some attention to modern methods of recovering the conditions of ancient urban life and the fundamental concept of the city in European history.
Meets International Perspectives Requirement.

CL ST 275H: The Ancient City: Honors
(4-0) Cr. 4. F.S.
Examination of ancient urban life, including historical context, physical space, material culture, religion, literature, and art; examination of civic identity (the "polis"). Contrast between the concepts of urban and rural. Examples drawn from specific ancient cities; some attention to modern methods of recovering the conditions of ancient urban life and the fundamental concept of the city in European history.
Meets International Perspectives Requirement.

CL ST 304: Cultural Heritage of the Ancient World
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
Historical examination of art, literature, thought, and religious beliefs of major civilizations of the ancient Mediterranean countries until the end of the 8th century.

CL ST 310: Ancient Philosophy
(Cross-listed with PHIL). (3-0) Cr. 3. F.
Prereq: PHIL 201
Survey of ancient Greek philosophy, focusing on the pre-Socratics, Plato, and Aristotle. Questions concerning being, knowledge, language, and the good life are treated in depth.

CL ST 350: Rhetorical Traditions
(Cross-listed with ENGL, SP CM). (3-0) Cr. 3. S.
Prereq: ENGL 250
Ideas about the relationship between rhetoric and society in contemporary and historical contexts. An exploration of classical and contemporary rhetorical theories in relation to selected topics that may include politics, gender, race, ethics, education, science, or technology.

CL ST 353: World Literature: Western Foundations through Renaissance
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.
Prereq: ENGL 250
Representative works from the drama, epics, poetry, and prose of the Ancient World through the late sixteenth century. May include Homer, Aeschylus, Sappho, Catullus, Dante, Marie de France, Boccaccio, Christine de Pizan, Cervantes, and others.
Meets International Perspectives Requirement.

CL ST 367: Christianity in the Roman Empire
(Cross-listed with RELIG). (3-0) Cr. 3.
An historical introduction to the rise of Christianity in the Roman empire, with special attention to the impact of Greco-Roman culture on the thought and practice of Christians and the interaction of early Christians with their contemporaries.

CL ST 372: Greek and Roman Tragedy and Comedy
(3-0) Cr. 3. S.
Prereq: CL ST 273 or CL ST 275 or one course in Latin or Greek or ENGL 250
Greek and Roman drama from the beginnings until today. Readings in English from authors such as Aeschylus, Sophocles, Euripides, Aristophanes, Menander, Plautus, Terence, Seneca. Course may cover performance, theories of comedy and tragedy, recent and current expressions of the comic and tragic in film and other media.
Meets International Perspectives Requirement.

CL ST 372H: Greek and Roman Tragedy and Comedy: Honors
(4-0) Cr. 4. S.
Prereq: CL ST 273 or CL ST 275 or one course in Latin or Greek or ENGL 250
Greek and Roman drama from the beginnings until today. Readings in English from authors such as Aeschylus, Sophocles, Euripides, Aristophanes, Menander, Plautus, Terence, Seneca. Course may cover performance, theories of comedy and tragedy, recent and current expressions of the comic and tragic in film and other media.
Meets International Perspectives Requirement.

CL ST 373: Heroes of Greece, Rome, and Today
(3-0) Cr. 3. F.
Prereq: CL ST 273 or CL ST 275 or one course in Latin or Greek or ENGL 250.
Cultural and political significance of ancient epic, especially in Greece and Rome. Course may include study of the heroic code in antiquity and its modern expressions including in film. Readings in English from authors such as Homer and Vergil.
Meets International Perspectives Requirement.

CL ST 373H: Heroes of Greece, Rome, and Today: Honors
(4-0) Cr. 4. F.
Prereq: CL ST 273 or CL ST 275 or one course in Latin or Greek or ENGL 250.
Cultural and political significance of ancient epic, especially in Greece and Rome. Course may include study of the heroic code in antiquity and its modern expressions including in film. Readings in English from authors such as Homer and Vergil.
Meets International Perspectives Requirement.

CL ST 374: Sex, Gender, and Culture in the Ancient Mediterranean World
(Cross-listed with HIST, W S). (3-0) Cr. 3. S.
Prereq: Any one course in Cl St, W S, Latin, or Greek
Chronological and topical survey of the status of women and men, focusing on sex and gender issues in the Ancient Mediterranean world; study of constructs of the female and the feminine. Readings from ancient and modern sources. Emphasis on ancient Greece, Rome, and Egypt.
Meets International Perspectives Requirement.

CL ST 376: Classical Archaeology
(Cross-listed with ANTHR, RELIG). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

CL ST 376A: Classical Archeology: Bronze Age and Early Iron Age Greece
(Cross-listed with ANTHR, RELIG). (3-0) Cr. 3. S.
Bronze Age (Minoan and Mycenaean palatial cultures) and Early Iron Age Greece. (ca 3000-700 BCE). Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

CL ST 376B: Classical Archeology: Archaic through Hellenistic Greece (ca 700-30 BCE)
(Cross-listed with ANTHR, RELIG). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

CL ST 376C: Classical Archaeology: Roman Archaeology (ca 1000 BCE-400 CE)
(Cross-listed with ANTHR). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Roman world and the role of archaeological context in understanding the varied aspects of ancient Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

CL ST 383: Greek and Roman Art
(Cross-listed with ART H). (3-0) Cr. 3.
Greek art from Neolithic to Hellenistic periods. Roman art from the traditional founding to the end of the empire in the West.

CL ST 383H: Greek and Roman Art: Honors
(Cross-listed with ART H). (3-0) Cr. 3-4.
Greek art from Neolithic to Hellenistic periods. Roman art from the traditional founding to the end of the empire in the West.

CL ST 384: Roman Italy: An Introduction
(Cross-listed with HIST). Cr. 2.
Prereq: Enrollment limited to students participating in CL ST 385/HIST 385. Instructor permission required.
Introduction to the topography, history, archaeology, monuments, and art of Rome from the Regal period through late Antiquity; attention given to the culture of modern Italy, preparatory to study abroad in Rome.
Meets International Perspectives Requirement.

CL ST 385: Study Abroad: Roman Italy: Building the Empire
(Cross-listed with HIST). Cr. 3.
Prereq: CL ST 384/HIST 384 and instructor's permission.
Supervised on-site instruction in the history, archaeology, monuments, and art of Rome and environs from the 8th center BCE to the 5th century CE; attention given to the culture of modern Italy.
Meets International Perspectives Requirement.

CL ST 394: The Archaeology of Greece: An Introduction
(2-0) Cr. 2. Repeatable, maximum of 4 credits. S.
Introduction to the topography, history, archaeology, monuments and art of Greece from the Bronze Age through the Ottoman period; attention given to the culture of modern Greece, preparatory to study abroad in Greece (Cl St 395).
Meets International Perspectives Requirement.

CL ST 395: Study Abroad: The Archaeology of Greece
Cr. 2-6. Repeatable, maximum of 9 credits. SS.
Prereq: CL ST 394
Supervised on-site instruction in the archaeology, monuments, and art of Greece from the Bronze Age through the Ottoman period; attention given to the culture of modern Greece.
Meets International Perspectives Requirement.

CL ST 402: Greek Civilization.
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
Ancient Greece from the Bronze Age to the Hellenistic period; evolution of the Greek polis and its cultural contributions with a particular emphasis on the writings of Herodotus and Thucydides.

CL ST 403: Roman Civilization.
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
Ancient Rome from the Regal Period to the Fall of the Western Empire; evolution of Roman institutions and Rome's cultural contributions studied through original sources.

CL ST 430: Foundations of Western Political Thought
(Cross-listed with POL S). (3-0) Cr. 3.
Prereq: 6 credits in political science, philosophy, or European history
Study of original texts in political thought ranging from the classical period to the renaissance. Topics such as justice, freedom, virtue, the allocation of political power, the meaning of democracy, human nature, and natural law.

CL ST 480: Seminar in Classical Studies
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 30 credits in Classical Studies or related courses, permission of Program Chair
Advanced study of a selected topic in Classical Studies. Research paper or project selected by the student.

CL ST 490: Independent Study
Cr. 1-6. Repeatable, maximum of 9 credits.
Prereq: 7 credits in classical studies at the 200 level or higher; permission of the Program Chair
Designed to meet the needs of students who wish to study specific topics in classical civilization in areas where courses are not offered, or to pursue such study beyond the limits of existing courses.

Courses primarily for graduate students, open to qualified undergraduates:

CL ST 512: Proseminar in European History
(3-0) Cr. 3.
Prereq: Permission of instructor.
Readings in European history.

CL ST 512A: Proseminar in European History, Ancient
(Cross-listed with HIST). (3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in European history.

CL ST 594: Seminar in European History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

CL ST 594A: Seminar in European History: Ancient
(Cross-listed with HIST). (3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

Communication Disorders (CMDIS)

Courses primarily for undergraduates:

CMDIS 275: Introduction to Communication Disorders
(Cross-listed with LING). (3-0) Cr. 3.
Survey of nature, causes, and types of major communication disorders including phonological, adult and child language, voice, cleft palate, fluency, and hearing disorders.

CMDIS 286: Communicating with the Deaf
(Cross-listed with LING). (3-0) Cr. 3.
Learn to communicate with the deaf using Signed English and Signed Pidgin English. Other topics covered include types, causes, and consequences of hearing loss, hearing technology (hearing aids, assistive listening devices, and cochlear implants), education of hearing-impaired children, Deaf culture, and the history of manual communication.
Meets U.S. Diversity Requirement

CMDIS 371: Phonetics and Phonology
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: ENGL 219
Analysis of speech through study of individual sounds, their variations, and relationships in context; English phonology; practice in auditory discrimination and transcription of sounds of American English; description of speech sounds in terms of their production, transmission, and perception.

CMDIS 471: Language and Reading Development in Children
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: CMDIS 275 or PSYCH 230 or ENGL 219 or LING 219
Theories and developmental processes related to the components of language(semantics, syntax, morphology, phonology, and pragmatics); the development of metalinguistic knowledge; theories and developmental processes of reading.

CMDIS 480: Topics in Communication Disorders
(Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: CMDIS/LING 275, CMDIS/LING 371, and BIOL 255; permission of instructor.
Guided examination of topics in preparation for graduate work in Speech-Language Pathology or Audiology. Primary course delivery by WWW.

CMDIS 480A: Topics in Communication Disorders: Anatomy and Physiology of Speech and Hearing
(Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: CMDIS/LING 275, CMDIS/LING 371, and BIOL 255; permission of instructor.
Guided examination of topics in preparation for graduate work in Speech-Language Pathology or Audiology. Primary course delivery by WWW.

CMDIS 480B: Topics in Communication Disorders: Articulation and Phonological Disorders
(Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: CMDIS/LING 275, CMDIS/LING 371, and BIOL 255; permission of instructor.
Guided examination of topics in preparation for graduate work in Speech-Language Pathology or Audiology. Primary course delivery by WWW.

CMDIS 480C: Topics in Communication Disorders: Evaluation and diagnosis of communication disorders
(Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: CMDIS/LING 275, CMDIS/LING 371, and BIOL 255; permission of instructor.
Guided examination of topics in preparation for graduate work in Speech-Language Pathology or Audiology. Primary course delivery by WWW.

Communication Studies (COMST)

Courses primarily for undergraduates:

COMST 101: Introduction to Communication Studies
(3-0) Cr. 3.
An introduction to communication theory, the development and functions of communication, and a survey of verbal, nonverbal, interpersonal, small group, organizational, and intercultural communication.

COMST 101L: Introduction to Communication Studies: Laboratory
(0-2) Cr. 1.
Prereq: Concurrent enrollment in COMST 101.
Laboratory component of COMST 101. Skill building, experiential activities, and in-depth discussions relevant to the study of communication.

COMST 102: Introduction to Interpersonal Communication
(3-0) Cr. 3.
Application of communication principles, theory, and research to the process of interpersonal communication; includes verbal and nonverbal communication, listening, and conflict management. Particular emphasis given to using communication to manage interpersonal relationships.

COMST 104: Orientation to Communication Studies
(1-0) Cr. 1.
Prereq: Available only for Communication Studies majors
Orientation to Communication Studies discipline, program requirements and career opportunities. Required of communication studies majors. Offered on a satisfactory-fail basis only.

COMST 203: Introduction to Communication Research Methods
(3-0) Cr. 3.
Prereq: COMST 101
An introduction to analyzing and conducting communication research. Provides an overview of quantitative and qualitative approaches to communication research.

COMST 210: Communication and U.S. Diversity
(3-0) Cr. 3. F.S.SS.
Introduction to the role of diversity in communication. Developing competent communication with diverse social groups within interpersonal and organizational contexts in the United States. Topics may include structured reflection of one's role in diverse communication experiences, cultural variations in communication mores, impacts of racial/ethnic/gender identities on communication, workplace policies regarding cultural diversity, the intersection of communication and cultural privilege, communication practices that can reduce prejudice/discrimination, and communication characteristics of advocates for diversity.
Meets U.S. Diversity Requirement

COMST 214: Professional Communication
(3-0) Cr. 3.
Communication theory and skill development in organizational settings. Emphasis on interpersonal skill development, team and meeting facilitation, informational interviewing, individual and team presentations, and self-assessment.

COMST 218: Conflict Management
(3-0) Cr. 3.
Exploration of communication theories, principles and methods associated with effective conflict management.

COMST 301: Human Communication Theory
(3-0) Cr. 3.
Prereq: COMST 101
Examination of the major theories related to human communication; with particular emphasis on theories underlying interpersonal, small group, organizational, and intercultural communication.

COMST 310: Intercultural Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Examines the theories, principles and research on intercultural communication to enhance cultural sensitivity and to recognize, accept, and adapt to cultural diversity. Interactive assignments.
Meets International Perspectives Requirement.

COMST 311: Studies in Interpersonal Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
This class focuses on studies of contemporary interpersonal communication concepts and theories. Emphasis on research that examines issues central to communication in interpersonal relationships.

COMST 313: Leadership Communication Theories
(3-0) Cr. 3. F.S.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Investigation of theories, research and principles of leadership communication. Exploration of the contexts in which leadership and communication occurs, with emphasis on the connection between communication and leadership and the dyadic linkage of leader and follower.

COMST 314: Organizational Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Theory and research in organizational communication. Provides strategies for assessing and improving individual and organizational communication effectiveness. Addresses issues such as technology, diversity, work-life negotiation, emotional labor, conflict, socialization, and socially responsible organizations. Explores how organizational meaning is created and sustained through human communication.

COMST 317: Small Group Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Theory and research in small group communication; application to group decision-making and leadership. Includes communication analyses of groups and teams.

COMST 319: Communication Training and Development
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Theories and approaches to communication training and development; includes adult learning theory. Emphasis on the design, presentation and assessment of communication skills in organizational contexts.

COMST 325: Nonverbal Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Approaches to studying nonverbal communication. Foci include topics such as emotion, gestures, gaze, use of space, and parsing intention in social interaction.

COMST 330: Computer Mediated Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Theories and approaches related to mediated communication in interpersonal and organizational settings. Focus on how new technology impacts human interaction and relationships.

COMST 384: Applied Organizational Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102 or equivalent course.
Theory and research of micro-level organizational communication, including interpersonal and small group interactions taking place in a professional setting. Topics include interpersonal dynamics in such areas as conflict, generational communication, negotiation, superior/subordinate communication, external communication, and virtual communication. Not available for major credit.

COMST 404: Research Seminar
(Dual-listed with COMST 504). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: COMST 301 plus 3 additional communication studies classes from the following list: COMST 310, COMST 311, COMST 313, COMST 314, COMST 317, COMST 319, COMST 325, or COMST 330.
Capstone communication studies course. Students develop an original research study linked to the study of communication. Data are collected and analyzed. Results are presented in a final research paper and a presentation.

COMST 450: Special Topics in Communication Studies
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.
Research and theory related to special topics and issues in communication studies.

COMST 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 9 credits in communication studies and junior classification
Application must be submitted for approval the semester prior to the independent study.

COMST 491: Research Practicum
Cr. arr. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: COMST 203, COMST 301 plus permission of instructor.
Providing research assistance on projects conducted by Communication Studies faculty.

COMST 497: Professional Internship
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 12 hours in Communication Studies including COMST 203, COMST 301, and one other 300-level COMST class. Junior Classification. Application required.
100 hours of on-site professional work per credit hour plus completion of the academic requirement set by the internship committee. Application should be submitted in the term prior to the term in which the internship will be served. Internship cannot be used to meet degree requirement in Communication Studies.

Courses primarily for graduate students, open to qualified undergraduates:

COMST 504: Research Seminar
(Dual-listed with COMST 404). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: COMST 301 plus 3 additional communication studies classes from the following list: COMST 310, COMST 311, COMST 313, COMST 314, COMST 317, COMST 319, COMST 325, or COMST 330.
Capstone communication studies course. Students develop an original research study linked to the study of communication. Data are collected and analyzed. Results are presented in a final research paper and a presentation.

COMST 590: Special Topics
Cr. 1-4. Repeatable.
Application must be submitted for approval the semester prior to the independent study.

Community Development (C DEV)

Courses primarily for graduate students, open to qualified undergraduates:

C DEV 502: Community and Natural Resource Management
(3-0) Cr. 3.
Detailed introduction to community resource management. Theoretical frameworks, methodological investigation, applied practices. Enhancement of ability of community development professionals to work with communities to plan, develop and monitor conversation and development of natural resources with multiple functions.

C DEV 503: Community Development I: Principles and Strategies of Community Change
(3-0) Cr. 3.
Analysis of principles and practices of community change and development. Use of case studies to relate community development approaches to conceptual models from diverse disciplines. Exploration of professional practice principles, and student construction of their personal framework for practicing community development.

C DEV 504: Community Analysis: Introduction to Methods
(3-0) Cr. 3.
Introduction to research methods relevant to community development. Formulate and begin a research effort, methods of data collection and how conceptual frameworks are used to develop the questions and analyze data. Emphasis on strategies for reporting findings and applying findings in community action and methods of evaluating the entire research process. Significant attention paid to issues of research ethics and inclusiveness.

C DEV 505: Community Development II: Organizing for Community Change
(3-0) Cr. 3.
Examines role of civil society in community planning efforts. Comparative approach to planning theories and approaches. Focus on change within communities and the roles of government, planners, and citizens in reacting to or shaping change. Dimensions of social capital and the context of change covered.

C DEV 506: Community and Regional Economic Analysis I
(3-0) Cr. 3.
Introduction to concepts of communities and regions, theories of economic growth, drivers of economic growth, the economic base of a community, sources of growth or decline in the community, roles of local government and institutions, and analytical tools. Strategies for local economic development will also be explored.

C DEV 507: Introduction to Native Communities
(3-0) Cr. 3.
A base knowledge course. For students currently working within, in partnership with, or considering working with Native communities. Basic understanding within the context of community development of the diversity of the tribal structures and cultures and the unique history and jurisdictional considerations of these nations. Working with tribes, Federal and Indian relations, and governance and cultural issues.

C DEV 508: Ecological Economics
(3-0) Cr. 3.
Approaches economy and community by looking at the inherent interdependence, jointness, and potential complimentarity between ecology and economy (utility) of a place.

C DEV 509: Building Native Community and Economic Capacity
(3-0) Cr. 3.
Focus on non-western approaches to helping Native communities build their capacity. Students will learn to take a participatory, culture-centered, and strength-based approach to development.

C DEV 510: Indian Country Agriculture and Natural Resources
(3-0) Cr. 3.
Introduction to the historical and contemporary issues related to natural resource management on Native American lands. Philosophical and economic arguments concerning natural resource conservation, preservation and extraction will be explored.

C DEV 512: Sustainable Communities
(3-0) Cr. 3.
Students will learn the conceptual relationships among Community and Sustainable Development and Sustainable Communities and examine the social, environmental, and economic aspects of sustainable communities. The course includes analysis of public policy impacts on community sustainability, practical actions for enhancing sustainability, and changing power dynamics and reward structures involved in incorporating sustainability into Community Development.

C DEV 513: Economic Development Strategies and Programs
(3-0) Cr. 3.
Course explores theories of local economic development and addresses the development issues faced by communities in the 21st century. Students will understand and apply concepts from economic development planning, economic analysis, business development, human resource development, community-based development, and high-technology development.

C DEV 520: Orientation in Community Development
(2-0) Cr. 2.
Introduction to the Community Development program. Focus on on-line delivery methods, graduate level research and writing, technology skills.

C DEV 521: Housing and Development
Cr. 3. S.
Prereq: None.
Review and evaluation of historical and current housing issues, production, and financial systems, including consideration of racial, ethnic, income, and gender issues as they relate to the role of housing developments and programs in community development.

C DEV 522: Community Leadership and Capacity Building
(3-0) Cr. 3.
Defining leadership and applying it to the workplace. Understanding of potential link between leadership and community capacity. Identifying strategies for leadership development in communities.

C DEV 523: Grantwriting for Community Development Professionals
(3-0) Cr. 3.
Basic Grant Development and Management will introduce students to the grant-getting process and provide an overview of what happens after a project is funded. The following topics will be covered: researching funding sources, generating cutting edge ideas, assessing needs, planning a project, establishing credibility, formulating a sustainable budget, designing an evaluation plan, managing the funded project, and disseminating project results.

C DEV 524: Non-Profit Management in Community Development
(3-0) Cr. 3.
Understanding of how non-profit organizations are run in order that they may participate more fully in community development efforts. Learning skills necessary to assist organizations to manage community development projects and programs, such as, budgeting, planning, personnel, facilities, volunteer management, and fundraising.

C DEV 525: Role of Tribal Colleges in Economic Development
(3-0) Cr. 3.
Focus on role of tribally-chartered colleges and universities in economic development within Native communities. Social capital analytic framework to examine and evaluate tribal college model of economic development.

C DEV 526: Immigration and Community Inclusion
(3-0) Cr. 3.
Mechanisms for community inclusion and exclusion in relation to immigration will be examined. Aspects of ethnicity, religion, occupation and transnationalism are addressed in terms of community mechanism for incorporating immigrants as community assets.

C DEV 527: Public and Non-Profit Budgeting
Cr. 3. SS.
Introduction to the fundamental theories and practices of budgeting in the public and non-profit sectors. Topics covered include overview of budgeting and budget reform, taxation, expenditures, budget preparation and adoption, budget implementation, and performance budgeting.

C DEV 528: Evaluation of Organizations and Programs
(3-0) Cr. 3.
Prereq: C DEV 504 with grade of C or better
Introduction to the philosophy, techniques, and methodologies of organizational and program evaluation. Overview of program evaluation and theory, techniques to evaluate program processes and performance, evaluation designs, assessing program efficiency, models to diagnose organizations, and methods to assess organizational performance.

C DEV 530: Toward Ethical Engagement
(3-0) Cr. 3.
Understanding what ethics are and identify ethical dimensions of a problem. Ability to employ ethical analysis and engagement strategies in public problem-solving.

C DEV 532: Community and Regional Economic Analysis II
(3-0) Cr. 3.
Prereq: C DEV 506
Substantive grounding in the theories and practice of measuring community economic dynamics; build solid foundation skills for applied community economic analysis.

C DEV 542: The Policy and Politics of Coastal Areas
(Cross-listed with POL S). (3-0) Cr. 3.
Exploration of political implications of coastal policy. Issues include: "Carrying capacity," zoning, regulation of human development activities, tradeoffs between conservation and jobs, the quality of coastal lifestyle, ways in which citizens participate in policy for coastal areas.

C DEV 590: Special Topics in Community Development
Cr. 1-3. Repeatable, maximum of 4 times. F.S.SS.
Special topics in Community Development. Independent Study, must get instructor approval.

C DEV 599: Creative Component
Cr. arr.
Students work with major professor to conduct research and carry out work on their creative component. Instructor permission required.

Courses for graduate students:

C DEV 699: Thesis Research
Cr. 1-6. F.S.SS.
Thesis Research.

Community and Regional Planning (C R P)

Courses primarily for undergraduates:

C R P 201: The North American Metropolis
(3-0) Cr. 3. F.S.
Examination of the evolution of American urban centers from the colonial era to the present. Considers the demographic changes and social movements underway in urban America and explores how an understanding of the history of cities provides us with knowledge that we can use to improve our cities today.
Meets U.S. Diversity Requirement

C R P 291: World Cities and Globalization
(3-0) Cr. 3. F.S.
World cities and globalization in developed and developing countries. Topics include globalization, world cities and regions, uneven economic development, the international division of labor, multinational corporations, international environmentalism, tourism, popular culture and place- based identity.
Meets International Perspectives Requirement.

C R P 293: Environmental Planning
(Cross-listed with ENV S). (3-0) Cr. 3. F.S.
Comprehensive overview of the field of environmental relationships and the efforts being made to organize, control, and coordinate environmental, aesthetic, and cultural characteristics of land, air, and water.

C R P 301: Planning Methods Studio
(3-2) Cr. 4. S.
An introduction to the methods and analytical techniques used by planners to study community change. Course includes identification of key sources of planning information and data. Students learn to use quantitative methods for analysis of population, land use, economic and transportation data. Students learn to apply basic analytic methods to community problems and learn the art of effective written, graphic, and oral presentation of data.

C R P 320: Urban Geography
(3-0) Cr. 3. F.S.
An introduction to urban geography. Study of urban centers, including people and infrastructure. Investigation of the origin and evolution of urban areas and the processes that shape urban change. Topics include urban form, and the social, economic, political, cultural, and institutional factors that shape cities.

C R P 330: Practicum
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Major in community and regional planning
Structured work experience under close supervision of a professional planner. Practical planning experience; relationships between theory and practice, professional responsibilities, and the scope of various planning roles.

C R P 331: Professional Practice Seminar
(2-0) Cr. 2. F.
Prereq: CRP 301 and junior classification
Preparation for working as a planning professional; development of resume and portfolio; discussion of professional ethics and expectations of employers and clients; presentations from planning professionals, and discussion of the range of career choices within the planning profession.

C R P 376: Rural, Urban and Regional Economics
(Cross-listed with ECON). (3-0) Cr. 3.
Prereq: ECON 101
Firm location with respect to regional resources, transport, scale economies, externalities, and policies. Measures of local comparative advantage and specialization. Spatial markets. Population location considering jobs, wages, commuting, and local amenities. Business, residential, and farm land use and value. Migration. Other topics may include market failure, regulation, the product cycle, theories of rural and urban development, developmental policy, firm recruiting, local public goods and public finance, schools, poverty, segregation, and crime.

C R P 383: Theory of the Planning Process
(3-0) Cr. 3. F.
Prereq: Junior classification
The nature of planning and its relation to social and economic planning; levels of planning, place of planning in decision making; steps in the planning process, uses and limitation of knowledge in planning, relation of facts and values.

C R P 391: Field Travel
Cr. 1-2. Repeatable. F.S.
Prereq: CRP major and permission of instructor
Observation of professional practice and community or regional problems and issues. Offered on a satisfactory-fail basis only.

C R P 410: Professional Work Experience
Cr. R. F.S.SS.
Prereq: Permission of department chair
Approved professional work experience.

C R P 416: Urban Design and Practice
(Dual-listed with C R P 516). (3-6) Cr. 6. S.
Prereq: C R P 201
Principles of urban design and their application to residential and commercial development in studio projects.

C R P 417: Urban Revitalization
(Dual-listed with C R P 517). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Junior classification
Planning methods available to further revitalization and preservation efforts, with particular attention to housing and neighborhoods. Relationship between neighborhood change and urban development process; public policy implications.

C R P 429: Planning in Developing Countries
(Dual-listed with C R P 529). (3-0) Cr. 3. F.S.
Introduction to issues in planning and governance in an international setting. Problems and strategies may include population movement and change, economic globalization, urban growth, rural development, and housing.

C R P 432: Community Planning Studio
(1-6) Cr. 4-6. F.S.
Prereq: C R P 201, C R P 301, or permission of instructor.
Integration of planning methods and theory in dealing with a community planning problem. Analysis of problem and formulation of strategies for implementation. Preparation of a community planning report.

C R P 435: Planning in Small Towns
(Dual-listed with C R P 535). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: C R P 201 or Junior classification
Contemporary planning problems in small towns and the design of viable strategies to enhance their social and economic position in today's society.

C R P 436: Community Economic Development
(Dual-listed with C R P 536). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
The nature and process of economic development in the context of community development. Recent changes and trends and their implications for local and regional development. Selected case studies and applications. Contemporary community economic development issues.

C R P 442: Site Development
(Dual-listed with C R P 542). (3-0) Cr. 3. S.
Introduction to site development including site review. Studio project integrating concept, finance, selection, analysis, and design.

C R P 445: Transportation Policy and Planning
(Dual-listed with C R P 545). (3-0) Cr. 3. F.
Prereq: C E 350 or equivalent. Note: CRP 545 prerequisite: Graduate Classification
Comprehensive overview of key policy issues related to transportation planning and investment in the United States and abroad. Policy issues explored include safety, environmental impact, sustainable communities, and economic development. Policy analysis and planning are studied in conjunction with each policy issue explored. Issues of concern to state, metropolitan, and local governments.

C R P 451: Introduction to Geographic Information Systems
(2-2) Cr. 3. F.S.SS.
Introduction to geographic information systems, including discussions of GIS hardware, software, data structures, data acquisition, data conversion, data presentation, analytical techniques, and implementation procedures. Laboratory emphasizes practical applications and uses of GIS.

C R P 452: Geographic Data Management and Planning Analysis
(Dual-listed with C R P 552). (2-2) Cr. 3. F.S.
Prereq: C R P 451 or equivalent
Extensive coverage of geo-relational database concept and design, GIS database creation and maintenance, geographic data manipulation and analysis. GIS output generation and geographic data presentation. Laboratory emphasizes practical applications and uses of GIS.

C R P 454: Fundamentals of Remote Sensing
(Cross-listed with L A). (3-0) Cr. 3. F.
Introduction to remote sensing techniques needed for basic analysis of satellite images, including: filtering and conflation techniques, stacking, pan sharpening, image rectification, image enhancement, unsupervised and supervised classification. Practical applications in a variety of topics to understand how to interpret images.

C R P 456: GIS Programming and Automation
(Dual-listed with C R P 556). (2-2) Cr. 3. F.
Prereq: one of the following: CRP 451, CRP 551, NREM 345, NREM 546, GEOL 552
Introduction to automated geoprocessing in Geographic Information Systems. Focus on learning scripting language and object-oriented programming, automation of custom-designed geoprocessing scripts, and application toward student research and/or interests.

C R P 458: Web Mapping/GIS
(Dual-listed with C R P 558). (Cross-listed with L A). (2-2) Cr. 3.
Prereq: CRP 451/551, LA 302. GEOL 452/552 or instructor permission.
Use and development of online mapping tools to support participatory GIS, Volunteered Geographic Information, information sharing, geodesign and decision making actions. Geoprocessing and Web Scripting/coding and user interface design. Laboratory emphasis practical applications and uses of Web GIS.

C R P 459: Digital Design Methods for Landscape Architecture
(Dual-listed with C R P 559). (Cross-listed with L A). (3-0) Cr. 3. S.
Introduction to digital tools used by landscape architects for design communication, visualization, and design development. Include 2D drafting, 3D modeling, image CAD, geospatial data handling (GIS), and animation. Emphasis on concepts and workflow interoperability.

C R P 460: Social Justice and Planning
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Investigation of the topic of social justice as it relates to the challenge of planning more socially just urban societies, emphasizing the importance of social justice issues to planning in a globalized world. Includes a range of issues and case studies of local social justice initiatives, both US and global. Students will complete individual service learning projects as part of the course requirement.

C R P 475: Grant Writing
(Dual-listed with C R P 575). (1-0) Cr. 1. F.
A short introduction to effective grant writing for the public and non-profit sectors. Includes identifying appropriate funding sources for an organization, identifying goals and objectives, and budgeting.

C R P 479: Public Finance and Planning
(Dual-listed with C R P 579). (3-0) Cr. 3. S.
Effective management of state and local government finance critical to successful community and regional planning. Economic concepts, topics in budgeting, revenue, expenditure, and financing, analytical techniques, economic impact, and case studies. Understanding of economic assessment in planning and understanding of various linkages between planning and public finance.

C R P 484: Sustainable Communities
(Dual-listed with C R P 584). (Cross-listed with ENV S). (3-0) Cr. 3. S.
Prereq: Junior classification
The history and theory of sustainable community planning. Procedural and substantive dimensions. Case studies of communities engaged in sustainability planning. Use and development of indicators.

C R P 490: Independent Study
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of an approved topic commensurate with student's interest and ability. Offered on a satisfactory-fail basis only.

C R P 490H: Independent Study: Honors
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of an approved topic commensurate with student's interest and ability. Offered on a satisfactory-fail basis only.

C R P 491: Environmental Law and Planning
(Dual-listed with C R P 591). (Cross-listed with ENV S, L A). (3-0) Cr. 3. S.
Prereq: 6 credits in natural sciences
Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs.

C R P 492: Planning Law, Administration and Implementation
(3-0) Cr. 3. F.
Prereq: C R P 383
The basis in constitutional, common, and statutory law for the powers of plan implementation. Problems of balancing public and private interests as revealed in the study of leading court cases. Administration of planning agencies and programs.

C R P 494: Senior Seminar in Planning
Cr. 1-3. Repeatable, maximum of 2 times. F.S.
Prereq: Senior classification
An advanced forum for seniors that focuses upon recent trends and important issues affecting planning today. Topics addressed will vary. A demonstration of understanding of current issues and their effects upon planning applications is expected.

Courses primarily for graduate students, open to qualified undergraduates:

C R P 510: Professional Work Experience
Cr. R. F.S.SS.
Prereq: Permission of department chair
Approved professional work experience.

C R P 516: Urban Design and Practice
(Dual-listed with C R P 416). (3-6) Cr. 6. S.
Prereq: C R P 201
Principles of urban design and their application to residential and commercial development in studio projects.

C R P 517: Urban Revitalization
(Dual-listed with C R P 417). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Junior classification
Planning methods available to further revitalization and preservation efforts, with particular attention to housing and neighborhoods. Relationship between neighborhood change and urban development process; public policy implications.

C R P 519: Middle Eastern Cities
(Cross-listed with ARCH). (3-0) Cr. 3.
Prereq: Graduate or Senior classification
Introduction to basic academic writings on Middle Eastern cities in addition to other contemporary cultural productions of the region. Study of various aspects of Middle Eastern life and the built environments that this life produces.
Meets International Perspectives Requirement.

C R P 529: Planning in Developing Countries
(Dual-listed with C R P 429). (3-0) Cr. 3. F.S.
Introduction to issues in planning and governance in an international setting. Problems and strategies may include population movement and change, economic globalization, urban growth, rural development, and housing.

C R P 530: Practicum
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification in Community and Regional Planning
Practical planning experience. Structured work in range of tasks under close supervision of a professional planner. Relationships between theory and practice, exposure to variety of roles in functioning specialties. Offered on a satisfactory-fail basis only.

C R P 532: Community Planning Studio
(1-6) Cr. 4. F.
Prereq: C R P 564 or equivalent
Comprehension and analysis of various geographic contexts pertinent to community planning and the use of planning theory, tools and techniques in an applied setting. Process of making a community plan: historical patterns, current conditions and strategies for planning.

C R P 535: Planning in Small Towns
(Dual-listed with C R P 435). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: C R P 201 or Junior classification
Contemporary planning problems in small towns and the design of viable strategies to enhance their social and economic position in today's society.

C R P 536: Community Economic Development
(Dual-listed with C R P 436). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
The nature and process of economic development in the context of community development. Recent changes and trends and their implications for local and regional development. Selected case studies and applications. Contemporary community economic development issues.

C R P 542: Site Development
(Dual-listed with C R P 442). (3-0) Cr. 3. S.
Introduction to site development including site review. Studio project integrating concept, finance, selection, analysis, and design.

C R P 545: Transportation Policy and Planning
(Dual-listed with C R P 445). (3-0) Cr. 3. F.
Prereq: C E 350 or equivalent. Note: CRP 545 prerequisite: Graduate Classification
Comprehensive overview of key policy issues related to transportation planning and investment in the United States and abroad. Policy issues explored include safety, environmental impact, sustainable communities, and economic development. Policy analysis and planning are studied in conjunction with each policy issue explored. Issues of concern to state, metropolitan, and local governments.

C R P 551: Introduction to Geographic Information Systems
(2-2) Cr. 3. F.S.SS.
Introduction to geographic information systems, including discussions of GIS hardware, software, data structures, data acquisition, data conversion, data presentation, analytical techniques, and implementation procedures. Laboratory emphasizes practical applications and uses of GIS.

C R P 552: Geographic Data Management and Planning Analysis
(Dual-listed with C R P 452). (2-2) Cr. 3. F.S.
Prereq: C R P 451 or equivalent
Extensive coverage of geo-relational database concept and design, GIS database creation and maintenance, geographic data manipulation and analysis. GIS output generation and geographic data presentation. Laboratory emphasizes practical applications and uses of GIS.

C R P 553: Analytical Planning/GIS
(2-2) Cr. 3. F.
Prereq: C R P 451/C R P 551
Integration of exploratory, participatory and predictive spatial analyses and 3D visualization into the planning process. GIS tools and techniques are used to automate decision analysis and facilitate future planning in analyzing and visualizing planning actions. Laboratory emphasizes practical uses of GIS tools and techniques.

C R P 556: GIS Programming and Automation
(Dual-listed with C R P 456). (2-2) Cr. 3. F.
Prereq: one of the following: CRP 451, CRP 551, NREM 345, NREM 546, GEOL 552
Introduction to automated geoprocessing in Geographic Information Systems. Focus on learning scripting language and object-oriented programming, automation of custom-designed geoprocessing scripts, and application toward student research and/or interests.

C R P 558: Web Mapping/GIS
(Dual-listed with C R P 458). (Cross-listed with L A). (2-2) Cr. 3.
Prereq: CRP 451/551, LA 302. GEOL 452/552 or instructor permission.
Use and development of online mapping tools to support participatory GIS, Volunteered Geographic Information, information sharing, geodesign and decision making actions. Geoprocessing and Web Scripting/coding and user interface design. Laboratory emphasis practical applications and uses of Web GIS.

C R P 559: Digital Design Methods for Landscape Architecture
(Dual-listed with C R P 459). (Cross-listed with L A). (3-0) Cr. 3. S.
Introduction to digital tools used by landscape architects for design communication, visualization, and design development. Include 2D drafting, 3D modeling, image CAD, geospatial data handling (GIS), and animation. Emphasis on concepts and workflow interoperability.

C R P 561: Planning Theory for Practice
(3-0) Cr. 3. S.
Use and development of theory/action relationship in planning practice. Competing normative theories of planning and their evolution, key components and fundamental critiques. Exploration of planning frameworks and approaches, including comprehensive planning; incrementalism; advocacy; communicative rationality; and others.

C R P 563: Planning the American Metropolis
(3-0) Cr. 3. F.
Focus on the historical role of planning in the shaping of American cities and regions, from the beginning of the Republic to the present. Examine the legacy of planning by exploring the intersection of design, politics and policy. Investigate the factors and the processes that produce the built environment.

C R P 564: Introduction to Analytical Methods for Planning
(3-0) Cr. 3. F.
Applications of analytical methods in planning with emphasis on the collection, description, analysis, presentation, and interpretation of planning data. Introduction to descriptive statistics. Sources of planning information and data including primary and secondary data types and sources. Demographic analysis, population projection techniques for planning at local and regional levels.

C R P 566: Policy Analysis and Planning
(3-0) Cr. 3. F.
Principles and methods for analyzing community problems and policies including forecasting, efficiency and equity measures, cost/benefit, political feasibility, and sensitivity analysis. Examination of social, political, economic, and environmental values and their manifestation in decision making methods used in planning. Application of tools used to analyze planning problems, project evaluation and public policies.

C R P 568: Planning and Development
(3-0) Cr. 3. S.
Prereq: C R P 564 or equivalent
Exploration and evaluation of the techniques, processes, and professional skills required to effectively manage land use change at various scales. Land classification systems; land supply and needs inventory for residential uses and commercial and employment centers; capacity and needs analysis for public infrastructure. Includes land use planning project(s) designed to apply the methods explored in this and other courses.

C R P 575: Grant Writing
(Dual-listed with C R P 475). (1-0) Cr. 1. F.
A short introduction to effective grant writing for the public and non-profit sectors. Includes identifying appropriate funding sources for an organization, identifying goals and objectives, and budgeting.

C R P 579: Public Finance and Planning
(Dual-listed with C R P 479). (3-0) Cr. 3. S.
Effective management of state and local government finance critical to successful community and regional planning. Economic concepts, topics in budgeting, revenue, expenditure, and financing, analytical techniques, economic impact, and case studies. Understanding of economic assessment in planning and understanding of various linkages between planning and public finance.

C R P 584: Sustainable Communities
(Dual-listed with C R P 484). (3-0) Cr. 3. S.
Prereq: Junior classification
The history and theory of sustainable community planning. Procedural and substantive dimensions. Case studies of communities engaged in sustainability planning. Use and development of indicators.

C R P 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590A: Special Topics: Planning Law, Administration and Implementation
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590B: Special Topics: Economic Development
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590C: Special Topics: Urban Design
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590D: Special Topics: Housing and Urban Revitalization
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590H: Special Topics: Environmental Planning
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590I: Special Topics: Land Use and Transportation Planning
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590N: Special Topics: International Planning
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590O: Special Topics: Spatial Analytical Methods
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590P: Special Topics: Planning in Small Towns
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590Q: Special Topics: Diversity and Equity in Planning
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590R: Special Topics: Geographic Information Systems
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 591: Environmental Law and Planning
(Dual-listed with C R P 491). (Cross-listed with L A). (3-0) Cr. 3. S.
Prereq: 6 credits in natural sciences
Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs.

C R P 592: Land Use and Development Regulation Law
(3-0) Cr. 3. F.
An in-depth analysis of the legal constructs that shape the practice of planning and plan implementation in the United States. An exploration of how land use regulations are applied to reconcile the competing needs and diverse uses of land. The positive and negative consequences of developing and implementing regulatory controls will be addressed.

C R P 595: Seminar in GIS Applications/Research
(1-0) Cr. 1. F.S.
Prereq: 9 credits in GIS Certificate program
Discussion and demonstration of current GIS applications and research in multiple disciplines. Offered on a satisfactory-fail basis only.

C R P 599: Professional Planning Report
Cr. arr. Repeatable.
Independent planning project with practical application, including research element.

Courses for graduate students:

C R P 698: Capstone Studio
(1-6) Cr. 4. S.
Prereq: Permission of instructor.
Synthesis and integration of core planning knowledge into professional work in a team setting.

C R P 699: Research
Cr. arr. Repeatable.

Complex Adaptive Systems (CAS)

Computer Engineering (CPR E)

Courses primarily for undergraduates:

CPR E 131: Introduction to Computer Security Literacy
(Cross-listed with INFAS). (1-0) Cr. 1.
Basic concepts of practical computer and Internet security: passwords, firewalls, antivirus software, malware, social networking, surfing the Internet, phishing, and wireless networks. This class is intended for students with little or no background in information technology or security. Basic knowledge of word processing required. Offered on a satisfactory-fail basis only.

CPR E 166: Professional Programs Orientation
(Cross-listed with E E). Cr. R. F.S.
(1-0) Overview of the nature and scope of electrical engineering and computer engineering professions. Overview of portfolios. Departmental rules, student services operations, degree requirements, program of study planning, career options, and student organizations.

CPR E 185: Introduction to Computer Engineering and Problem Solving I
(2-2) Cr. 3.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Introduction to Computer Engineering. Project based examples from computer engineering. Individual interactive skills for small and large groups. Computer-based projects. Solving engineering problems and presenting solutions through technical reports. Solution of engineering problems using a programming language.

CPR E 186: Introduction to Computer Engineering and Problem Solving II
(0-2) Cr. 1. S.
Prereq: CPR E 185
Project based examples from computer engineering. Group skills needed to work effectively in teams. Group problem solving. Computer based projects. Technical reports and presentations. Students will work on 2 or 3 self-directed team based projects that are representative of problems faced by computer engineers.

CPR E 231: Cyber Security Concepts and Tools
(2-3) Cr. 3.
Prereq: COM S 107, COM S 207, COM S 227, or E E 285
Basic concepts of practical computer and Internet security and the tools used to protect and attack systems and networks. Computer and network security methods including: user authentication, access control, firewalls, intrusion detection and wireless networks. Vulnerability assessment tools and methods. Ethics and legal issues in cyber security. Laboratory experiments and exercises including computer and network configuration.

CPR E 261: Transfer Orientation
(Cross-listed with E E). Cr. R.
Introduction to the College of Engineering and the engineering profession specifically for transfer students. Information concerning university and college policies, procedures, and resources. Offered on a satisfactory-fail basis only.

CPR E 281: Digital Logic
(3-3) Cr. 4. F.S.
Prereq: sophomore classification
Number systems and representation. Boolean algebra and logic minimization. Combinational and sequential logic design. Arithmetic circuits and finite state machines. Use of programmable logic devices. Introduction to computer-aided schematic capture systems, simulation tools, and hardware description languages. Design of simple digital systems.

CPR E 288: Embedded Systems I: Introduction
(3-2) Cr. 4. F.S.
Prereq: CPR E 281, COM S 207 or COM S 227 or E E 285
Embedded C programming. Interrupt handling. Memory mapped I/O in the context of an application. Elementary embedded design flow/ methodology. Timers, scheduling, resource allocation, optimization, state machine based controllers, real time constraints within the context of an application. Applications laboratory exercises with embedded devices.

CPR E 294: Program Discovery
(Cross-listed with E E). Cr. R.
Prereq: CPR E 166 or E E 166
The roles of professionals in computer and electrical engineering. Relationship of coursework to industry and academic careers. Issues relevant to today's world. Offered on a satisfactory-fail basis only.

CPR E 308: Operating Systems: Principles and Practice
(3-3) Cr. 4. F.S.
Prereq: CPR E 381 or COM S 321
Operating system concepts, processes, threads, synchronization between threads, process and thread scheduling, deadlocks, memory management, file systems, I/O systems,security, Linux-based lab experiments.

CPR E 310: Theoretical Foundations of Computer Engineering
(3-1) Cr. 3. F.S.
Prereq: COM S 228
Propositional logic and methods of proof; set theory and its applications; mathematical induction and recurrence relations; functions and relations; and counting; trees and graphs; applications in computer engineering.

CPR E 315: Applications of Algorithms in Computer Engineering
(3-0) Cr. 3. F.S.SS.
Prereq: CPR E 310
Solving computer engineering problems using algorithms. Emphasis on problems related to the core focus areas in computer engineering. Real world examples of algorithms used in the computer engineering domain. Algorithm engineering. Prototyping of algorithms.

CPR E 329: Software Project Management
(Cross-listed with S E). (3-0) Cr. 3.
Prereq: COM S 309
Process-based software development. Capability Maturity Model (CMM). Project planning, cost estimation, and scheduling. Project management tools. Factors influencing productivity and success. Productivity metrics. Analysis of options and risks. Version control and configuration management. Inspections and reviews. Managing the testing process. Software quality metrics. Modern software engineering techniques and practices.

CPR E 330: Integrated Electronics
(Cross-listed with E E). (3-3) Cr. 4.
Prereq: E E 201, credit or enrollment in E E 230, CPR E 281
Semiconductor technology for integrated circuits. Modeling of integrated devices including diodes, BJTs, and MOSFETs. Physical layout. Circuit simulation. Digital building blocks and digital circuit synthesis. Analysis and design of analog building blocks. Laboratory exercises and design projects with CAD tools and standard cells.

CPR E 332: Cyber Defense Competition
(Cross-listed with INFAS). (0-2) Cr. 1. Repeatable. S.
Participation in cyber defense competition driven by scenario-based network design. Includes computer system setup, risk assessment and implementation of security systems, as well as defense of computer and network systems against trained attackers. Team based. Offered on a satisfactory-fail basis only.

CPR E 339: Software Architecture and Design
(Cross-listed with S E). (3-0) Cr. 3.
Prereq: S E 319
Modeling and design of software at the architectural level. Architectural styles. Basics of model-driven architecture. Object-oriented design and analysis. Iterative development and unified process. Design patterns. Design by contract. Component based design. Product families. Measurement theory and appropriate use of metrics in design. Designing for qualities such as performance, safety, security, reliability, reusability, etc. Analysis and evaluation of software architectures. Introduction to architecture definition languages. Basics of software evolution, reengineering, and reverse engineering. Case studies. Introduction to distributed system software.

CPR E 370: Toying with Technology
(Cross-listed with MAT E). (2-2) Cr. 3. F.S.
Prereq: C I 201 or C I 202
A project-based, hands-on learning course. Technology literacy, appreciation for technological innovations, principles behind many technological innovations, hands-on laboratory experiences based upon simple systems constructed out of LEGOs and controlled by small microcomputers. Future K-12 teachers will leave the course with complete lesson plans for use in their upcoming careers.

CPR E 381: Computer Organization and Assembly Level Programming
(3-2) Cr. 4. F.S.
Prereq: CPR E 288
Introduction to computer organization, evaluating performance of computer systems, instruction set design. Assembly level programming: arithmetic operations, control flow instructions, procedure calls, stack management. Processor design. Datapath and control, scalar pipelines, introduction to memory and I/O systems.

CPR E 388: Embedded Systems II: Mobile Platforms
(3-2) Cr. 4.
Prereq: CPR E 288
Contemporary programming techniques for event driven systems. Mobile platforms and operating systems. Location and motion sensors based user interfaces. Threading and scheduling. Resource management - measurement and control techniques - for memory and energy. Client-server application design. Distributed applications. Laboratory includes exercises based on a mobile platform.

CPR E 394: Program Exploration
(Cross-listed with E E). Cr. R.
Prereq: CPR E 294 or E E 294
Exploration of academic and career fields for electrical and computer engineers. Examination of professionalism in the context of engineering and technology with competencies based skills. Introduction to professional portfolio development and construction. Offered on a satisfactory-fail basis only.

CPR E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

CPR E 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

CPR E 412: Formal Methods in Software Engineering
(Cross-listed with COM S, S E). (3-0) Cr. 3. S.
Prereq: COM S 230 or CPR E 310; COM S 311, STAT 330; for graduate credit: graduate standing or permission of instructor
A study of formal techniques for model-based specification and verification of software systems. Topics include logics, formalisms, graph theory, numerical computations, algorithms and tools for automatic analysis of systems. Graduate credit requires in-depth study of concepts.

CPR E 416: Software Evolution and Maintenance
(Cross-listed with S E). (3-0) Cr. 3.
Prereq: COM S 309
Practical importance of software evolution and maintenance, systematic defect analysis and debugging techniques, tracing and understanding large software, impact analysis, program migration and transformation, refactoring, tools for software evolution and maintenance, experimental studies and quantitative measurements of software evolution. Written reports and oral presentation.

CPR E 418: High Speed System Engineering Measurement and Testing
(Cross-listed with E E). (3-2) Cr. 4. F.
Prereq: E E 230 and E E 311
Measurement of high speed systems and mixed signal systems. Measurement accuracy and error. Network analysis and spectrum analysis used in high speed measurement and testing. Test specification process and parametric measurement. Sampling and digital signal processing concepts. Design for testability. Testing equipment. Applications.

CPR E 419: Software Tools for Large Scale Data Analysis
(Cross-listed with S E). (3-3) Cr. 4.
Prereq: CPR E 308 or COM S 352, COM S 309
Software tools for managing and manipulating large volumes of data, external memory processing, large scale parallelism, and stream processing, data interchange formats. Weekly programming labs that involve the use of a parallel computing cluster.

CPR E 424: Introduction to High Performance Computing
(Cross-listed with COM S, MATH). (2-2) Cr. 3. F.
Prereq: MATH 265; MATH 207 or MATH 317
UNIX, serial programming for high performance, OpenMP for high performance, shared memory parallelization. Semester project required.

CPR E 425: High Performance Computing for Scientific and Engineering Applications
(Cross-listed with COM S). (3-1) Cr. 3. S.
Prereq: COM S 311, COM S 230, ENGL 250, SP CM 212
Introduction to high performance computing platforms including parallel computers and workstation clusters. Discussion of parallel architectures, performance, programming models, and software development issues. Sample applications from science and engineering. Practical issues in high performance computing will be emphasized via a number of programming projects using a variety of programming models and case studies. Oral and written reports.

CPR E 426: Introduction to Parallel Algorithms and Programming
(Dual-listed with CPR E 526). (Cross-listed with COM S). (3-2) Cr. 4. F.
Prereq: CPR E 308 or COM S 321, CPR E 315 or COM S 311
Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms.

CPR E 430: Network Protocols and Security
(Dual-listed with CPR E 530). (Cross-listed with INFAS). (3-0) Cr. 3.
Prereq: CPR E 381 or equivalent
Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

CPR E 431: Basics of Information System Security
(3-0) Cr. 3. S.
Prereq: credit or enrollment in CPR E 308 or COM S 352
Introduction to and application of basic mechanisms for protecting information systems from accidental and intentional threats. Basic cryptography use and practice. Computer security issues including authentication, access control, and malicious code. Network security mechanisms such as intrusion detection, firewalls, IPSEC, and related protocols. Ethics and legal issues in information security. Wireless security. Programming and system configuration assignments.

CPR E 435: Analog VLSI Circuit Design
(Cross-listed with E E). (3-3) Cr. 4. S.
Prereq: E E 324, E E 330, E E 332, and either E E 322 or STAT 330
Basic analog integrated circuit and system design including design space exploration, performance enhancement strategies, operational amplifiers, references, integrated filters, and data converters.

CPR E 444: Bioinformatic Analysis
(Cross-listed with BCB, BCBIO, BIOL, COM S, GEN). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

CPR E 450: Distributed Systems and Middleware
(Dual-listed with CPR E 550). (3-0) Cr. 3.
Prereq: CPR E 308 or COM S 352
Fundamentals of distributed computing, software agents, naming services, distributed transactions, security management, distributed object-based systems, web-based systems, middleware-based application design and development, case studies of middleware and internet applications.

CPR E 454: Distributed Systems
(Dual-listed with CPR E 554). (Cross-listed with COM S). (3-1) Cr. 3. S.
Prereq: COM S 311, COM S 352; for graduate credit: graduate standing or permission of instructor
(3-1) Cr. 3. Theoretical and practical issues of design and implementation of distributed systems. The client server paradigm, inter-process communications, synchronization and concurrency control, naming, consistency and replication, fault tolerance, and distributed file systems. Graduate credit requires additional in-depth study of concepts. Programming projects and written reports.

CPR E 458: Real Time Systems
(Dual-listed with CPR E 558). (3-0) Cr. 3.
Prereq: CPR E 308 or COM S 352
Fundamental concepts in real-time systems. Real time task scheduling paradigms. Resource management in uniprocessor, multiprocessor, and distributed real-time systems. Fault-tolerance, resource reclaiming, and overload handling. Real-time channel, packet scheduling, and real-time LAN protocols. Case study of real-time operating systems. Laboratory experiments.

CPR E 465: Digital VLSI Design
(Cross-listed with E E). (3-3) Cr. 4. S.
Prereq: E E 330
Digital design of integrated circuits employing very large scale integration (VLSI) methodologies. Technology considerations in design. High level hardware design languages, CMOS logic design styles, area-energy-delay design space characterization, datapath blocks: arithmetic and memory, architectures and systems on a chip (SOC) considerations. VLSI chip hardware design project.

CPR E 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, AER E, B M E, E E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

CPR E 467: Multidisciplinary Engineering Design II
(Cross-listed with AER E, E E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: Student must be within two semesters of graduation or receive permission of instructor.
Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

CPR E 480: Graphics Processing and Architecture
(3-3) Cr. 4. S.
Prereq: CPR E 381 or COM S 321
Introduction to hardware architectures for computer graphics and their programming models. System-level view, including framebuffers, video output devices, displays, 2D and 3D graphics acceleration, and device interfacing. Architectural design of GPUs, from 2D and 3D sprite engines to 3D rendering pipelines to unified shader architectures. Computing models for graphics processors. GPGPU and GPU computing.

CPR E 483: Hardware Software Integration
(3-3) Cr. 4. S.
Prereq: CPR E 381
Embedded system design using hardware description language (HDL) and field programmable gate array (FPGA). HDL modeling concepts and styles are introduced; focus on synthesizability, optimality, reusability and portability in hardware design description. Introduction to complex hardware cores for data buffering, data input/output interfacing, data processing. System design with HDL cores and implementation in FPGA. Laboratory-oriented design projects.

CPR E 488: Embedded Systems Design
(3-3) Cr. 4.
Prereq: CPR E 381 or COM S 321
Embedded microprocessors, embedded memory and I/O devices, component interfaces, embedded software, program development, basic compiler techniques, platform-based FPGA technology, hardware synthesis, design methodology, real-time operating system concepts, performance analysis and optimizations.

CPR E 489: Computer Networking and Data Communications
(3-2) Cr. 4. F.S.
Prereq: CPR E 381 or E E 324
Modern computer networking and data communications concepts. TCP/IP, OSI protocols, client server programming, data link protocols, local area networks, and routing protocols.

CPR E 490: Independent Study
Cr. arr. Repeatable.
Prereq: Senior classification in computer engineering
Investigation of an approved topic.

CPR E 490H: Independent Study: Honors
Cr. arr. Repeatable.
Prereq: Senior classification in computer engineering
Investigation of an approved topic.

CPR E 491: Senior Design Project I and Professionalism
(Cross-listed with E E). (2-3) Cr. 3. F.S.
Prereq: E E 322 or CPR E 308, completion of 24 credits in the E E core professional program or 29 credits in the Cpr E core professional program, ENGL 314
Preparing for entry to the workplace. Selected professional topics. Use of technical writing skills in developing project plan and design report; design review presentation. First of two-semester team-oriented, project design and implementation experience.

CPR E 492: Senior Design Project II
(Cross-listed with E E). (1-3) Cr. 2. F.S.
Prereq: CPR E 491 or E E 491
Second semester of a team design project experience. Emphasis on the successful implementation and demonstration of the design completed in E E 491 or Cpr E 491 and the evaluation of project results. Technical writing of final project report; oral presentation of project achievements; project poster.

CPR E 494: Portfolio Assessment
(Cross-listed with E E). Cr. R.
Prereq: CPR E 394 or E E 394, credit or enrollment in CPR E 491 or E E 491
Portfolio update and evaluation. Portfolios as a tool to enhance career opportunities.

Courses primarily for graduate students, open to qualified undergraduates:

CPR E 501: Analog and Mixed-Signal VLSI Circuit Design Techniques
(Cross-listed with E E). (3-3) Cr. 4. F.
Prereq: E E 435
Design techniques for analog and mixed-signal VLSI circuits. Amplifiers; operational amplifiers, transconductance amplifiers, finite gain amplifiers and current amplifiers. Linear building blocks; differential amplifiers, current mirrors, references, cascading and buffering. Performance characterization of linear integrated circuits; offset, noise, sensitivity and stability. Layout considerations, simulation, yield and modeling for high-performance linear integrated circuits.

CPR E 504: Power Management for VLSI Systems
(Cross-listed with E E). (3-3) Cr. 4.
Prereq: E E 435, Credit or Registration for E E 501
Theory, design and applications of power management and regulation circuits (Linear and switching regulators, battery chargers, and reference circuits) including: Architectures, Performance metrics and characterization, Noise and stability analysis, Practical implementation and on-chip integration issues, design considerations for portable, wireless, and RF SoCs.

CPR E 505: CMOS and BiCMOS Data Conversion Circuits
(Cross-listed with E E). (3-3) Cr. 4. Alt. S., offered even-numbered years.
Prereq: E E 501
Theory, design and applications of data conversion circuits (A/D and D/A converters) including: architectures, characterization, quantization effects, conversion algorithms, spectral performance, element matching, design for yield, and practical comparators, implementation issues.

CPR E 506: Design of CMOS Phase-Locked Loops
(Cross-listed with E E). (3-3) Cr. 4.
Prereq: E E 435 or E E 501 or instructor approval
Analysis and design of phase-locked loops implemented in modern CMOS processes including: architectures, performance metrics, and characterization; noise and stability analysis; and design issues of phase-frequency detectors, charge pumps, loop filters (passive and active), voltage controlled oscillators, and frequency dividers.

CPR E 507: VLSI Communication Circuits
(Cross-listed with E E). (3-3) Cr. 4. Alt. S., offered odd-numbered years.
Prereq: E E 435 or E E 501
Phase-locked loops, frequency synthesizers, clock and data recovery circuits, theory and implementation of adaptive filters, low-noise amplifiers, mixers, power amplifiers, transmitter and receiver architectures.

CPR E 511: Design and Analysis of Algorithms
(Cross-listed with COM S). (3-0) Cr. 3. F.
Prereq: COM S 311
A study of basic algorithm design and analysis techniques. Advanced data structures, amortized analysis and randomized algorithms. Applications to sorting, graphs, and geometry. NP-completeness and approximation algorithms.

CPR E 522: Cognitive Radio Networks
(Cross-listed with E E). (3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: Permission of instructor
Topics on cognitive radio networks: Cognitive Radio Networks Architecture; Software Defined Radio Architecture; Spectrum Sensing; Spectrum Management; Spectrum Sharing; Spectrum Mobility; Applications of Cognitive Radio Networks.

CPR E 525: Numerical Analysis of High Performance Computing
(Cross-listed with COM S, MATH). (3-0) Cr. 3. S.
Prereq: CPR E 308 or MATH 481; experience in scientific programming; knowledge of FORTRAN or C
Introduction to parallelization techniques and numerical methods for distributed memory high performance computers. A semester project in an area related to each student's research interests is required.

CPR E 526: Introduction to Parallel Algorithms and Programming
(Dual-listed with CPR E 426). (Cross-listed with COM S). (3-2) Cr. 4. F.
Prereq: CPR E 308 or COM S 321, CPR E 315 or COM S 311
Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms.

CPR E 528: Probabilistic Methods in Computer Engineering
(3-0) Cr. 3.
Prereq: CPR E 315 or COM S 311
The application of randomization and probabilistic methods in the design of computer algorithms, and their efficient implementation. Discrete random variables in modeling algorithm behavior, with applications to sorting, selection, graph algorithms, hashing, pattern matching, cryptography, distributed systems, and massive data set algorithmics.

CPR E 530: Network Protocols and Security
(Dual-listed with CPR E 430). (Cross-listed with INFAS). (3-0) Cr. 3.
Prereq: CPR E 381 or equivalent
Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

CPR E 531: Information System Security
(Cross-listed with INFAS). (3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530 or COM S 586 or MIS 535
Computer, software, and data security: basic cryptography, security policies, multilevel security models, attack and protection mechanisms, legal and ethical issues.

CPR E 532: Information Warfare
(Cross-listed with INFAS). (3-0) Cr. 3. S.
Prereq: CPR E 531
Computer system and network security: implementation, configuration, testing of security software and hardware, network monitoring. Authentication, firewalls, vulnerabilities, exploits, countermeasures. Study and use of attack tools. Ethics in information assurance. Emphasis on laboratory experiments.

CPR E 533: Cryptography
(Cross-listed with INFAS, MATH). (3-0) Cr. 3. S.
Prereq: MATH 301 or CPR E 310 or COM S 330
Basic concepts of secure communication, DES and AES, public-key cryptosystems, elliptic curves, hash algorithms, digital signatures, applications. Relevant material on number theory and finite fields.

CPR E 534: Legal and Ethical Issues in Information Assurance
(Cross-listed with INFAS, POL S). (3-0) Cr. 3. S.
Prereq: Graduate classification; CPR E 531 or INFAS 531
Legal and ethical issues in computer security. State and local codes and regulations. Privacy issues.

CPR E 535: Steganography and Digital Image Forensics
(Cross-listed with INFAS, MATH). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E E 524 or MATH 317 or MATH 407 or COM S 330
Basic principles of covert communication, steganalysis, and forensic analysis for digital images. Steganographic security and capacity, matrix embedding, blind attacks, image forensic detection and device identification techniques. Related material on coding theory, statistics, image processing, pattern recognition.

CPR E 536: Computer and Network Forensics
(Cross-listed with INFAS). (3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530
Fundamentals of computer and network forensics, forensic duplication and analysis, network surveillance, intrusion detection and response, incident response, anonymity and pseudonymity, privacy-protection techniques, cyber law, computer security policies and guidelines, court testimony and report writing, and case studies. Emphasis on hands-on experiments.

CPR E 537: Wireless Network Security
(3-0) Cr. 3. S.
Prereq: Credit or enrollment in CPR E 489 or CPR E 530
Introduction to the physical layer and special issues associated with the security of wireless networks. The basics of wireless communication systems (antennas and propagation, modulation, multiple access, channel modeling, specific security issues of the wireless link), jamming and countermeasures (spread spectrum technologies, channel coding, interleaving), authentication and confidentiality (basics of classic cryptography, common authentication and encryption algorithms). Detailed case studies on authentication, encryption and privacy flaws, and good practices based on the most common wireless technologies, including WiFi, GSM/3G, Bluetooth, and RFID. Individual or team-based class projects.

CPR E 538: Reverse Engineering and Security Testing
(Cross-listed with INFAS). (2-3) Cr. 3. S.
Prereq: COM S 321 or CPR E 381, COM S 352 or CPR E 308
Techniques and tools for understanding the behavior of software/hardware systems based on reverse engineering. Flaw hypothesis, black, grey, and white box testing as well as other methods for testing the security of software systems. Discussion of counter-reverse engineering techniques.

CPR E 539: Cyber Physical System Security for the Smart Grid
(3-0) Cr. 3. S.
Introduction to cyber security, cyber physical system (CPS), and smart grid automation technologies; supervisor control and data acquisition (SCADA) systems; cyber risk modeling, vulnerability analysis, impact analysis, defense and mitigation techniques; cyber security of wide-area monitoring, protection, and control; security and privacy in advanced metering infrastructure (AMI), cyber security compliance and best practices, CPS security test-beds and attack-defense hands-on laboratory experiments.

CPR E 541: High-Performance Communication Networks
(3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530
Computer architectures and protocols designed for high-performance networking environments; software defined networking (SDN) and supporting protocols; cloud and data center networks; network traffic management and congestion control strategies; quality of service; high-speed access network protocols.

CPR E 542: Optical Communication Networks
(3-0) Cr. 3. S.
Prereq: CPR E 489
Optical components and interfaces; optical transmission and reception techniques; wavelength division multiplexing; network architectures and protocol for first generation, single and multihop optical network; routing and wavelength assignment in second generation wavelength routing networks; traffic grooming, optical network control; survivability; access networks; metro networks.

CPR E 543: Wireless Network Architecture
(3-0) Cr. 3.
Prereq: Credit or enrollment in CPR E 489 or CPR E 530
Introduction to the protocol architecture of the data link layer, network layer and transport layer for wireless networking. Operation and management of Medium Access Control in Wireless Local Area Networks (WLAN) and Wireless Metropolitan Area Networks (WMAN); recent developments in IEEE 802.11 & 802.16 and Bluetooth; Mobile IP; Mobile TCP.

CPR E 544: Fundamentals of Bioinformatics
(Cross-listed with BCB, COM S, GDCB). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent
A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies.

CPR E 545: Fault-Tolerant Systems
(3-0) Cr. 3.
Prereq: CPR E 381
Faults and their manifestations, errors, and failures; fault detection, location and reconfiguration techniques; time, space, and information (coding) redundancy management; design for testability; self-checking and fail-safe circuits; system-level fault diagnosis; Byzantine agreement; stable storage and RAID; clock synchronization; fault-tolerant networks; fault tolerance in real-time systems; reliable software design; checkpointing and rollback recovery; atomic actions; replica management protocols; and reliability evaluation techniques and tools.

CPR E 546: Wireless and Sensor Networks
(3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530
Fundamental and well-known protocols for wireless ad hoc and sensor networks at various layers, including physical layer issues, MAC (medium access control) layer protocols, routing protocols for wireless ad hoc and sensor networks, data management in sensor networks, coverage and connectivity, localization and tracking, security and privacy issues. Introduction to TinyOS and the nesC language. Hands-on experiments with Crossbow Mote sensor devices.

CPR E 547: Resource Allocation in Communication Networks
(3-0) Cr. 3.
Analytical approach to resource allocation on communication networks (e.g. the Internet, multihop wireless networks, etc.). Network utility maximization and the internet congestion control algorithm. Layering as optimization decomposition: a cross-layer design approach in multihop wireless networks. Capacity of ad hoc wireless networks.

CPR E 549: Advanced Algorithms in Computational Biology
(Cross-listed with COM S). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: COM S 311 and either COM S 228 or COM S 208
Design and analysis of algorithms for applications in computational biology, pairwise and multiple sequence alignments, approximation algorithms, string algorithms including in-depth coverage of suffix trees, semi-numerical string algorithms, algorithms for selected problems in fragment assembly, phylogenetic trees and protein folding. No background in biology is assumed. Also useful as an advanced algorithms course in string processing.

CPR E 550: Distributed Systems and Middleware
(Dual-listed with CPR E 450). (3-0) Cr. 3.
Prereq: CPR E 308 or COM S 352
Fundamentals of distributed computing, software agents, naming services, distributed transactions, security management, distributed object-based systems, web-based systems, middleware-based application design and development, case studies of middleware and internet applications.

CPR E 554: Distributed Systems
(Dual-listed with CPR E 454). (Cross-listed with COM S). (3-1) Cr. 3. S.
Prereq: COM S 311, COM S 352; for graduate credit: graduate standing or permission of instructor
(3-1) Cr. 3. Theoretical and practical issues of design and implementation of distributed systems. The client server paradigm, inter-process communications, synchronization and concurrency control, naming, consistency and replication, fault tolerance, and distributed file systems. Graduate credit requires additional in-depth study of concepts. Programming projects and written reports.

CPR E 556: Scalable Software Engineering
(3-0) Cr. 3.
Prereq: COM S 309
Design and analysis techniques scalable to large software, project-based learning of problem solving techniques, automation tools for high productivity and reliability of software, analysis-based measurement and estimation techniques for predictable software engineering.

CPR E 557: Computer Graphics and Geometric Modeling
(Cross-listed with COM S, M E). (3-0) Cr. 3. F.
Prereq: M E 421, programming experience in C
Fundamentals of computer graphics technology. Data structures. Parametric curve and surface modeling. Solid model representations. Applications in engineering design, analysis, and manufacturing.

CPR E 558: Real Time Systems
(Dual-listed with CPR E 458). (3-0) Cr. 3.
Prereq: CPR E 308 or COM S 352
Fundamental concepts in real-time systems. Real time task scheduling paradigms. Resource management in uniprocessor, multiprocessor, and distributed real-time systems. Fault-tolerance, resource reclaiming, and overload handling. Real-time channel, packet scheduling, and real-time LAN protocols. Case study of real-time operating systems. Laboratory experiments.

CPR E 566: Physical Design of VLSI Systems
(3-0) Cr. 3.
Prereq: CPR E 465
Physical design of VLSI systems. Partitioning algorithms. Placement and floorplanning algorithms. Routing-global and detailed. Layout compaction. Physical design of FPGA's and MCM's. Performance-driven layout synthesis.

CPR E 567: Bioinformatics I (Bioinformatics Algorithms)
(Cross-listed with BCB, COM S). (3-0) Cr. 3. F.
Prereq: COM S 228; COM S 330; credit or enrollment in BIOL 315, STAT 430
Biology as an information science. A review of the algorithmic principles that are driving the advances in bioinformatics and computational biology.

CPR E 569: Bioinformatics III (Structural Bioinformatics)
(Cross-listed with BBMB, BCB, COM S, GDCB). (3-0) Cr. 3. F.
Prereq: BCB 567, BBMB 316, GEN 409, STAT 430
Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution.

CPR E 570: Bioinformatics IV (Systems Biology)
(Cross-listed with BCB, COM S, GDCB, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or COM S 311, COM S 228, GEN 409, STAT 430
Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration.

CPR E 575: Computational Perception
(Cross-listed with COM S, HCI). (3-0) Cr. 3. S.
Prereq: Graduate standing or permission of instructor
Statistical and algorithmic methods for sensing, recognizing, and interpreting the activities of people by a computer. Focuses on machine perception techniques that facilitate and augment human-computer interaction. Introduce computational perception on both theoretical and practical levels. Participation in small groups to design, implement, and evaluate a prototype of a human-computer interaction system that uses one or more of the techniques covered in the lectures.

CPR E 581: Computer Systems Architecture
(Cross-listed with COM S). (3-0) Cr. 3. F.
Prereq: CPR E 381
Quantitative principles of computer architecture design, instruction set design, processor architecture: pipelining and superscalar design, instruction level parallelism, memory organization: cache and virtual memory systems, multiprocessor architecture, cache coherency, interconnection networks and message routing, I/O devices and peripherals.

CPR E 582: Computer Systems Performance
(3-0) Cr. 3.
Prereq: CPR E 381, CPR E 310 and STAT 330
Review of probability and stochastic processes concepts; Markovian processes; Markovian queues; renewal theory; semi-Markovian queues; queueing networks, applications to multiprocessor architectures, computer networks, and switching systems.

CPR E 583: Reconfigurable Computing Systems
(Cross-listed with COM S). (3-0) Cr. 3.
Prereq: Background in computer architecture, design, and organization
Introduction to reconfigurable computing, FPGA technology and architectures, spatial computing architectures such as systolic and bit serial adaptive network architectures, static and dynamic rearrangeable interconnection architectures, processor architectures incorporating reconfigurabiltiy.

CPR E 584: Models and Techniques in Embedded Systems
(3-0) Cr. 3.
Industry-standard tools and optimization strategies; practical embedded platforms and technology (reconfigurable platforms, multi-core platforms, low-power platforms); instruction augmentation, memory-mapped accelerator design, embedded software optimization. Students will be encouraged to compete as teams in an embedded system design competition.

CPR E 585: Developmental Robotics
(Cross-listed with HCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: knowledge of C/C++ programming language.
An introduction to the emerging interdisciplinary field of Developmental Robotics, which crosses the boundaries between robotics, artificial intelligence, developmental psychology, and philosophy. The main goal of this field is to create autonomous robots that are more intelligent, more adaptable, and more useful than the robots of today, which can only function in very limited domains and situations.

CPR E 586: Pervasive Computing
(3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530
Fundamentals of pervasive computing, including location and context awareness, mobile and location services, ubiquitous data access, low power computing and energy management, middleware, security and privacy issues.

CPR E 588: Embedded Computer Systems
(3-0) Cr. 3.
Prereq: CPR E 308
Hardware/software systems and codesign. Models of computation for embedded systems. System-level design. Modeling, specification, synthesis, and verification. Hardware/software implementation. Design space exploration. Performance analysis and optimization. Multiprocessor system on chip. Platform-based design. Design methodologies and tools. Case studies and design projects.

CPR E 590: Special Topics
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in computer engineering.

CPR E 592: Seminar in Computer Engineering
Cr. 1-4. Repeatable.
Prereq: Permission of instructor
Projects or seminar in Computer Engineering.

CPR E 594: Selected Topics in Computer Engineering
(3-0) Cr. 3. Repeatable.

CPR E 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

CPR E 626: Parallel Algorithms for Scientific Applications
(Cross-listed with COM S). (3-0) Cr. 3.
Prereq: CPR E 526
Algorithm design for high-performance computing. Parallel algorithms for multidimensional tree data structures, space-filling curves, random number generation, graph partitioning and load balancing. Applications to grid and particle-based methods and computational biology.

CPR E 632: Information Assurance Capstone Design
(Cross-listed with INFAS). (3-0) Cr. 3.
Prereq: INFAS 531, INFAS 532, INFAS 534
Capstone design course which integrates the security design process. Design of a security policy. Creation of a security plan. Implementation of the security plan. The students will attack each other's secure environments in an effort to defeat the security systems. Students evaluate the security plans and the performance of the plans. Social, political and ethics issues. Student self-evaluation, journaling, final written report.

CPR E 681: Advanced Topics in Computer Architecture
(Cross-listed with COM S). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: CPR E 581. Repeatable with Instructor permission
Current topics in computer architecture design and implementation. Advanced pipelining, cache and memory design techniques. Interaction of algorithms with architecture models and implementations. Tradeoffs in architecture models and implementations.

CPR E 697: Engineering Internship
(Cross-listed with E E). Cr. R. Repeatable.
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

CPR E 699: Research
Cr. arr. Repeatable.

Computer Science (COM S)

Courses primarily for undergraduates:

COM S 101: Orientation
Cr. R. F.S.
Introduction to the procedures and policies of Iowa State University and the Department of Computer Science, test-outs, honorary societies, etc. Issues relevant to student adjustment to college life will also be discussed. Offered on a satisfactory-fail basis only.

COM S 103: Computer Applications
Cr. 4. F.S.SS.
Introduction to computer literacy and applications. Applications: Windows, Internet browser/HTML, word processing, spreadsheets, database management and presentation software. Literacy: history of computing, structure of computers, telecommunications, computer ethics, computer crime, and history of programming languages. No prior computer experience necessary. Offered online only. Attendance at an orientation session the first week of class is required. Only one of COM S 103 and COM S 113 may count toward graduation.

COM S 104: Introduction to Programming
(1.5-1) Cr. 2. F.S.
Offered first 8 weeks and last 8 weeks. Use of personal computer and workstation operating systems and beginning programming. Project-oriented approach to computer operation and programming, including use of tools to aid in programming. Topics from computer history, using basic Windows and Unix tools, program structure, expression, variables, decision and logic, and iteration. No prior computer experience necessary.

COM S 105: Short Course in Computer Programming
Cr. 2. F.S.
Prereq: Com S 104
8-week course in programming, including instruction in syntax and semantics, of the following current programming languages.

COM S 105A: Short Course in Computer Programming: Perl
(1-2) Cr. 2. F.S.
Prereq: Com S 104
8-week course in programming using Perl.

COM S 105B: Short Course in Computer Programming: MATLAB
(2-0) Cr. 2. F.S.
Prereq: Com S 104
8-week course in programming using MATLAB.

COM S 106: Introduction to Web Programming
(3-0) Cr. 3. S.
Introduction to Web programming basics. Fundamentals of developing Web pages using a comprehensive Web development life cycle. In-depth experience with current Web design techniques such as HTML5 and cascading style sheets. Programming strategies for accessibility, usability and search engine optimization.

COM S 107: Applied Computer Programming
(3-0) Cr. 3. F.S.
Introduction to computer programming for non-majors using a language such as the Visual Basic language. Basics of good programming and algorithm development. Graphical user interfaces.

COM S 108: Applied Computer Programming II
(3-0) Cr. 3. F.S.
Prereq: Com S 107 or equivalent
Advanced programming applications in Visual Basic for non-majors. Emphasis on programming projects including sorting, file processing, database processing, web programming, and graphics and animation. Students will learn problem solving techniques and advanced programming skills to build real-world applications.

COM S 113: Introduction to Spreadsheets and Databases
(2-2) Cr. 3. F.S.SS.
Using Microsoft Excel spreadsheets and Microsoft Access databases to input, store, process, manipulate, query, and analyze data for business and industrial applications. Credit in Com S 113 may not be applied toward graduation in the COM S, S E, and CPR E majors. Only one of COM S 103 and COM S 113 may count toward graduation.

COM S 127: Introduction to Programming for Problem Solving
(3-2) Cr. 4. F.S.
Prereq: MATH 140
Introduction to computer programming with an emphasis on problem solving. Topics include: program structures, expressions, variables, decision and logic, iteration, collections, input and output. Program construction and testing. Programming assignments including games and applications. No prior programming experience necessary. This course is intended for Computer Science majors.

COM S 203: Careers in Computer Science
Cr. R. F.S.
Computer science as a profession. Introduction to career fields open to computer science majors. Relationship of coursework to careers. Presentations by computer science professionals. Offered on a satisfactory-fail basis only.

COM S 207: Fundamentals of Computer Programming
(Cross-listed with MIS). (3-1) Cr. 3. F.S.
Prereq: MATH 150 or placement into MATH 140/MATH 141/MATH 142 or higher
An introduction to computer programming using an object-oriented programming language. Emphasis on the basics of good programming techniques and style. Extensive practice in designing, implementing, and debugging small programs. Use of abstract data types. Interactive and file I/O. Exceptions/error-handling. This course is not designed for computer science, software engineering, and computer engineering majors. Credit may not be applied toward graduation for both Com S 207/ MIS 207 and Com S 227.

COM S 208: Intermediate Computer Programming
(3-1) Cr. 3. S.
Prereq: MIS/COM S 207, credit or enrollment in MATH 151, MATH 160, or MATH 165
Intermediate-level programming techniques. Emphasis on designing, writing, testing, debugging, and documenting medium-sized programs. Data structures and their uses. Dynamic memory usage. Inheritance and polymorphism. Algorithm design and efficiency: recursion, searching, and sorting. Event-driven and GUI programming. The software development process. This course is not designed for computer science, software engineering and computer engineering majors. Credit may not be applied toward the major in computer science, software engineering, or computer engineering.

COM S 227: Introduction to Object-oriented Programming
(3-2) Cr. 4. F.S.
Prereq: Placement into MATH 143, 165, or higher; recommended: a previous high school or college course in programming or equivalent experience.
Introduction to object-oriented design and programming techniques. Symbolic and numerical computation, recursion and iteration, modularity procedural and data abstraction, and specifications and subtyping. Object-oriented techniques including encapsulation, inheritance and polymorphism. Imperative programming. Emphasis on principles of programming and object-oriented design through extensive practice in design, writing, running, debugging, and reasoning. Course intended for Com S majors. Credit may not be applied toward graduation for both Com S 207 and 227.

COM S 228: Introduction to Data Structures
(3-1) Cr. 3. F.S.
Prereq: Minimum of C- in 227, credit or enrollment in MATH 165
An object-oriented approach to data structures and algorithms. Object-oriented analysis, design, and programming, with emphasis on data abstraction, inheritance and subtype polymorphism. Abstract data type specification and correctness. Collections and associated algorithms, such as stacks, queues, lists, trees. Searching and sorting algorithms. Graphs. Data on secondary storage. Analysis of algoritms. Emphasis on object-oriented design, writing and documenting medium-sized programs. This course is designed for majors.

COM S 230: Discrete Computational Structures
(3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 227 and MATH 165; ENGL 150
Concepts in discrete mathematics as applied to computer science. Logic, proof techniques, set theory, relations, graphs, combinatorics, discrete probability and number theory.

COM S 252: Linux Operating System Essentials
(3-0) Cr. 3. F.
Prereq: COM S 107 or COM S 127 or COM S 207 or COM S 227
Introduction to installation, utilization, and administration of Linux systems. Topics include open-source software, package installation and management, shell programming and command-line utilities, process and service management, account management, network configuration, file sharing, interoperation with other computers and operating systems, automation, and system security.

COM S 290: Independent Study
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor
Offered on a satisfactory-fail basis only.

COM S 290H: Independent Study: Honors
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor
Offered on a satisfactory-fail basis only.

COM S 309: Software Development Practices
(3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165
A practical introduction to methods for managing software development. Process models, requirements analysis, structured and object-oriented design, coding, testing, maintenance, cost and schedule estimation, metrics. Programming projects.

COM S 311: Design and Analysis of Algorithms
(3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228; MATH 166, ENGL 150, and COM S 230 or CPR E 310
Basic techniques for design and analysis of efficient algorithms. Sorting, searching, graph algorithms, computational geometry, string processing and NP-completeness. Design techniques such as dynamic programming and the greedy method. Asymptotic, worst-case, average-case and amortized analyses. Data structures including heaps, hash tables, binary search trees and red-black trees. Programming projects.

COM S 319: Software Construction and User Interfaces
(Cross-listed with S E). (3-0) Cr. 3. F.
Prereq: COM S 228
Basic theory of grammars, parsing. Language paradigms. State transition and table-based software design. Review of principles of object orientation, object oriented analysis using UML. Frameworks and APIs. User interface architecture, evaluation of user interface. Design of windows, menus, and commands. Introduction to formal specification and model-based software design. Introduction to domain-specific software engineering.

COM S 321: Introduction to Computer Architecture and Machine-Level Programming
(3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165; CPR E 281 and ENGL 250
Introduction to computer architecture and organization. Emphasis on evaluation of performance, instruction set architecture, datapath and control, memory-hierarchy design, and pipelining. Assembly language on a simulator.

COM S 327: Advanced Programming Techniques
(3-0) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165
Object-oriented programming experience using a language suitable for exploring advanced topics in programming. Topics include memory management, parameter passing, inheritance, compiling, debugging, and maintaining programs. Significant programming projects.

COM S 331: Theory of Computing
(Cross-listed with LING). (3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228, MATH 166, and in COM S 230 or CPR E 310; ENGL 250
Models of computation: finite state automata, pushdown automata and Turing machines. Study of grammars and their relation to automata. Limits of digital computation, unsolvability and Church-Turing thesis. Chomsky hierarchy and relations between classes of languages.

COM S 336: Introduction to Computer Graphics
(3-0) Cr. 3. F.
Prereq: COM S 327, CoReq MATH 207 or MATH 317
Basic algorithms, design, and programming of interactive computer graphics systems and hardware. Topics include 2D and 3D transformations, 3D viewing, visible surface algorithms, collision detection, illumination models, shading, ray tracing, shadows, transparency and texture mapping.

COM S 342: Principles of Programming Languages
(Cross-listed with S E). (3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165; COM S 230 or CPR E 310
Study of concepts in programming languages and major programming paradigms, especially functional programming. Special emphasis on design tradeoffs that enable students to make sound choices of programming languages for a given software development task. Programming projects.

COM S 350: Number Theory
(Cross-listed with MATH). (3-0) Cr. 3. S.
Prereq: MATH 201 or COM S 230
Divisibility, integer representations, primes and divisors, linear diophantine equations, congruences, and multiplicative functions. Applications to cryptography.

COM S 352: Introduction to Operating Systems
(3-1) Cr. 3. F.S.
Prereq: COM S 321, and COM S 327; ENGL 250
Survey of operating system issues. Introduction to hardware and software components including: processors, peripherals, interrupts, management of processes, threads and memory, deadlocks, file systems, protection, virtual machines and system organization, and introduction to distributed operating systems. Programming projects.

COM S 362: Object-Oriented Analysis and Design
(3-0) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165; ENGL 250
Object-oriented requirements analysis and systems design. Design notations such as the Unifed Modeling Language. Design Patterns. Group design and programming with large programming projects.

COM S 363: Introduction to Database Management Systems
(3-0) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165; ENGL 250
Relational, object-oriented, and semistructured data models and query languages. SQL, ODMG, and XML standards. Database design using entity-relationship model, data dependencies and object definition language. Application development in SQL-like languages and general purpose host languages with application program interfaces. Information integration using data warehouses, mediators and wrappers. Programming Projects.

COM S 398: Cooperative Education
Cr. R. Repeatable.
Prereq: Permission of department chair
Required of all cooperative students. Students must register for this course prior to commencing each work period.

COM S 402: Computer Science Senior Project
Cr. 2-3. Repeatable, maximum of 6 credits. F.S.
Students work as individuals and teams to complete the planning, design, and implementation of a significant project in the topic area. Oral and written reports. No more than 6 credits of 402A, 402B, and 402C may be used toward graduation.

COM S 402A: Computer Science Senior Project: Multimedia and Computer Gaming I
Cr. 2-3. Repeatable, maximum of 6 credits. F.S.
Prereq: COM S 437
Students conceive, plan, architect and design a computer game. Student registered in this course will work with students in ARTIS 409. Oral and written reports. No more than 6 credits of 402A, 402B, and 402C may be used toward graduation.

COM S 402B: Computer Science Senior Project: Multimedia and Computer Gaming II
Cr. 2-3. Repeatable, maximum of 6 credits. F.S.
Prereq: COM S 402A
Students implement, test, and present a completed production computer game. Students in this class will work with students in ARTIS 409. Oral and written reports. No more than 6 credits of 402A, 402B, and 402C may be used toward graduation.

COM S 402C: Computer Science Senior Project: Project in Computer Science
(0-6) Cr. 2-3. Repeatable, maximum of 6 credits. F.
Prereq: Permission of instructor
Students work as individuals and teams to complete the planning, design, and implementation of a significant project in the topic area. Oral and written reports. No more than 6 credits of 402A, 402B, and 402C may be used toward graduation.

COM S 409: Software Requirements Engineering
(Dual-listed with COM S 509). (3-0) Cr. 3. F.
Prereq: COM S 309; for graduate credit: graduate standing or permission of instructor
The requirements engineering process including identification of stakeholders requirements elicitation techniques such as interviews and prototyping, analysis fundamentals, requirements specification, and validation. Use of Models: State-oriented, Function-oriented, and Object-oriented. Documentation for Software Requirements. Informal, semi-formal, and formal representations. Structural, informational, and behavioral requirements. Non-functional requirements. Use of requirements repositories to manage and track requirements through the life cycle. Case studies, software projects, written reports, and oral presentations will be required.

COM S 410: Distributed Development of Software
(Dual-listed with COM S 510). (3-0) Cr. 3. F.
Prereq: COMS 228, COMS 309, COMS 327; for graduate credit: graduate standing or permission of instructor
Team with students at foreign universities to develop a software application. Importance of distributed development. Design for distributed development, effective processes for distributed development, and cultural issues in distributed development, organizing for distributed development, communication techniques and skills for distributed development,including oral presentations. Graduate credit requires in--depth study of concepts.

COM S 412: Formal Methods in Software Engineering
(Dual-listed with COM S 512). (Cross-listed with CPR E, S E). (3-0) Cr. 3. S.
Prereq: COM S 230 or CPR E 310; COM S 311, STAT 330; for graduate credit: graduate standing or permission of instructor
A study of formal techniques for model-based specification and verification of software systems. Topics include logics, formalisms, graph theory, numerical computations, algorithms and tools for automatic analysis of systems. Graduate credit requires in-depth study of concepts.

COM S 414: Gerontechnology in Smart Home Environments
(Dual-listed with COM S 514). (3-0) Cr. 3. F.
Prereq: COM S 227 or (COM S 207 or GERON 377 or ARTGR 271) or equivalent; for graduate credit: graduate standing or permission of instructor
An interdisciplinary course designed for students who are interested in assistive technology, pervasive computing, mobile computing and principles of universal and inclusive design for end users, in particular, the elderly population. Students will work in semester-long projects as interdisciplinary teams to apply knowledge obtained from lectures and mutual presentations. For graduate credit students are required to submit a research report and give an oral presentation.

COM S 415: Software System Safety
(Dual-listed with COM S 515). (3-0) Cr. 3. S.
Prereq: For graduate credit: graduate standing or permission of instructor
An introduction to the analysis, design, and testing of software for safety-critical and high-integrity systems. Analysis techniques, formal verification, fault identification and recovery, model checking, and certification issues. Emphasizes a case-based and systematic approach to software's role in safe systems.

COM S 417: Software Testing
(Cross-listed with S E). (3-0) Cr. 3. S.
Prereq: COM S 309; COM S 230 or CPR E 310; ENGL 250, SP CM 212
Comprehensive study of software testing, principles, methodologies, management strategies and techniques. Test models, test design techniques (black box and white box testing techniques), test adequacy criteria,integration, regression, system testing methods, and software testing tools.

COM S 418: Introduction to Computational Geometry
(Dual-listed with COM S 518). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: COM S 311 or permission of instructor; for graduate credit: graduate standing or permission of instructor
Introduction to data structures, algorithms, and analysis techniques for computational problems that involve geometry. Line segment intersection, polygon triangulation, 2D linear programming, range queries, point location, arrangements and duality, Voronoi diagrams and Delaunay triangulation, convex hulls, robot motion planning, visibility graphs. Other selected topics. Programming assignments.

COM S 421: Logic for Mathematics and Computer Science
(Cross-listed with MATH). (3-0) Cr. 3. S.
Prereq: MATH 301 or MATH 207 or MATH 317 or COM S 230
Propositional and predicate logic. Topics selected from Horn logic, equational logic, resolution and unification, foundations of logic programming, reasoning about programs, program specification and verification, model checking and binary decision diagrams, temporal logic and modal logic.

COM S 424: Introduction to High Performance Computing
(Cross-listed with CPR E, MATH). (2-2) Cr. 3. F.
Prereq: MATH 265; MATH 207 or MATH 317
UNIX, serial programming for high performance, OpenMP for high performance, shared memory parallelization. Semester project required.

COM S 425: High Performance Computing for Scientific and Engineering Applications
(Cross-listed with CPR E). (3-1) Cr. 3. S.
Prereq: COM S 311, COM S 230, ENGL 250, SP CM 212
Introduction to high performance computing platforms including parallel computers and workstation clusters. Discussion of parallel architectures, performance, programming models, and software development issues. Sample applications from science and engineering. Practical issues in high performance computing will be emphasized via a number of programming projects using a variety of programming models and case studies. Oral and written reports.

COM S 426: Introduction to Parallel Algorithms and Programming
(Dual-listed with COM S 526). (Cross-listed with CPR E). (3-2) Cr. 4. F.
Prereq: CPR E 308 or COM S 321, CPR E 315 or COM S 311
Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms.

COM S 430: Advanced Programming Tools
(3-1) Cr. 3. S.
Prereq: COM S 311, COM S 362 or COM S 363, ENGL 250, SP CM 212
Topics in advanced programming techniques and tools widely used by industry (e.g., event-driven programming and graphical user interfaces, standard libraries, client/server architectures and techniques for distributed applications). Emphasis on programming projects in a modern integrated development environment. Oral and written reports.

COM S 433: Computational Models of Nanoscale Self-Assembly
(Dual-listed with COM S 533). (3-0) Cr. 3. S.
Prereq: Minimum of C- in COM S 331 or consent of the instructor; for graduate credit: graduate standing or permission of instructor
Modeling and analysis of natural and engineered systems that spontaneously assemble themselves from small components. Topics include biomolecular self-assembly, tile assembly models, computation via self-assembly, distributed folding, origami models, and self-repair. Emphasis on mathematical methods of describing, simulating, programming, and verifying the behaviors of self-assembling systems. Graduate credit requires a written or oral report on current research.

COM S 435: Algorithms for Large Data Sets: Theory and Practice
(Dual-listed with COM S 535). (3-0) Cr. 3. S.
Prereq: COM S 228, COM S 230 or CPR E 310, COM S 311 or equivalent
Challenges involved in solving computational problems on massive data sets. Discussion of computational problems that arise in the context of web search, social network analysis, recommendation systems, and online advertising etc. Theoretical aspects include modeling the computational problems using graphs, study of similarity measures and hash functions, and design of efficient algorithms for graphs. Practical aspects include implementation and performance evaluation of the algorithms on real world data sets. Graduate credit requires a written report on current research.

COM S 437: Computer Game and Media Programming
(3-0) Cr. 3. S.
Prereq: COM S 336 or permission of instructor
Students will learn video game programming using current game engine interfaces with real hardware. Particular attention is paid to the console architecture, development environment, tool chains, 2D graphics, 3D graphics, controllers, memory management, and audio systems. Students will complete the course by writing a simple game that runs on console hardware.

COM S 440: Principles and Practice of Compiling
(Dual-listed with COM S 540). (3-1) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: COM S 331, COM S 342, ENGL 250, SP CM 212; for graduate credit: graduate standing or permission of instructor
Theory of compiling and implementation issues of programming languages. Programming projects leading to the construction of a compiler. Projects with different difficulty levels will be given for 440 and 540. Topics: lexical, syntax and semantic analyses, syntax-directed translation, runtime environment and library support. Written reports.

COM S 441: Programming Languages
(Dual-listed with COM S 541). (3-1) Cr. 3. F.
Prereq: COM S 342 or COM S 440; for graduate credit: graduate standing or permission of instructor
Survey of the goals and problems of language design. Formal and informal studies of a wide variety of programming language features including type systems. Creative use of functional and declarative programming paradigms.

COM S 444: Bioinformatic Analysis
(Cross-listed with BCB, BCBIO, BIOL, CPR E, GEN). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

COM S 454: Distributed Systems
(Dual-listed with COM S 554). (Cross-listed with CPR E). (3-1) Cr. 3. S.
Prereq: COM S 311, COM S 352; for graduate credit: graduate standing or permission of instructor
(3-1) Cr. 3. Theoretical and practical issues of design and implementation of distributed systems. The client server paradigm, inter-process communications, synchronization and concurrency control, naming, consistency and replication, fault tolerance, and distributed file systems. Graduate credit requires additional in-depth study of concepts. Programming projects and written reports.

COM S 455: Simulation: Algorithms and Implementation
(Dual-listed with COM S 555). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: COM S 311 and COM S 230, STAT 330, ENGL 150, SP CM 212; for graduate credit: graduate standing or permission of instructor
Introduction to discrete-event simulation with a focus on computer science applications, including performance evaluation of networks and distributed systems. Overview of algorithms and data structures necessary to implement simulation software. Discrete and continuous stochastic models, random number generation, elementary statistics, simulation of queuing and inventory systems, Monte Carlo simulation, point and interval parameter estimation. Graduate credit requires additional in-depth study of concepts. Oral and written reports.

COM S 461: Principles and Internals of Database Systems
(Dual-listed with COM S 561). (3-1) Cr. 3. F.
Prereq: COM S 311, ENGL 250, SP CM 212; for graduate credit: graduate standing or permission of instructor
Models for structured and semistructured data. Algebraic, first order, and user-oriented query languages. Database schema design. Physical storage, access methods, and query processing. Transaction management, concurrency control, and crash recovery. Database security. Information integration using data warehouses, mediators, wrappers, and data mining. Parallel and distributed databases, and special purpose databases. Students enrolling in Com S 561 will require additional study of advanced concepts in database systems.

COM S 472: Principles of Artificial Intelligence
(Dual-listed with COM S 572). (3-1) Cr. 3. F.
Prereq: COM S 311, COM S 230 or CPR E 310, STAT 330, ENGL 250, SP CM 212, COM S 342 or comparable programming experience; for graduate credit: graduate standing or permission of instructor
Specification, design, implementation, and selected applications of intelligent software agents and multi-agent systems. Computational models of intelligent behavior, including problem solving, knowledge representation, reasoning, planning, decision making, learning, perception, action, communication and interaction. Reactive, deliberative, rational, adaptive, learning and communicative agents and multiagent systems. Artificial intelligence programming. A research project and a written report is required for students enrolled in Com S 572.

COM S 474: Introduction to Machine Learning
(3-1) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: COM S 311, COM S 230 or CPR E 310, STAT 330, MATH 165, ENGL 250, SP CM 212, COM S 342 or comparable programming experience
Basic principles, techniques, and applications of Machine Learning. Design, analysis, implementation, and applications of learning algorithms. Topics include: statistical learning, pattern classification, function approximation, Bayesian learning, linear models, artificial neural networks, support vector machines, decision trees, instance based learning, probabilistic graphical models, unsupervised learning, selected applications in automated knowledge acquisition, pattern recognition, and data mining.

COM S 477: Problem Solving Techniques for Applied Computer Science
(Dual-listed with COM S 577). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: COM S 228; COM S 230 or CPR E 310, MATH 166, MATH 207 or MATH 317, or consent of the instructor; for graduate credit: graduate standing or permission of instructor
Selected topics in applied mathematics and modern heuristics that have found applications in areas such as geometric modeling, graphics, robotics, vision, human machine interface, speech recognition, computer animation, etc. Homogeneous coordinates and transformations, perspective projection, quaternions and rotations, polynomial interpolation, roots of polynomials, resultants, solution of linear and nonlinear equations, approximation, data fitting, Fourier series and fast Fourier transform, linear programming, nonlinear optimization, Lagrange multipliers, parametric and algebraic curves, curvature, Frenet formulas, Bezier curves. Programming components. A scholarly report is required for graduate credit.

COM S 481: Numerical Methods for Differential Equations
(Cross-listed with MATH). (3-0) Cr. 3. S.
Prereq: MATH 265 and either MATH 266 or MATH 267; knowledge of a programming language
First order Euler method, high order Runge-Kutta method, and multistep method for solving ordinary differential equations. Finite difference and finite element methods for solving partial differential equations. Local truncation error, stability, and convergence for finite difference method. Numerical solution space, polynomial approximation, and error estimate for finite element method.

COM S 486: Fundamental Concepts in Computer Networking
(3-0) Cr. 3. S.
Prereq: COM S 352
An introduction to fundamental concepts in the design and implementation of computer communication in both the wired and wireless networks, their protocols, and applications. Layered network architecture in the Internet, applications, transport, Socket APIs, network, and data link layers and their protocols, multimedia networking, and network security.

COM S 487: Network Programming, Applications, and Research Issues
(Dual-listed with COM S 587). (3-0) Cr. 3. S.
Prereq: Com S 352 or CPR E 489 or equivalent; for graduate credit: graduate standing or permission of instructor
Programming paradigms for building distributed and networking applications, including multithreaded client-server programming, socket programming, distributed object frameworks and programming suites, and web computing and security. Introduction to some on-going research issues in distributed and networking applications, including peer-to-peer computing, multimedia communications, and mobile computing and networking. A written report and an oral presentation is required for students enrolling in Com S 587.

COM S 490: Independent Study
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in computer science, permission of instructor
Offered on a satisfactory-fail basis only. No more than 9 credits of Com S 490 may be counted toward graduation.

COM S 490H: Independent Study: Honors
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in computer science, permission of instructor
Offered on a satisfactory-fail basis only. No more than 9 credits of Com S 490 may be counted toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

COM S 509: Software Requirements Engineering
(Dual-listed with COM S 409). (3-0) Cr. 3. F.
Prereq: COM S 309; for graduate credit: graduate standing or permission of instructor
The requirements engineering process including identification of stakeholders requirements elicitation techniques such as interviews and prototyping, analysis fundamentals, requirements specification, and validation. Use of Models: State-oriented, Function-oriented, and Object-oriented. Documentation for Software Requirements. Informal, semi-formal, and formal representations. Structural, informational, and behavioral requirements. Non-functional requirements. Use of requirements repositories to manage and track requirements through the life cycle. Case studies, software projects, written reports, and oral presentations will be required.

COM S 510: Distributed Development of Software
(Dual-listed with COM S 410). (3-0) Cr. 3. F.
Prereq: COMS 228, COMS 309, COMS 327; for graduate credit: graduate standing or permission of instructor
Team with students at foreign universities to develop a software application. Importance of distributed development. Design for distributed development, effective processes for distributed development, and cultural issues in distributed development, organizing for distributed development, communication techniques and skills for distributed development,including oral presentations. Graduate credit requires in--depth study of concepts.

COM S 511: Design and Analysis of Algorithms
(Cross-listed with CPR E). (3-0) Cr. 3. F.
Prereq: COM S 311
A study of basic algorithm design and analysis techniques. Advanced data structures, amortized analysis and randomized algorithms. Applications to sorting, graphs, and geometry. NP-completeness and approximation algorithms.

COM S 512: Formal Methods in Software Engineering
(Dual-listed with COM S 412). (3-0) Cr. 3. S.
Prereq: COM S 230 or CPR E 310; COM S 311, STAT 330; for graduate credit: graduate standing or permission of instructor
A study of formal techniques for model-based specification and verification of software systems. Topics include logics, formalisms, graph theory, numerical computations, algorithms and tools for automatic analysis of systems. Graduate credit requires in-depth study of concepts.

COM S 514: Gerontechnology in Smart Home Environments
(Dual-listed with COM S 414). (3-0) Cr. 3. F.
Prereq: COM S 227 or (COM S 207 or GERON 377 or ARTGR 271) or equivalent; for graduate credit: graduate standing or permission of instructor
An interdisciplinary course designed for students who are interested in assistive technology, pervasive computing, mobile computing and principles of universal and inclusive design for end users, in particular, the elderly population. Students will work in semester-long projects as interdisciplinary teams to apply knowledge obtained from lectures and mutual presentations. For graduate credit students are required to submit a research report and give an oral presentation.

COM S 515: Software System Safety
(Dual-listed with COM S 415). (3-0) Cr. 3. S.
Prereq: For graduate credit: graduate standing or permission of instructor
An introduction to the analysis, design, and testing of software for safety-critical and high-integrity systems. Analysis techniques, formal verification, fault identification and recovery, model checking, and certification issues. Emphasizes a case-based and systematic approach to software's role in safe systems.

COM S 518: Introduction to Computational Geometry
(Dual-listed with COM S 418). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: COM S 311 or permission of instructor; for graduate credit: graduate standing or permission of instructor
Introduction to data structures, algorithms, and analysis techniques for computational problems that involve geometry. Line segment intersection, polygon triangulation, 2D linear programming, range queries, point location, arrangements and duality, Voronoi diagrams and Delaunay triangulation, convex hulls, robot motion planning, visibility graphs. Other selected topics. Programming assignments.

COM S 525: Numerical Analysis of High Performance Computing
(Cross-listed with CPR E, MATH). (3-0) Cr. 3. S.
Prereq: CPR E 308 or MATH 481; experience in scientific programming; knowledge of FORTRAN or C
Introduction to parallelization techniques and numerical methods for distributed memory high performance computers. A semester project in an area related to each student's research interests is required.

COM S 526: Introduction to Parallel Algorithms and Programming
(Dual-listed with COM S 426). (Cross-listed with CPR E). (3-2) Cr. 4. F.
Prereq: CPR E 308 or COM S 321, CPR E 315 or COM S 311
Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms.

COM S 531: Theory of Computation
(3-0) Cr. 3. S.
Prereq: COM S 331
A systematic study of the fundamental models and analytical methods of theoretical computer science. Computability, the Church-Turing thesis, decidable and undecidable problems, and the elements of recursive function theory. Time complexity, logic, Boolean circuits, and NP-completeness. Role of randomness in computation.

COM S 533: Computational Models of Nanoscale Self-Assembly
(Dual-listed with COM S 433). (3-0) Cr. 3. S.
Prereq: Minimum of C- in COM S 331 or consent of the instructor; for graduate credit: graduate standing or permission of instructor
Modeling and analysis of natural and engineered systems that spontaneously assemble themselves from small components. Topics include biomolecular self-assembly, tile assembly models, computation via self-assembly, distributed folding, origami models, and self-repair. Emphasis on mathematical methods of describing, simulating, programming, and verifying the behaviors of self-assembling systems. Graduate credit requires a written or oral report on current research.

COM S 535: Algorithms for Large Data Sets: Theory and Practice
(Dual-listed with COM S 435). (3-0) Cr. 3. S.
Prereq: COM S 228, COM S 230 or CPR E 310, COM S 311 or equivalent
Challenges involved in solving computational problems on massive data sets. Discussion of computational problems that arise in the context of web search, social network analysis, recommendation systems, and online advertising etc. Theoretical aspects include modeling the computational problems using graphs, study of similarity measures and hash functions, and design of efficient algorithms for graphs. Practical aspects include implementation and performance evaluation of the algorithms on real world data sets. Graduate credit requires a written report on current research.

COM S 540: Principles and Practice of Compiling
(Dual-listed with COM S 440). (3-1) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: COM S 331, COM S 342, ENGL 250, SP CM 212; for graduate credit: graduate standing or permission of instructor
Theory of compiling and implementation issues of programming languages. Programming projects leading to the construction of a compiler. Projects with different difficulty levels will be given for 440 and 540. Topics: lexical, syntax and semantic analyses, syntax-directed translation, runtime environment and library support. Written reports.

COM S 541: Programming Languages
(Dual-listed with COM S 441). (3-1) Cr. 3. F.
Prereq: COM S 342 or COM S 440; for graduate credit: graduate standing or permission of instructor
Survey of the goals and problems of language design. Formal and informal studies of a wide variety of programming language features including type systems. Creative use of functional and declarative programming paradigms.

COM S 544: Fundamentals of Bioinformatics
(Cross-listed with BCB, CPR E, GDCB). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent
A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies.

COM S 549: Advanced Algorithms in Computational Biology
(Cross-listed with CPR E). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: COM S 311 and either COM S 228 or COM S 208
Design and analysis of algorithms for applications in computational biology, pairwise and multiple sequence alignments, approximation algorithms, string algorithms including in-depth coverage of suffix trees, semi-numerical string algorithms, algorithms for selected problems in fragment assembly, phylogenetic trees and protein folding. No background in biology is assumed. Also useful as an advanced algorithms course in string processing.

COM S 550: Evolutionary Problems for Computational Biologists
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: COM S 311 and some knowledge of programming
Discussion and analysis of basic evolutionary principles and the necessary knowledge in computational biology to solve real world problems. Topics include character and distance based methods, phylogenetic tree distances, and consensus methods, and approaches to extract the necessary information from sequence-databases to build phylogenetic trees.

COM S 551: Computational Techniques for Genome Assembly and Analysis
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: COM S 311 and some knowledge of programming
Introduction to practical sequence assembly and comparison techniques. Topics include global alignment, local alignment, overlapping alignment, banded alignment, linear-space alignment, word hashing, DNA-protein alignment, DNA-cDNA alignment, comparison of two sets of sequences, construction of contigs, and generation of consensus sequences. Focus on development of sequence assembly and comparison programs.

COM S 552: Principles of Operating Systems
(3-0) Cr. 3. F.
Prereq: For graduate credit: graduate standing or permission of instructor
A comparative study of high-level language facilities for process synchronization and communication. Formal analysis of deadlock, concurrency control and recovery. Protection issues including capability-based systems, access and flow control, encryption, and authentication. Additional topics chosen from distributed operating systems, soft real-time operating systems, and advanced security issues.

COM S 554: Distributed Systems
(Dual-listed with COM S 454). (Cross-listed with CPR E). (3-1) Cr. 3. S.
Prereq: COM S 311, COM S 352; for graduate credit: graduate standing or permission of instructor
(3-1) Cr. 3. Theoretical and practical issues of design and implementation of distributed systems. The client server paradigm, inter-process communications, synchronization and concurrency control, naming, consistency and replication, fault tolerance, and distributed file systems. Graduate credit requires additional in-depth study of concepts. Programming projects and written reports.

COM S 555: Simulation: Algorithms and Implementation
(Dual-listed with COM S 455). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: COM S 311 and COM S 230, STAT 330, ENGL 150, SP CM 212; for graduate credit: graduate standing or permission of instructor
Introduction to discrete-event simulation with a focus on computer science applications, including performance evaluation of networks and distributed systems. Overview of algorithms and data structures necessary to implement simulation software. Discrete and continuous stochastic models, random number generation, elementary statistics, simulation of queuing and inventory systems, Monte Carlo simulation, point and interval parameter estimation. Graduate credit requires additional in-depth study of concepts. Oral and written reports.

COM S 556: Analysis Algorithms for Stochastic Models
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: For graduate credit: graduate standing or permission of instructor
Introduction to the use of stochastic models to study complex systems, including network communication and distributed systems. Data structures and algorithms for analyzing discrete-state models expressed in high-level formalisms. State space and reachability graph construction, model checking, Markov chain construction and numerical solution, computation of performance measures, product-form models, approximations, and advanced techniques.

COM S 557: Computer Graphics and Geometric Modeling
(Cross-listed with CPR E, M E). (3-0) Cr. 3. F.
Prereq: M E 421, programming experience in C
Fundamentals of computer graphics technology. Data structures. Parametric curve and surface modeling. Solid model representations. Applications in engineering design, analysis, and manufacturing.

COM S 558: Introduction to the 3D Visualization of Scientific Data
(Cross-listed with GEOL, HCI). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Graduate-student standing in the mathematical or natural sciences or engineering; basic programming knowledge
Introduction to visualizing scientific information with 3D computer graphics and their foundation in human perception. Overview of different visualization techniques and examples of 3D visualization projects from different disciplines (natural sciences, medicine, and engineering). Class project in interactive 3D visualization using the ParaView, Mayavi, TVTK, VTK or a similar system.

COM S 561: Principles and Internals of Database Systems
(Dual-listed with COM S 461). (3-1) Cr. 3. F.
Prereq: COM S 311, ENGL 250, SP CM 212; for graduate credit: graduate standing or permission of instructor
Models for structured and semistructured data. Algebraic, first order, and user-oriented query languages. Database schema design. Physical storage, access methods, and query processing. Transaction management, concurrency control, and crash recovery. Database security. Information integration using data warehouses, mediators, wrappers, and data mining. Parallel and distributed databases, and special purpose databases. Students enrolling in Com S 561 will require additional study of advanced concepts in database systems.

COM S 567: Bioinformatics I (Bioinformatics Algorithms)
(Cross-listed with BCB, CPR E). (3-0) Cr. 3. F.
Prereq: COM S 228; COM S 330; credit or enrollment in BIOL 315, STAT 430
Biology as an information science. A review of the algorithmic principles that are driving the advances in bioinformatics and computational biology.

COM S 568: Bioinformatics II (Statistical Bioinformatics)
(Cross-listed with BCB, GDCB, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or (BIOL 315 and STAT 430), credit or enrollment in GEN 409
Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models.

COM S 569: Bioinformatics III (Structural Bioinformatics)
(Cross-listed with BBMB, BCB, CPR E, GDCB). (3-0) Cr. 3. F.
Prereq: BCB 567, BBMB 316, GEN 409, STAT 430
Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution.

COM S 570: Bioinformatics IV (Systems Biology)
(Cross-listed with BCB, CPR E, GDCB, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or COM S 311, COM S 228, GEN 409, STAT 430
Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration.

COM S 572: Principles of Artificial Intelligence
(Dual-listed with COM S 472). (3-1) Cr. 3. F.
Prereq: COM S 311, COM S 230 or CPR E 310, STAT 330, ENGL 250, SP CM 212, COM S 342 or comparable programming experience; for graduate credit: graduate standing or permission of instructor
Specification, design, implementation, and selected applications of intelligent software agents and multi-agent systems. Computational models of intelligent behavior, including problem solving, knowledge representation, reasoning, planning, decision making, learning, perception, action, communication and interaction. Reactive, deliberative, rational, adaptive, learning and communicative agents and multiagent systems. Artificial intelligence programming. A research project and a written report is required for students enrolled in Com S 572.

COM S 573: Machine Learning
(3-1) Cr. 3. S.
Prereq: For graduate credit: graduate standing or permission of instructor
Algorithmic models of learning. Design, analysis, implementation and applications of learning algorithms. Learning of concepts, classification rules, functions, relations, grammars, probability distributions, value functions, models, skills, behaviors and programs. Agents that learn from observation, examples, instruction, induction, deduction, reinforcement and interaction. Computational learning theory. Data mining and knowledge discovery using artificial neural networks, support vector machines, decision trees, Bayesian networks, association rules, dimensionality reduction, feature selection and visualization. Learning from heterogeneous, distributed, dynamic data and knowledge sources. Learning in multi-agent systems. Selected applications in automated knowledge acquisition, pattern recognition, program synthesis, bioinformatics and Internet-based information systems. Oral and written reports.

COM S 575: Computational Perception
(Cross-listed with CPR E, HCI). (3-0) Cr. 3. S.
Prereq: Graduate standing or permission of instructor
Statistical and algorithmic methods for sensing, recognizing, and interpreting the activities of people by a computer. Focuses on machine perception techniques that facilitate and augment human-computer interaction. Introduce computational perception on both theoretical and practical levels. Participation in small groups to design, implement, and evaluate a prototype of a human-computer interaction system that uses one or more of the techniques covered in the lectures.

COM S 577: Problem Solving Techniques for Applied Computer Science
(Dual-listed with COM S 477). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: COM S 228; COM S 230 or CPR E 310, MATH 166, MATH 207 or MATH 317, or consent of the instructor; for graduate credit: graduate standing or permission of instructor
Selected topics in applied mathematics and modern heuristics that have found applications in areas such as geometric modeling, graphics, robotics, vision, human machine interface, speech recognition, computer animation, etc. Homogeneous coordinates and transformations, perspective projection, quaternions and rotations, polynomial interpolation, roots of polynomials, resultants, solution of linear and nonlinear equations, approximation, data fitting, Fourier series and fast Fourier transform, linear programming, nonlinear optimization, Lagrange multipliers, parametric and algebraic curves, curvature, Frenet formulas, Bezier curves. Programming components. A scholarly report is required for graduate credit.

COM S 581: Computer Systems Architecture
(Cross-listed with CPR E). (3-0) Cr. 3. F.
Prereq: CPR E 381
Quantitative principles of computer architecture design, instruction set design, processor architecture: pipelining and superscalar design, instruction level parallelism, memory organization: cache and virtual memory systems, multiprocessor architecture, cache coherency, interconnection networks and message routing, I/O devices and peripherals.

COM S 583: Reconfigurable Computing Systems
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: Background in computer architecture, design, and organization
Introduction to reconfigurable computing, FPGA technology and architectures, spatial computing architectures such as systolic and bit serial adaptive network architectures, static and dynamic rearrangeable interconnection architectures, processor architectures incorporating reconfigurabiltiy.

COM S 586: Computer Network Architectures
(3-0) Cr. 3. F.
Prereq: COM S 511, COM S 552 or CPR E 489
Design and implementation of computer communication networks: layered network architectures, local area networks, data link protocols, distributed routing, transport services, network programming interfaces, network applications, error control, flow/congestion control, interconnection of heterogeneous networks, TCP/IP, ATM networks, multimedia communications, IP and application multicast, overlay networks, network security and web computing.

COM S 587: Network Programming, Applications, and Research Issues
(Dual-listed with COM S 487). (3-0) Cr. 3. S.
Prereq: Com S 352 or CPR E 489 or equivalent; for graduate credit: graduate standing or permission of instructor
Programming paradigms for building distributed and networking applications, including multithreaded client-server programming, socket programming, distributed object frameworks and programming suites, and web computing and security. Introduction to some on-going research issues in distributed and networking applications, including peer-to-peer computing, multimedia communications, and mobile computing and networking. A written report and an oral presentation is required for students enrolling in Com S 587.

COM S 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Offered on a satisfactory-fail basis only.

COM S 592: Research Colloquia
Cr. 1. F.S.
Prereq: Graduate classification
Attend Computer Science Research Colloquia. Written summary is required. Offered on a satisfactory-fail basis only.

COM S 598: Graduate Internship
Cr. R. Repeatable. F.S.SS.
Prereq: Graduate Classification
Supervised internship working in professional settings appropriate to the student's degree program. Academic work under faculty supervision.

COM S 599: Creative Component
Cr. 1-3.
Creative component for nonthesis option of Master of Science degree. Offered on a satisfactory-fail basis only.

Courses for graduate students:

COM S 610: Seminar
Cr. arr.
Offered on a satisfactory-fail basis only.

COM S 611: Advanced Topics in Analysis of Algorithms
(3-0) Cr. 3. Repeatable. Alt. S., offered odd-numbered years.
Prereq: COM S 511, COM S 531
Advanced algorithm analysis and design techniques. Topics include graph algorithms, algebraic algorithms, number-theoretic algorithms, randomized and parallel algorithms. Intractable problems and NP-completeness. Advanced data structures.

COM S 612: Distributed Algorithms
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: COM S 511 or COM S 531
The theory of distributed computation. Algorithms, lower bounds and impossibility results. Leader Elections, mutual exlusion, consensus and clock synchronization algorithms. Synchronous, asynchronous and partially synchronous distributed systems models. Shared memory and message passing systems. Fault-tolerance and randomization. Broadcast and multicast. Wait-free object simulations. Distributed shared memory.

COM S 626: Parallel Algorithms for Scientific Applications
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: CPR E 526
Algorithm design for high-performance computing. Parallel algorithms for multidimensional tree data structures, space-filling curves, random number generation, graph partitioning and load balancing. Applications to grid and particle-based methods and computational biology.

COM S 631: Advanced Topics in Computational Complexity
(3-0) Cr. 3. Repeatable. Alt. F., offered even-numbered years.
Prereq: COM S 531
Advanced study in the quantitative theory of computation. Time and space complexity of algorithmic problems. The structure of P, NP, PH, PSPACE, and other complexity classes, especially with respect to resource-bounded reducibilities and complete problems. Complexity relative to auxiliary information, including oracle computation and relativized classes, randomized algorithms, advice machines, Boolean circuits. Kolmogorov complexity and randomness.

COM S 633: Advanced Topics in Computational Randomness
(3-0) Cr. 3. Repeatable. Alt. F., offered odd-numbered years.
Prereq: COM S 531
Advanced study of the role of randomness in computation. Randomized algorithms, derandomization, and probabilistic complexity classes. Kolmogorov complexity, algorithmic information theory, and algorithmic randomness. Applications chosen from cryptography, interactive proof systems, computational learning, lower bound arguments, mathematical logic, and the organization of complex systems.

COM S 634: Theory of Games, Knowledge and Uncertainty
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: COM S 330
Fundamentals of Game Theory: individual decision making, strategic and extensive games, mixed strategies, backward induction, Nash and other equilibrium concepts. Discussion of Auctions and Bargaining. Repeated, Bayesian and evolutionary games. Interactive Epistemology: reasoning about knowledge in multiagent environment, properties of knowledge, agreements, and common knowledge. Reasoning about and representing uncertainty, probabilities, and beliefs. Uncertainty in multiagent environments. Aspects and applications of game theory, knowledge, and uncertainty in other areas, especially Artificial Intelligence and Economics, will be discussed.

COM S 641: Advanced Topics in Programming Language Semantics
(3-0) Cr. 3. Repeatable. Alt. S., offered even-numbered years.
Prereq: COM S 531, COM S 541
Operational and other mathematical models of programming language semantics. Type systems and their soundness. Applications of semantics on areas such as program correctness, language design or translation.

COM S 652: Advanced Topics in Distributed Operating Systems
(3-0) Cr. 3. Repeatable. Alt. F., offered odd-numbered years.
Prereq: COM S 552
Concepts and techniques for network and distributed operating systems: Communications protocols, processes and threads, name and object management, synchronization, consistency and replications for consistent distributed data, fault tolerance, protection and security, distributed file systems, design of reliable software, performance analysis.

COM S 657: Advanced Topics in Computer Graphics
(3-0) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered even-numbered years.
Prereq: COM S 228, I E 557/M E 557/CPR E 557/COM S 557
Modern lighting models: Rendering Equation, Spherical Harmonics, Lafortune, Cook-Torrance. Non-polygonal primitives: volumes, points, particles. Textures: filtering, reflections creation. Graphics hardware: pipeline, performance issues, programmability in vertex and fragment path. Per-pixel lighting. Nonphotorealistic rendering. Radiosity; Ray tracing.

COM S 661: Advanced Topics in Database Systems
(3-0) Cr. 3. Repeatable. Alt. F., offered even-numbered years.
Prereq: COM S 461 or COM S 561
Advanced topics chosen from the following: database design, data models, query systems, query optimization, incomplete information, logic and databases, multimedia databases; temporal, spatial and belief databases, semistructured data, concurrency control, parallel and distributed databases, information retrieval, data warehouses, wrappers, mediators, and data mining.

COM S 672: Advanced Topics in Computational Models of Learning
(3-0) Cr. 3. Repeatable. Alt. S., offered even-numbered years.
Prereq: COM S 572 or COM S 573 or COM S 472 or COM S 474
Selected topics in Computational Learning Theory (PAC learning, Sample complexity, VC Dimension, Occam Learning, Boosting, active learning, Kolomogorov Complexity, Learning under helpful distributions, Mistake Bound Analysis). Selected topics in Bayesian and Information Theoretic Models (ML, MAP, MDL, MML). Advanced statistical methods for machine learning. Selected topics in reinforcement learning.

COM S 673: Advanced Topics in Computational Intelligence
(3-0) Cr. 3. Repeatable. Alt. S., offered odd-numbered years.
Prereq: COM S 572 or COM S 573 or COM S 472 or COM S 474
Advanced applications of artificial intelligence in bioinformatics, distributed intelligent information networks and the Semantic Web. Selected topics in distributed learning, incremental learning, multi-task learning, multi-strategy learning; Graphical models, multi-relational learning, and causal inference; statistical natural language processing; modeling the internet and the web; automated scientific discovery; neural and cognitive modeling.

COM S 681: Advanced Topics in Computer Architecture
(Cross-listed with CPR E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: CPR E 581. Repeatable with Instructor permission
Current topics in computer architecture design and implementation. Advanced pipelining, cache and memory design techniques. Interaction of algorithms with architecture models and implementations. Tradeoffs in architecture models and implementations.

COM S 699: Research
Cr. arr. Repeatable.
Prereq: Approval of instructor
Offered on a satisfactory-fail basis only.

Construction Engineering (CON E)

Courses primarily for undergraduates:

CON E 121: Cornerstone Learning Community: Orientation to Academic Life
(0-2) Cr. 1. F.
Integration of first-year and transfer students into the engineering profession and the Construction Engineering program. Assignments and activities completed both individually and in learning teams involving teamwork, academic preparation, and study skills. Introduction to construction industry professionals. Teamwork topics include interdisciplinary teamwork, skills for academic success, diversity issues and leadership. Introduction to organization of program, department, college, and university. Overview of faculty, staff, policies, procedures and resources.

CON E 122: Cornerstone Learning Community: Orientation to Professional Life
(0-2) Cr. 1. S.
Continuation of Con E 121. Integration of first-year and transfer students into the engineering profession. Career preparation, professional ethics, construction research, leadership. Introduction to construction industry professionals including how they interact with engineers in other disciplines. Continued introduction to program, department, college, and university organization. Overview of faculty, staff, policies, procedures and resources.

CON E 222: Contractor Organization and Management of Construction
(2-2) Cr. 3. F.S.
Prereq: Completion of basic program
Entry level course for construction engineering: integration of significant engineering and management issues related to construction company operations. Company organization and operations; construction and project administration; construction contracts; delivery systems; construction safety; contract documents.

CON E 241: Construction Materials and Methods
(2-3) Cr. 3. F.S.
Prereq: CON E 222
Introduction to materials and methods of building construction and to construction drawings. Foundation, structural framing, floor, roof, and wall systems. Blueprint reading and quantity takeoff techniques.

CON E 251: Mechanical/Electrical Materials and Methods
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in CON E 241
Introduction to the materials and methods for mechanical and electrical construction systems and drawings. HVAC, water and waste water, power distribution, lighting, and fire protection. Blueprint reading and quantity takeoff.

CON E 322: Construction Equipment and Heavy Construction Methods
(2-2) Cr. 3. F.S.
Prereq: CON E 241 or C E 306
Selection and acquisition of construction equipment. Application of engineering fundamentals and economics to performance characteristics and production of equipment. Heavy construction methods and economic applications.

CON E 340: Concrete and Steel Construction
(2-2) Cr. 3. F.S.
Prereq: E M 324, credit or enrollment in CON E 322
Planning and field engineering for concrete and steel construction. Design and applications of concrete formwork to construction. Erection of structural steel. Emerging industry themes.

CON E 352: Mechanical Systems in Buildings
(2-2) Cr. 3. F.S.
Prereq: CON E 251, PHYS 222
Comprehensive coverage of mechanical systems, plumbing, fire protection. Analysis techniques and design principles for each system. Required comprehensive design project for a major building project.

CON E 353: Electrical Systems in Buildings
(2-2) Cr. 3. F.S.
Prereq: PHYS 222 and credit or enrollment in CON E 352
Comprehensive coverage of building electrical systems including power, lighting, fire alarm, security and communications. Analysis techniques and design principles for each system. Required comprehensive design project for a major building project.

CON E 354: Building Energy Performance
(3-0) Cr. arr. F.
Prereq: Junior Classification
Energy performance of buildings, building shells, HVAC, electrical and other building systems. Analysis and evaluation of building performance, energy efficiency, environmental quality, first costs, and operating costs. Strategies to exceed energy code requirements through the ASHRAE Standard 90.1.

CON E 380: Engineering Law
(3-0) Cr. 3. F.S.
Prereq: Junior classification
Introduction to law and judicial procedure as they relate to the practicing engineer. Contracts, professional liability, professional ethics, licensing, bidding procedures, intellectual property, products liability, risk analysis. Emphasis on development of critical thinking process, abstract problem analysis and evaluation.

CON E 381: Bidding Construction Projects I
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 381A: Bidding Construction Projects I: Heavy and Highway
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 381B: Bidding Construction Projects I: Building
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 381C: Bidding Construction Projects I: Mechanical
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 381D: Bidding Construction Projects I: Electrical
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 381E: Bidding Construction Projects I: Mechanical and Electrical
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 381F: Bidding Construction Projects I: Miscellaneous
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

CON E 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

CON E 422: Construction Cost Estimating and Cost Engineering
(2-2) Cr. 3. F.S.
Prereq: CON E 241 and 251
Conceptual and detailed cost estimating. Theory and practice of estimating construction costs of materials, labor, equipment, contingency, overhead and markup. Estimating competencies and bid ethics. Electronic quantity take off and pricing methods. Assemblies costs, unit costs, production rates. Analysis of project profitability, cost analysis and cost control methods. Value engineering. Life cycle cost analysis.

CON E 441: Construction Planning, Scheduling, and Control
(2-2) Cr. 3. F.S.
Prereq: Credit or enrollment in CON E 421
Integration of previous construction coursework into the planning, scheduling, and management of time, costs, and other resources. Emphasis on preparation and analysis of network schedules. Comprehensive planning and scheduling project. Computer project management applications.

CON E 481: Bidding Construction Projects II
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 481A: Bidding Construction Projects II: Heavy and Highway
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 481B: Bidding Construction Projects II: Building
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 481C: Bidding Construction Projects II: Mechanical
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 481D: Bidding Construction Projects II: Electrical
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 481E: Bidding Construction Projects II: Mechanical and Electrical
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 481F: Bidding Construction Projects II: Miscellaneous
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 487: Construction Engineering Design I
(2-2) Cr. 3. F.S.
Prereq: CON E 380 or ACCT 215, CON E 340 (B, H), CON E 352 (B, E, M), CON E 353 (B, E, M), CON E 421, CON E 441. Student must be within two semesters of graduation
The integrated delivery of project services as a team, including preliminary engineering design process, constructability review, interaction with the client, identification of engineering problems, developments of a proposal, identification of design criteria, cost estimating, planning and scheduling, application of codes and standards, development of feasible alternatives, selection of best alternative, and delivery of oral presentations.

CON E 488: Construction Engineering Design II
(1-5) Cr. 3. F.S.
Prereq: CON E 380 or ACCT 215. Coreq: CON E 487
Application of team design concepts to a construction engineering project. Project planning. Advanced construction and project management.

CON E 490: Independent Study

Cr. 1-5. Repeatable. F.S.SS.

Prereq: Permission of instructor

Individual study in any phase of construction engineering. Pre-enrollment contract required.

Criminal Justice Studies (CJ ST)

Courses primarily for undergraduates:

CJ ST 240: Introduction to the U.S. Criminal Justice System

(3-0) Cr. 3. F.

Provides systematic overview of law, police organization and behavior, prosecution and defense, sentencing, the judiciary, community corrections, penology, and capital punishment. The course demonstrates the role of discretion in all of these agencies as well as the sociological influences of age, race, gender, and social class on criminal justice system processes.

CJ ST 241: Youth and Crime

(Cross-listed with SOC). (3-0) Cr. 3. F.

An examination of delinquency that focuses on the relationship between youth as victims and as offenders, social and etiological features of delinquency, the role of the criminal justice system, delinquents' rights, and traditional and alternative ways of dealing with juvenile crime.

CJ ST 320: American Judicial Process

(Cross-listed with POL S). (3-0) Cr. 3. S.

Prereq: POL S 215

An overview of the American judicial process. Emphasis on specific topics such as application of constitutional rights to the states (particularly the Fourth, Fifth, Sixth, and Fourteenth Amendments), mechanics of judicial opinions, constitutional philosophies of Supreme Court Justices, decisions of first impression, and the value and scope of precedent.

CJ ST 332: Philosophy of Law

(Cross-listed with PHIL). (3-0) Cr. 3. F.S.

Prereq: PHIL 201 or PHIL 230

Extent of our obligation to obey the law; what constitutes just punishment; how much of the immoral should be made illegal? Relation of these questions to major theories of law and the state. Discussion of such concepts as coercion, equality, and responsibility.

CJ ST 339: Liberty and Law in America

(Cross-listed with PHIL, POL S). Cr. 3.

Prereq: Sophomore status

An exploration of competing conceptions of liberty in American political thought and debates about how liberty should be protected by the law. Contemporary debates about topics such as health care, drugs, property, speech, religion, and sex.

CJ ST 340: Deviant and Criminal Behavior

(Cross-listed with SOC). (3-0) Cr. 3. S.SS.

Prereq: SOC 134 or CJ ST 240

Theory and research on the etiology of types of social deviance; issues relating to crime, antisocial behavior and social policies designed to control deviant behavior.

CJ ST 341: Criminology

(3-0) Cr. 3. F.

Prereq: CJ ST 240

The nature of crime and criminology; the concept of crime; statistics and theories of criminality; major forms of crime; official responses to crime and control of crime.

CJ ST 351: Police and Society

(3-0) Cr. 3. F.S.

Prereq: CJ ST 241, SOC 241 or CJ ST 240

Introduction and overview of law enforcement in the United States. Theory and research on police history, function, and organization; constitutional issues of policing; and critical topics, such as community policing, officer discretion and decision-making, corruption, use of force, and racial profiling. The course illustrates the interconnections between communities, police organizations, citizens, and criminal offenders.

CJ ST 352: Punishment, Corrections, and Society

(3-0) Cr. 3. F.S.

Prereq: CJ ST 241, SOC 241 or CJ ST 240

Introduction and overview of corrections in the United States. Theory and research on probation, parole, intermediate sanctions, prison, inmate society, inmate behavior and misconduct, capital punishment, recidivism, correctional treatment, rehabilitation, and offender reintegration into society.

CJ ST 402: White-Collar Crime

(3-0) Cr. 3. S.

Prereq: CJ ST 241, SOC 241 or CJ ST 240

Introduction and overview of white-collar crime as a form of deviance. Theory and research on occupational, corporate, and organizational offending; prevalence, costs, and consequences of white-collar crime; predictors and correlates of white-collar crime; and political, business, and public policy responses to white-collar crime.

CJ ST 403: Criminal Offenders

(3-0) Cr. 3. F.S.

Prereq: CJ ST 240 or CJ ST 241

Introduction and overview of criminal offenders. Theory and research on epidemiology, offender typologies, etiology of violence, recidivism, societal costs, correctional supervision, treatment, and prevention of serious antisocial behavior.

CJ ST 410: Capital Punishment
(3-0) Cr. 3.
Prereq: CJ ST 240
History, philosophy, demographics, administration, and punishment rationales of capital punishment in the United States from its founding to the present. Methods of execution and trends in public opinion about the death penalty. Examination of correlates of capital offending and criminological characteristics of persons who are sentenced to death.

CJ ST 460: Criminal and Juvenile Justice Practicum
(Cross-listed with SOC). Cr. 3-12. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Junior or senior classification; permission of criminal justice studies coordinator; major or minor in criminal justice or sociology
Study of the criminal and juvenile justice systems and social control processes. Supervised placement in a police department, prosecutor's office, court, probation and parole department, penitentiary, juvenile correctional institution, community-based rehabilitation program, or related agency. Assessed service learning component. Offered on a satisfactory-fail basis only. No more than a total of 9 credits of 460 can be counted toward graduation. No credits in Soc 460 may be used to satisfy minimum sociology requirements for sociology majors.

CJ ST 484: Topical Studies in Criminal and Juvenile Justice
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in CJ ST and permission from instructor
Thematic or topical issues and studies dealing with the sociology of police, judiciary, institutional and community-based corrections, gender/ethnicity and crime/delinquency, criminal and delinquent gangs, and crime and delinquency prevention.

Curriculum and Instruction (C I)

Courses primarily for undergraduates:

C I 201: Learning Technologies in the PK-6 Classroom
(2-2) Cr. 3. F.S.Alt. SS., offered odd-numbered years.
Overview of ways to use educational technologies to support instruction in PK-6 settings. Focus on pedagogical approaches that integrate technologies to support learning in the content areas. Laboratory experiences include development of activities to use web 2.0 tools, apps, multimedia, web page development, digital video and other technologies to facilitate learning and teaching.

C I 202: Learning Technologies in the 7-12 Classroom
(2-2) Cr. 3. F.S.Alt. SS., offered even-numbered years.
Overview of ways to use educational technologies to support instruction in 7-12 settings. Focus on pedagogical approaches that integrate technologies to support learning in the content areas. Laboratory experiences include development of activities to use tool software, multimedia, web page development, digital video and other technologies to facilitate learning and teaching.

C I 204: Social Foundations of Education in the United States
(3-0) Cr. 3. F.S.SS.
Introduction to the historical and contemporary landscape of schooling in the United States. Emphasis is placed on topics and tensions in the relationship between school and society (e.g. equity of access to education and competing purposes of education) and the implications of these topics and tensions for teaching and learning at the secondary level in public schools. For prospective teachers in an ISU Secondary Education teacher preparation program. Open to students who are considering teaching and/or work in education as a career path. Students in Early Childhood and Elementary Education programs should take C I 203.

C I 208: Early Childhood Education Teacher Orientation
(Cross-listed with HD FS). Cr. 1. F.S.
Prereq: classification as ECE major
Overview of early childhood education (birth-grade 3) teacher licensure requirements. Program planning and university procedures. Required of all students majoring in early childhood education. Offered on a satisfactory-fail basis only.

C I 216: Learning Community Orientation to Teacher Education
(1-0) Cr. 1. F.
Prereq: All first semester freshman Elementary Education majors are automatically enrolled.
Learning Community for Elementary Education majors to help with their transition to university life. Offers an overview of K-8 teacher certification in Iowa as well as degree and career planning. With the help of guest speakers and peer mentors, students learn about elementary teaching as a profession and are introduced to a social justice orientation to teaching. Offered on a satisfactory-fail basis only.

C I 219: Orientation to Teacher Education: Math, Science, FCS Education, and History/Social Science Majors
Cr. 1. F.S.
Prereq: Students seeking teacher licensure in mathematics, science family and consumer sciences, or history/social sciences in grades 5-12
Overview of mathematics, science, family and consumer sciences and history/social sciences secondary education (grades 5-12), teacher licensure requirements in Iowa and other states. Program and career planning. Offered on a satisfactory-fail basis only.

C I 245: Strategies in Teaching
(2-2) Cr. 3. F.S.
Prereq: C I 203 or 204; sophomore classification.
Introduction to instructional planning, curriculum organization, instructional strategies, and classroom management that provide equitable learning opportunities for all students, as well as teaching in culturally affirming ways. Open to students majoring in Elementary Education or Early Childhood Education.

C I 280: Pre-Student Teaching Experience I
(1-8) Cr. 0.5-2. Repeatable. F.S.
Pre-Student teaching experience in area educational settings. Offered on a satisfactory-fail basis only. C I 280 may be taken more than once for credit toward graduation.

C I 280A: Pre-Student Teaching Experience I: Core Experience
(1-8) Cr. 1-2. Repeatable. F.S.
Prereq: Restricted to students with admission to teacher education.
Pre-Student teaching experience in school settings. 1/2 day of time needed. Clinical Experience Level 2. Offered on a satisfactory-fail basis only. C I 280 may be taken more than once for credit toward graduation.

C I 280B: Pre-Student Teaching Experience I: Learning Technologies
(1-8) Cr. 1-2. Repeatable. F.S.
Prereq: C I 201 or C I 202. Permission of instructor needed for 2 credits.
Pre-Student teaching experience in learning technologies in various educational settings with K-12 technology leaders. 2 1/2-hour blocks of time needed. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. C I 280 may be taken more than once for credit toward graduation.

C I 280C: Pre-Student Teaching Experience I: Native American Tutoring
(1-8) Cr. 1. Repeatable. F.S.
Pre-Student teaching experience in Native American tutoring in school settings. 2 1/2 hour blocks of time needed. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. C I 280 may be taken more than once for credit toward graduation.

C I 280D: Pre-Student Teaching Experience I: Museum Education
(1-8) Cr. 1. Repeatable. F.S.
Prereq: Completion of or concurrent enrollment in C I 280A.
Pre-Student teaching experience in museum settings. 2 1/2-hour blocks of time needed. Supervision level 1. Offered on a satisfactory-fail basis only. C I 280 may be taken more than once for credit toward graduation.

C I 280E: Pre-Student Teaching Experience I: Multicultural Youth
(1-8) Cr. 1-2. Repeatable. F.S.
Prereq: C I 280A must be either a prerequisite or taken currently; permission of instructor for 2 credits.
Pre-Student teaching experience for multicultural youth in school settings. 2 1/2-hour blocks of time needed. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. C I 280 may be taken more than once for credit toward graduation.

C I 280I: Pre-Student Teaching Experience I: Mild/Moderate Disabilities
(1-8) Cr. 1-2. Repeatable. F.
Prereq: Admission to teacher education; concurrent enrollment in SP ED 330.
Pre-Student teaching experience in mild/moderate disabilities in school settings. 2 1/2-hour blocks of time needed. Clinical Experience Level 1. Offered on a satisfactory-fail basis only.

C I 280J: Pre-Student Teaching Experience I: Mathematics Clinic
Cr. 1. Repeatable. S.
Early field experience where students explore and develop an understanding of research-based instructional practices that could be implemented with middle level students to teach mathematical concepts. Clinical Experience Level 1. Offered on a satisfactory-fail basis only.

C I 280K: Pre-Student Teaching Experience I: Music
(Cross-listed with MUSIC). Cr. 0.5. Repeatable. S.
Pre-student teaching experience in music in school settings. Permission of Music coordinator required prior to enrollment. Clinical Experience Level 1. Offered on a satisfactory-fail basis only.

C I 280L: Pre-Student Teaching Experience I: Secondary Education
Cr. 0.5. Repeatable. F.S.
Pre-student teaching experience for secondary education students in school settings. 2 1/2 hour blocks of time needed. Clinical Experience Level 1. Offered on a satisfactory-fail basis only.

C I 280M: Pre-Student Teaching Experience I: Secondary Science
(1-8) Cr. 1-2. Repeatable. S.
Prereq: Permission of instructor for 2 credits.
Pre-student teaching experience in secondary science in school settings. 2 1/2-hour blocks of time needed. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. C I 280 may be taken more than once for credit toward graduation.

C I 280N: Pre-Student Teaching Experience I: Learning Community
(1-8) Cr. 1. Repeatable. F.S.
Prereq: Permission of department required.
Pre-student teaching experience for Preparing Tomorrow's Teachers learning community students in school settings. 2 1/2-hour blocks of time needed. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. C I 280 may be taken more than once for credit toward graduation.

C I 280O: Pre-Student Teaching Experience 1: Art Education
(1-8) Cr. 1. Repeatable. F.S.
Prereq: Permission of the Art and Design Department required.
Pre-student teaching experience in art education in school settings. 2 1/2-hour blocks of time needed. Clinical Experience Level 1. Offered on a satisfactory-fail basis only. C I 280 may be taken more than once for credit toward graduation.

C I 280S: Pre-Student Teaching Experience I: English as a Second Language (ESL)
(0-4) Cr. 1. Repeatable, maximum of 2 times. F.S.
Prereq: Admission to teacher education.
Pre-student teaching experience in English as a Second Language. 1/2 day of time needed. Clinical Experience Level 1. Offered on a satisfactory-fail basis only.

C I 280T: Pre-Student Teaching Experience I: Tutoring
Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor
Pre-student teaching experience tutoring in a school setting focused on mathematics, literacy, and/or other content areas. Two, one-hour blocks of time per week needed. Clinical Experience Level 1. Offered on a satisfactory-fail basis only.

C I 290: Independent Study
Cr. 1-3.
Prereq: 6 credits in education, permission of department chair
Independent study, under faculty supervision, of a topic in the field of education.

C I 302: Principles and Practices of Learning with Technology
(2-2) Cr. 3. F.S.
Prereq: C I 201 or C I 202
Advanced integration of learning technologies into K-12 educational contexts. Examine current trends in using learning technologies with K-12 students; explore current applications used in formal and informal educational settings; and discuss issues focused on technology use in education. Required for Learning Technologies minor.

C I 315: Transfer Orientation
Cr. 1. F.S.
Overview of elementary education requirements, curricular opportunities, and university procedures. Learning community required of all transfer students and change of major students pursuing Elementary Education. Offers an overview of Elementary Education requirements, university procedures, K-8 certification in Iowa as well as degree and career planning. With the help of guest speakers and peer mentors, students learn about elementary teaching as a profession and are introduced to a social justice orientation to teaching. Offered on a satisfactory-fail basis only. Offered on a satisfactory-fail basis only.

C I 332: Educational Psychology of Young Learners
(3-0) Cr. 3. F.S.
Prereq: PSYCH 230 or HD FS 102, open only to majors in Early Childhood Education or Elementary Education
Psychological theory relevant to classroom learning, cognition, motivation, classroom management and assessment for children from kindergarten to grade 8. Implications of theory for teaching children and for assessing learning in educational settings with primary and intermediate grade children.

C I 333: Educational Psychology
(Cross-listed with PSYCH). (3-0) Cr. 3. F.S.
Prereq: PSYCH 230 or HD FS 102, application to the teacher education program or major in psychology
Classroom learning with emphasis on theories of learning and cognition, and instructional techniques. Major emphasis on measurement theory and the classroom assessment of learning outcomes.

C I 347: Nature of Science
(Dual-listed with C I 547). (3-0) Cr. 3. F.
Prereq: C I 280M; concurrent enrollment in C I 418 or instructor permission
The intersection of issues in the history, philosophy sociology, and psychology of science and their application to and impact on science teaching and learning, science teacher education, and science education research.

C I 377: The Teaching of Reading and Language Arts in the Primary Grades (K-3)
(4-0) Cr. 4. F.S.SS.
Prereq: Admission to teacher education program, C I 245, SP ED 250, HD FS 240 (ECE majors); concurrent enrollment in C I 405, C I 448, C I 468A, and C I 468C (El Ed majors) or C I 438, C I 468F, C I 468G, SP ED 368, HD FS 343 (ECE majors)
Theories, teaching strategies, and instructional materials pertinent to teaching reading, writing, listening, and speaking to children in kindergarten through third grade.

C I 378: The Teaching of Reading and Language Arts in the Intermediate Grades (4-6)
(4-0) Cr. 4. F.S.SS.
Prereq: C I 377; concurrent enrollment in C I 449, C I 468B, C I 468D, and C I 443
Theories and processes of literacy. Application through reading and writing across the curriculum, integration of language arts, literature-based instruction, and metacognitive strategies.

C I 395: Content Area Reading and Literacy
(Dual-listed with C I 595). (3-0) Cr. 3. F.S.
Prereq: C I 204 and junior standing
Analysis and application of strategies to enhance students' literacy development in middle and secondary school settings.

C I 406: Social Justice Education and Teaching: Secondary
(3-0) Cr. 3. F.S.SS.
Prereq: C I 201 or C I 202, C I 332 or C I 333, junior classification, admission to teacher preparation program. Restricted to those enrolled in Secondary and K-12 Education Programs.
Awareness and nature of social justice in relation to the educational system; need for cultural competence; multicultural concepts and theories; awareness of context of cultural groups - their history, perspective, needs, and contributions; problems and issues regarding prejudice, and discrimination based on race, ethnicity, socioeconomic class, gender, sexual identity and language in the school environment. Special attention to culturally relevant teaching in grades 7 through 12, along with curriculum transformation and social action in those grades. Meets U.S. Diversity Requirement

C I 407: Principles and Practices of Distance Learning
(Dual-listed with C I 507). (2-2) Cr. 3. F.SS.
Prereq: C I 201 or C I 202; convenient access to the Web
Review of flexible and distance learning (FDL) cases in a variety of contexts and pedagogic styles, identification of underlying principles and frameworks for best practice in this field. Required for the Learning Technologies minor.

C I 416: Supervised Student Teaching - Elementary
Cr. arr. F.S.
Prereq: GPA 2.5; full admission to teacher education; senior classification; C I 378, C I 443, C I 448, C I 449; reservation required
Supervised teaching experience in the elementary grades.

C I 416A: Supervised Student Teaching - Elementary: Primary grades (K-3)
Cr. arr. F.S.
Prereq: GPA 2.5; full admission to teacher education; senior classification; C I 378, C I 443, C I 448, C I 449; reservation required
Supervised teaching experience in the elementary grades.

C I 416B: Supervised Student Teaching - Elementary: Intermediate grades (4-6)
Cr. arr. F.S.
Prereq: GPA 2.5; full admission to teacher education; senior classification; C I 378, C I 443, C I 448, C I 449; reservation required
Supervised teaching experience in the elementary grades.

C I 416C: Supervised Student Teaching - Elementary: World Language
Cr. arr. F.S.
Prereq: GPA 2.5; full admission to teacher education; senior classification; C I 378, C I 443, C I 448, C I 449; reservation required
Supervised teaching experience in the elementary grades.

C I 416D: Supervised Student Teaching - Elementary: International Student Teaching - Primary Grades
Cr. arr. F.S.
Prereq: GPA 2.5; full admission to teacher education; senior classification; C I 378, C I 443, C I 448, C I 449; reservation required
Supervised teaching experience in the elementary grades.

C I 416E: Supervised Student Teaching - Elementary: International Student Teaching - Intermediate Grades
Cr. arr. F.S.
Prereq: GPA 2.5; full admission to teacher education; senior classification; C I 378, C I 443, C I 448, C I 449; reservation required
Supervised teaching experience in the elementary grades.

C I 416Z: Supervised Student Teaching - Elementary: English as a Second Language
Cr. arr. F.S.
Prereq: GPA 2.5; full admission to teacher education; senior classification; ENGL 219; ENGL 220; ENGL 425; C I 280S; C I 480S; C I 378.
Supervised teaching experience in the elementary grades.

C I 417: Student Teaching
(Dual-listed with C I 517). Cr. arr. F.S.
Prereq: Full admission to teacher education or licensed teacher; approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching.

C I 417A: Student Teaching: Social Studies-Middle School
(Dual-listed with C I 517A). Cr. arr. F.S.
Prereq: GPA 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

C I 417B: Student Teaching: Physical Sciences
(Dual-listed with C I 517B). Cr. arr. F.S.
Prereq: Full admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in physical sciences grades 5-12.

C I 417C: Student Teaching: Mathematics
(Dual-listed with C I 517C). Cr. arr. F.S.
Prereq: Full admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in mathematics grades 5-12.

C I 417D: Student Teaching: Biological Sciences
(Dual-listed with C I 517D). Cr. arr. F.S.
Prereq: Full admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in biological sciences grades 5-12.

C I 417E: Student Teaching: English and Literature
(Cross-listed with ENGL). Cr. arr. F.S.
Prereq: ENGL 494, admission to teacher education, approval of coordinator the semester prior to student teaching
Full-time teaching in secondary English: long term and unit planning, lesson planning, classroom teaching practice in English language arts.

C I 417G: Student Teaching: World Language
(Dual-listed with C I 517G). (Cross-listed with WLC). Cr. arr. F.S.
Prereq: minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in world languages, secondary grades.

C I 417J: Student Teaching: Earth Sciences
(Dual-listed with C I 517J). Cr. arr. F.S.
Prereq: Full admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in earth sciences grades 5-12.

C I 417M: Student Teaching: Science - Basic
(Dual-listed with C I 517M). Cr. arr. F.S.
Prereq: Full admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in basic sciences grades 5-12.

C I 417N: Student Teaching: International
(Dual-listed with C I 517N). Cr. arr. F.S.
Prereq: GPA 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

C I 417P: Student Teaching: Social Studies-High School
(Dual-listed with C I 517P). Cr. arr. F.S.
Prereq: GPA 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

C I 417R: Student Teaching: Music-Elementary
(Dual-listed with C I 517R). (Cross-listed with MUSIC). Cr. arr. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

C I 417S: Student Teaching: Music-Secondary
(Dual-listed with C I 517S). (Cross-listed with MUSIC). Cr. arr. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

C I 417Z: Student Teaching: English as Second Language
Cr. arr. F.S.
Prereq: GPA 2.5; Admission to teacher education, approval of coordinator during semester before student teaching.
Evaluation of instruction, lesson planning, and teaching in English as a Second Language grades 7-12.

C I 418: Secondary Science Methods I: A Research-Based Framework for Teaching Science
(Dual-listed with C I 518). (3-0) Cr. 3. F.
Prereq: C I 280M or C I 514; undergraduate students must register concurrently for C I 347 and C I 468J
Development of a research-based framework for teaching science that includes student goals, congruent student actions, the character and role of science inquiry, teaching behaviors and strategies, contemporary learning theories, and self evaluation.

C I 419: Secondary Science Methods II: Advancing a Research-Based Framework for Teaching Science
(Dual-listed with C I 519). (3-0) Cr. 3. S.
Prereq: C I 418 or C I 518, undergraduate students must register concurrently for C I 468K
Advancing a research-based framework for teaching science in a variety of school settings; emphasizing the teacher's role, content area reading strategies, science safety and classroom management, issues in using technology, and student assessment.

C I 420: Bilingualism, Bilingual Education, and U.S. Mexican Youth
(Dual-listed with C I 520). (3-0) Cr. 3. F.
Prereq: C I 406
Introduction to research on bilingualism and examination of the social, historical, and political contexts of bilingual education in U.S. schools. Attention to policy environment, school program structure, mode of classroom instruction, family and community context, and attainment of bilingualism and biculturalism for U.S. Mexican youth.

C I 426: Principles of Secondary Education
(Dual-listed with C I 526). (3-0) Cr. 3. F.S.SS.
Prereq: Senior classification and admission to teacher education program
Introduction to secondary education teaching strategies, lesson planning that provides equitable learning opportunities for all students, classroom management, legal aspects of schools, professional and ethical issues, current educational issues, professional learning communities, and social-justice oriented teaching.

C I 433: Teaching Social Studies in the Primary Grades
(2-0) Cr. 2. F.S.
Prereq: C I 377, HD FS 224; concurrent enrollment in C I 439, SP ED 355, SP ED 455, and C I 468I
Emphasis is placed on providing equity and justice-oriented social studies learning experiences (e.g. curriculum content, instructional strategies, and assessment) for primary grade children.

C I 438: Teaching Mathematics in the Primary Grades
(2-0) Cr. 2. F.S.
Prereq: C I 377 concurrent enrollment in CI 378, CI 449, CI 468B and CI 468D (El Ed majors)
Develop an understanding of effective mathematics teaching practices situated in equitable pedagogies that support primary students' mathematical understanding.

C I 439: Teaching Science in the Primary Grades
(2-0) Cr. 2. F.S.
Prereq: C I 377, HD FS 224; concurrent enrollment in C I 433, C I 468I, SP ED 355, SP ED 455
Development and application of current methods in the teaching and learning of primary science. Emphasis is on research-based teaching practices, developmental implications, and providing appropriate science learning experiences in the early elementary grades.

C I 443: The Teaching of Social Studies
(3-0) Cr. 3. F.S.SS.
Prereq: C I 377, concurrent enrollment in CI 378, CI 449, CI 468B and CI 468D (El Ed majors)
Emphasis is placed on providing equity and justice-oriented social studies learning experiences (e.g. curriculum content, instructional strategies, and assessment) for primary and intermediate grade children.

C I 448: Teaching Children Mathematics
(3-0) Cr. 3. F.S.SS.
Prereq: MATH 195 (minimum grade of C-), MATH 196 (minimum grade of C-); concurrent enrollment in C I 377, C I 468A, C I 468C, and C I 405 (El Ed majors) or C I 377, C I 468F, C I 468G and Sp Ed 368 (ECE majors)
Develop an understanding of effective mathematics teaching practices situated in equitable pedagogies that support elementary students' mathematical understanding.

C I 449: The Teaching of Science
(3-0) Cr. 3. F.S.SS.
Prereq: C I 377, concurrent enrollment in C I 378, C I 468B, C I 468D, junior classification
Procedures for teaching science to children. Emphasis on developmental implications, teaching processes and methods, current programs, and assessment of learning in science.

C I 450: Ethnicity and Learning
(Dual-listed with C I 550). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: C I 332 or C I 333, C I 406
Examination of cultural relevance in education. Development and application of strategies and techniques for implementing multicultural goals and multiethnic perspectives in PreK-12 school classroom settings. Meets U.S. Diversity Requirement

C I 452: Assessment for Literacy and Learning
(Dual-listed with C I 552). (3-0) Cr. 3. F.S.SS.
Prereq: C I 378 or equivalent
Identification, analysis and correction of reading problems in five areas: print knowledge, integration of print knowledge, oral reading fluency, vocabulary, and comprehension.

C I 454: Emerging Topics in Learning Technologies
(2-2) Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: C I 201 or C I 202
Development and application of emerging technology topics related to digital learning. Series of 1-3 credit on-line learning modules on current technology being used in education and topics being addressed. These modules extend learning opportunities from other courses and experiences. Required for the Learning Technologies minor.

C I 456: Integrating Technology into Literacy
(Dual-listed with C I 556). (3-0) Cr. 3. F.SS.
Prereq: C I 201 or C I 202, C I 377
Methods and strategies used to integrate technology into K-8 literacy. Examination of the use and evaluation of technology appropriate for elementary literacy classrooms.

C I 468: Pre-Student Teaching Experience II
Cr. 1-2. F.S.SS.
Prereq: Admission to teacher education program
Application of current methods, and instructional experiences with children in a supervised elementary, middle, or high school classroom while engaged in other methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only.

C I 468A: Pre-Student Teaching Experience II: Primary Grades, Reading and Language Arts
Cr. 1. F.S.SS.
Prereq: Admission to teacher education program
Application of current methods and instructional experiences with children in a supervised K-3 elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only.

C I 468B: Pre-Student Teaching Experience II: Intermediate Grades, Reading and Language Arts
Cr. 1. F.S.SS.
Prereq: Admission to teacher education program
Application of current methods and instructional experiences with children in a supervised 3-6 elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only.

C I 468C: Pre-Student Teaching Experience II: Primary Grades, Mathematics
Cr. 1. F.S.SS.
Prereq: Admission to teacher education program
Application of current methods, and instructional experiences with children in a supervised K-3 elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only.

C I 468D: Pre-Student Teaching Experience II: Intermediate Grades, Science
Cr. 1. F.S.SS.
Prereq: Admission to teacher education program
Application of current methods and instructional experiences with children in a supervised 3-6 elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only.

C I 468E: Pre-Student Teaching Experience II: World Languages
Cr. 1. F.
Prereq: Admission to teacher education program
Application of current methods, and instructional experiences with children in a supervised K-6 elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only.

C I 468F: Pre-Student Teaching Experience II: Primary Grades Inclusive, Literacy
Cr. 1. F.S.
Prereq: Admission to teacher education program
Application of current methods and instructional experiences with children in a supervised K-3 inclusive elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only.

C I 468G: Pre-Student Teaching Experience II: Primary Grades Inclusive, Mathematics
Cr. 1. F.S.
Prereq: Admission to teacher education program
Application of current methods and instructional experiences with children in a supervised K-3 inclusive elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only.

C I 468I: Pre-Student Teaching Experience II: Primary Grades Inclusive, Science
Cr. 1. F.S.
Prereq: Admission to teacher education program
Application of current methods and instructional experiences with children in a supervised K-3 inclusive elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only.

C I 468J: Pre-Student Teaching Experience II: Secondary Science I
Cr. 2. F.
Prereq: Admission to teacher education program
Application of current methods and instructional experiences with children in a supervised grade 5-12 science classroom while engaged in other elementary methods courses. Clinical Supervision Level 3. Offered on a satisfactory-fail basis only.

C I 468K: Pre-Student Teaching Experience II: Secondary Science II
Cr. 2. S.
Prereq: Admission to teacher education program
Application of current methods and instructional experiences with children in a supervised 5-12 science classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only.

C I 468R: Pre-Student Teaching Experience II: Intermediate Grades, Reading Endorsement
Cr. 1. F.S.SS.
Prereq: Admission to teacher education program. Permission of School of Education required; concurrent enrollment in C I 378
Application of current methods and instructional experiences with children in a supervised 3-6 elementary classroom while engaged in other elementary methods courses. Clinical Experience Level 3. Offered on a satisfactory-fail basis only.

C I 469: Pre-student Teaching Seminar
Cr. 1. Repeatable. F.S.
Prereq: Admission to teacher education program.
Future teachers learn about teaching as they connect theory, practice and classroom experiences. Learning is supported with video-based seminars focused on effective classroom practices. Offered on a satisfactory-fail basis only.

C I 480: Pre-Student Teaching Experience III
(Cross-listed with MUSIC). Cr. 0.5-2. Repeatable. F.S.
Prereq: Admission to Teacher Education
Observation and participation in a variety of school settings after admission to the teacher education program. Permission of area coordinator required prior to enrollment. (S/F grading may be used in some offerings of some sections.).

C I 480A: Pre-Student Teaching Experience III: History/Social Sciences
(Cross-listed with HIST). Cr. 2. Repeatable, maximum of 2 times. F.
Prereq: Admission to Teacher Education
Supervised participation in a 5-12 school setting. Permission of History/Social Sciences coordinator required prior to enrollment. 1/2 day of time needed. Clinical Supervision Level 3.

C I 480B: Field Experience for Secondary Teaching Preparation: Physical Sciences
Cr. 0.5. Repeatable, maximum of 2 times. F.S.
Prereq: Permission of area coordinator required prior to enrolllment
Observation and participation in a variety of school settings after admission to the teacher preparation program. Physical Sciences.

C I 480C: Pre-Student Teaching Experience III: Mathematics
Cr. 0.5-2. Repeatable, maximum of 2 times. F.S.
Prereq: Admission to teacher education
Supervised participation mathematics in a 5-12 school setting. Permission of mathematics coordinator required prior to enrollment. 1/2 day of time needed. Clinical Experience Level 3.

C I 480D: Field Experience for Secondary Teaching Preparation: Biological Sciences
Cr. 0.5. Repeatable, maximum of 2 times. F.S.
Prereq: Permission of area coordinator required prior to enrollment
D. Biological Sciences.

C I 480E: Pre-Student Teaching Experience III: English
Cr. 1-2. Repeatable, maximum of 2 times. F.S.
Prereq: Admission to teacher education
Supervised participation in a 5-12 school setting. Cross listed with English 480K. Permission of English coordinator required prior to enrollment. 1/2 day of time needed. Clinical Experience Level 3.

C I 480G: Pre-Student Teaching Experience III: World Languages and Cultures
Cr. 1-2. Repeatable, maximum of 2 times. F.
Prereq: Admission to teacher education
Supervised participation in a 5-12 school setting. Permission of World Languages and Cultures coordinator required prior to enrollment. 1/2 day of time needed. Clinical Experience Level 3.

C I 480J: Field Experience for Secondary Teaching Preparation: Earth Science
Cr. 0.5. Repeatable, maximum of 2 times. F.S.
J. Earth Science.

C I 480K: Pre-Student Teaching Experience III: Music
(Cross-listed with MUSIC). Cr. 1. Repeatable. F.S.
Prereq: Admission to teacher education
Participation in a K-12 school setting. Permission of Music coordinator required prior to enrollment. Clinical Experience Level 2. Offered on a satisfactory-fail basis only.

C I 480S: Pre-Student Teaching Experience III: English as a Second Language (ESL)
(0-4) Cr. 2. Repeatable, maximum of 2 times.
Prereq: C I 280S, ENGL/LING 219; ENGL/LING 220; ENGL/LING 511; admission to teaching education.
Supervised participation in a school setting. Permission of ESL area coordinator required prior to enrollment. 1/2 day of time needed. Clinical experience level 3. Offered on a satisfactory-fail basis only.

C I 481: Philosophy of Education
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Introduction to Western philosophy of education. Emphasis is placed on enduring debates about the purposes(s) of education in a just society. Readings include classic and contemporary texts.

C I 486: Methods in Elementary School World Language Instruction
(Cross-listed with LING, WLC). (3-0) Cr. 3. F.
Prereq: 25 credits in a world language
Planning, implementation, and assessment of standards-based, student-centered, and thematic instruction in the elementary (K-8) classroom. Special emphasis on K-8 students' communicative skills, cultural knowledge, and content learning.

C I 487: Methods in Secondary School World Language Instruction
(Cross-listed with LING, WLC). (3-0) Cr. 3. F.
Prereq: 25 credits in a world language, admission to the teacher education program, OPI
Theories and principles of contemporary world language learning and teaching. Special emphasis on designing instruction and assessments for active learning.

C I 488: Supervised Tutoring in Reading
(Dual-listed with C I 588). (2-2) Cr. 3. F.S.SS.
Prereq: concurrent enrollment in or completion of one course in corrective reading; diagnosis and correction of reading problems; graduate status required for C I 588
Using formal and informal diagnostic procedures to plan and implement individualized reading instruction. Field experience in tutoring and a related research project.

C I 490: Independent Study
Cr. 1-3. F.S.SS.
Prereq: GPA of 2.5 or more for preceding semester

C I 490A: Independent Study: Education
(Cross-listed with MUSIC). Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor; 12 credits in music, approval of department head

C I 490C: Independent Study: Curriculum Construction
Cr. 1-3. F.S.SS.
Prereq: GPA of 2.5 or more for preceding semester

C I 490D: Independent Study: Principles of Education
Cr. 1-3. F.S.SS.
Prereq: GPA of 2.5 or more for preceding semester

C I 490E: Independent Study: Methods of Teaching
Cr. 1-3. F.S.SS.
Prereq: GPA of 2.5 or more for preceding semester

C I 490F: Independent Study: Educational Psychology
Cr. 1-3. F.S.SS.
Prereq: GPA of 2.5 or more for preceding semester

C I 490G: Independent Study: Digital Learning
Cr. 1-3. F.S.SS.
Prereq: GPA of 2.5 or more for preceding semester

C I 490H: Independent Study: Honors
Cr. 1-3. F.S.SS.
Prereq: GPA of 2.5 or more for preceding semester

C I 490J: Independent Study: Multicultural Education
Cr. 1-3. F.S.SS.
Prereq: GPA of 2.5 or more for preceding semester

C I 490K: Independent Study: History/Social Sciences
Cr. 1-3. F.S.SS.
Prereq: GPA of 2.5 or more for preceding semester

C I 490L: Independent Study: Literacy Education
Cr. 1-3. F.S.SS.
Prereq: GPA of 2.5 or more for preceding semester

C I 490M: Independent Study: Mathematics Education
Cr. 1-3. F.S.SS.
Prereq: GPA of 2.5 or more for preceding semester

C I 490N: Independent Study: World Language
Cr. 1-3. F.S.SS.
Prereq: GPA of 2.5 or more for preceding semester

C I 490O: Independent Study: Foundations of Education
Cr. 1-3. F.S.SS.
Prereq: GPA of 2.5 or more for preceding semester

C I 490P: Independent Study: Science Education
Cr. 1-3. F.S.
Prereq: GPA of 2.5 or more for preceding semester
Independent Study in science education.

C I 494: Practice and Theory of Teaching Literature in the Secondary Schools
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.
Prereq: ENGL 310, ENGL 397, 9 other credits in English beyond ENGL 250, PSYCH 333, admission to teacher education program
Portfolio review. Current theories and practices in the teaching of literature to secondary school students. Integrating literary study and writing. Preparation and selection of materials. Classroom presentation. Unit planning. (Taken concurrently with C I 280, Cr. 2, and Sp Ed 450).

C I 495B: Independent Study: Teaching Speech
(Cross-listed with SP CM). (3-0) Cr. 3. F.
Prereq: C I 301; 9 credits in speech communication; minimum GPA of 2.5 in speech communication courses
Problems, methods, and materials related to teaching speech, theatre, and media in secondary schools.

C I 497: Teaching Secondary School Mathematics
(Cross-listed with MATH). (3-0) Cr. 3. F.
Prereq: 15 credits in college mathematics. If in a teacher licensure program, concurrent enrollment in C I 426 or C I 526.
Develop an understanding of instructional planning, lesson implementation, and assessment in grades 5-12 mathematics, with a focus on reform-based mathematics, equity, and conceptual understanding.

C I 498: Methods of Teaching History/Social Sciences
(Cross-listed with HIST). (3-0) Cr. 3. F.S.
Prereq: Concurrent enrollment in HIST 480A; Admission to teacher education and 30 credits in subject-matter field
Concurrent enrollment in 480A; Admission to teacher education and 30 credits in subject-matter field. Theories and processes of teaching and learning secondary history/social sciences. Emphasis on development and enactment of current methods, assessments, and curriculum materials for providing appropriate learning experiences.

Courses primarily for graduate students, open to qualified undergraduates:

C I 501: Foundations of Learning Technologies
(3-0) Cr. 3. F.SS.
Prereq: Graduate classification
Educational philosophies and theories of teaching, learning, and learning technologies. Application of research to the production and use of learning technologies in various educational contexts. Equipment operation.

C I 503: Designing Effective Learning Environments
(3-0) Cr. 3. F.
Prereq: 501
Introduction to theories and models of instructional design. Design decision-making based on the analysis of performance problems and instructional inputs. Practical experience with the design and development of instruction and evaluation principles.

C I 504: Evaluating Digital Learning Environments
(Cross-listed with HCI). (3-0) Cr. 3. S.
Prereq: C I 501
Principles and procedures to plan, design, and conduct effective evaluation studies (formative, summative, usability) in different settings are studied. Opportunities to engage in real or simulated evaluation projects of substantial scope are provided. Create evaluation instruments, develop methods with which to evaluate a product or program, conduct try-outs or usability sessions, analyze the data, report the findings, and recommendations are some of the course activities.

C I 505: Using Technology in Learning and Teaching
(3-0) Cr. 3. F.S.SS.
Prereq: Graduate classification
Teaching and learning using computers. Selection and evaluation of digital tools for teaching and learning. Research on instructional technology. Tool software. Trends in computer-based instruction.

C I 506: Social Justice Education and Teaching: Advanced
(3-0) Cr. 3. F.
Prereq: 6 graduate credits in education
Engage with justice-oriented multicultural frameworks for transformative education and education research, understand equity in education issues in historical and contemporary contexts, develop principled approaches to critical self-reflection, interpret educational situations in justice-oriented ways, and counter inequities in education through curriculum, pedagogy, and research.

C I 507: Principles and Practices of Distance Learning
(Dual-listed with C I 407). (2-2) Cr. 3. F.SS.
Prereq: C I 201 or C I 202; convenient access to the Web
Review of flexible and distance learning (FDL) cases in a variety of contexts and pedagogic styles, identification of underlying principles and frameworks for best practice in this field. Required for the Learning Technologies minor.

C I 508: Algebra in the K-12 Classrooms
(3-0) Cr. 3. F.
Prereq: 6 credits of mathematics; credit or concurrent enrollment in C I 448 or C I 497 or C I 597
Focus on Algebraic reasoning, concepts, and associated procedures in K-12 classrooms. Learning trajectories in algebra, examination of representation, and analysis of mathematical situations are discussed. Attention is given to algebraic habits of mind, generalization, functions, and the transition from arithmetic to algebra.

C I 509: Geometry in the K-12 Classrooms
(3-0) Cr. 3. S.
Prereq: 6 credits of mathematics; credit or concurrent enrollment in C I 448 or C I 497 or C I 597
Explore the fundamental mathematical theory underlying the content area of geometry and measurement through research-based pedagogies in K-12 classrooms. An investigative approach involving problem solving, reasoning and proof, connections, and communication are emphasized.

C I 511: Technology Diffusion, Leadership and Change
(3-0) Cr. 3. S.
Prereq: Admission to graduate study, C I 501 or equivalent and C I 505 or equivalent
Principles and practices of technology diffusion, leadership and school change. Readings and coursework focus on technology diffusion in a broad sense, and examine more closely how this has played out in educational contexts. Leadership is addressed relative to frameworks and strategies for professional development ad organizational change.

C I 512: Research Trends in Digital Learning
(3-0) Cr. 3. F.
Prereq: Admission to graduate study and at least two courses in research and foundations of instructional technology
Critical review of current research trends in educational technology. Designed to consolidate graduate students' knowledge of current trends, issues in research, and methods of conducting research in practice.

C I 513: Mathematical Problem Solving in K-12 Classrooms
(3-0) Cr. 3. F.
Prereq: 6 credits of mathematics; credit or concurrent enrollment in C I 448 or C I 497 or C I 597
Develop problem solving strategies across all strands of mathematics (e.g., geometry, algebra, number theory). Issues surrounding the appropriate role of problem solving in K-12 mathematics classrooms are discussed, including distinctions among teaching "about," "for," and "through" problem solving.

C I 514: Introduction to the Purposes and Complexities of Science Teaching
(1-2) Cr. 2. SS.
Prereq: Admission to M.A.T. program
Introduction to critical issues facing science education, science education goals reflecting contemporary purposes of schooling, and how people learn science.

C I 515: Action Research in Education
(3-0) Cr. 3. S.
Prereq: Admission to graduate study, one course in research methods, educational inquiry, statistics, educational psychology, or instructional design
Philosophy and methods of conducting and communicating action research focused on improving educational practices. Designed specifically for practicing teachers.

C I 516: Antiracist Curriculum Development and Implementation
(2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 9 credits in education
Introduction to historical, sociological, philosophical and pedagogical foundations of antiracist/multicultural education. Examination of causes of racism, other forms of discrimination, and intergroup conflict from different theoretical perspectives and experiential exercises.

C I 517: Student Teaching
(Dual-listed with C I 417). Cr. arr. F.S.
Prereq: Full admission to teacher education or licensed teacher; approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching.

C I 517A: Student Teaching: Social Studies-Middle School
(Dual-listed with C I 417A). Cr. arr. F.S.
Prereq: GPA 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

C I 517B: Student Teaching: Physical Sciences
(Dual-listed with C I 417B). Cr. arr. F.S.
Prereq: Full admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in physical sciences grades 5-12.

C I 517C: Student Teaching: Mathematics
(Dual-listed with C I 417C). Cr. arr. F.S.
Prereq: Full admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in mathematics grades 5-12.

C I 517D: Student Teaching: Biological Sciences
(Dual-listed with C I 417D). Cr. arr. F.S.
Prereq: Full admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in biological sciences grades 5-12.

C I 517G: Student Teaching: World Language
(Dual-listed with C I 417G). (Cross-listed with WLC). Cr. arr. F.S.
Prereq: minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in world languages, secondary grades.

C I 517J: Student Teaching: Earth Sciences
(Dual-listed with C I 417J). Cr. arr. F.S.
Prereq: Full admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in earth sciences grades 5-12.

C I 517M: Student Teaching: Science - Basic
(Dual-listed with C I 417M). Cr. arr. F.S.
Prereq: Full admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in basic sciences grades 5-12.

C I 517N: Student Teaching: International
(Dual-listed with C I 417N). Cr. arr. F.S.
Prereq: GPA 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

C I 517P: Student Teaching: Social Studies-High School
(Dual-listed with C I 417P). Cr. arr. F.S.
Prereq: GPA 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

C I 517R: Student Teaching: Music-Elementary
(Dual-listed with C I 417R). (Cross-listed with MUSIC). Cr. arr. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

C I 517S: Student Teaching: Music-Secondary
(Dual-listed with C I 417S). (Cross-listed with MUSIC). Cr. arr. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

C I 518: Science Methods I: A Research-Based Framework for Teaching Science
(Dual-listed with C I 418). (3-0) Cr. 3. F.
Prereq: C I 514; concurrent enrollment in C I 547 and C I 591D
Development of a research-based framework for teaching science that includes student goals, congruent student actions, the character and role of science inquiry, teaching behaviors and strategies, contemporary learning theories, and self-evaluation.

C I 519: Secondary Science Methods II: Advancing a Research-Based Framework for Teaching Science
(Dual-listed with C I 419). (3-0) Cr. 3. S.
Prereq: C I 418 or C I 518, undergraduate students must register concurrently for C I 468K
Advancing a research-based framework for teaching science in a variety of school settings; emphasizing the teacher's role, content area reading strategies, science safety and classroom management, issues in using technology, and student assessment.

C I 520: Bilingualism, Bilingual Education, and U.S. Mexican Youth
(Dual-listed with C I 420). (3-0) Cr. 3. F.
Prereq: C I 406
Introduction to research on bilingualism and examination of the social, historical, and political contexts of bilingual education in U.S. schools. Attention to policy environment, school program structure, mode of classroom instruction, family and community context, and attainment of bilingualism and biculturalism for U.S. Mexican youth.

C I 523: Teaching Students who Struggle in Mathematics
(3-0) Cr. 3. SS.
Prereq: C I 438 or C I 448
Explore and develop an understanding of research-based instructional practices that could be implemented with elementary students who are struggling with learning mathematical concepts.

C I 526: Principles of Secondary Education
(Dual-listed with C I 426). (3-0) Cr. 3. F.S.SS.
Prereq: Senior classification and admission to teacher education program
Introduction to secondary education teaching strategies, lesson planning that provides equitable learning opportunities for all students, classroom management, legal aspects of schools, professional and ethical issues, current educational issues, professional learning communities, and social-justice oriented teaching.

C I 529: Educational Psychology and the Secondary Classroom
(3-0) Cr. 3. SS.
Prereq: Bachelor's degree; admission into a graduate level teacher licensure program
Analysis of psychological research theory related to learning, cognition, motivation, individual differences, and teaching techniques. Student and classroom assessment to facilitate positive learning outcomes. Adaption and differentiation of instruction to meet individual learners' needs. This course can only be used for teacher licensure programs. It is not acceptable for use in meeting the non-licensure M.Ed., M.S. or Ph.D. requirements.

C I 533: Educational Psychology of Learning, Cognition, and Memory
(Cross-listed with PSYCH). (3-0) Cr. 3. F.
Learning, cognition, and memory in educational/training settings.

C I 541: How People Learn: Implications for Teaching Science
(3-0) Cr. 3.
Prereq: Bachelor's degree
Current theories of learning, motivation, and attribution in science education and their application to science classrooms. Examination of teaching models congruent with learning theory.

C I 546: Advanced Pedagogy in Science Education
(3-0) Cr. 3. S.SS.
Prereq: Bachelor's degree
Advanced examination of pedagogy, emphasizing teacher behaviors and strategies, methods of self-assessment, action research, and current issues and trends in science education.

C I 547: Nature of Science
(Dual-listed with C I 347). (3-0) Cr. 3. F.
Prereq: C I 280M; concurrent enrollment in C I 418 or instructor permission
The intersection of issues in the history, philosophy sociology, and psychology of science and their application to and impact on science teaching and learning, science teacher education, and science education research.

C I 548: Restructuring Science Activities
(3-0) Cr. 3. SS.
Prereq: Admission to teacher education or teaching license
Modification of laboratory activities and other everyday science activities so they are more congruent with how students learn, the nature of science, and national standards.

C I 550: Ethnicity and Learning
(Dual-listed with C I 450). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: C I 332 or C I 333, C I 406
Examination of cultural relevance in education. Development and application of strategies and techniques for implementing multicultural goals and multiethnic perspectives in PreK-12 school classroom settings. Meets U.S. Diversity Requirement

C I 551: Foundations of Reading and Language Arts
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: Teaching license
Analyzing, discussing, and researching the theory and practice of current literacy issues.

C I 552: Assessment for Literacy and Learning
(Dual-listed with C I 452). (3-0) Cr. 3. F.S.SS.
Prereq: C I 378 or equivalent
Identification, analysis and correction of reading problems in five areas: print knowledge, integration of print knowledge, oral reading fluency, vocabulary, and comprehension.

C I 553: Teaching Adolescent Readers with Reading Difficulties
(Cross-listed with SP ED). (3-0) Cr. 3. SS.
Prereq: Teaching license
Instructional strategies for enhancing the fluency, vocabulary and comprehension of adolescents with reading difficulties. Attention to content-area reading materials and strategies.

C I 554: Reading and Responding to Children's Literature
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Senior status or teaching license
Research and discussion of issues surrounding the classroom use of literature for children and young adults including censorship, diversity, selection, and the influences of technology.

C I 555: Literacy, Leadership, and Advocacy
(3-0) Cr. 3. S.
Prereq: Graduate Standing
Examination of the roles of literacy specialists/coaches in diverse pre-K-12 schools and communities. Particular focus placed on current theories, research, standards, and policies relative to literacy processes and instruction, including culturally responsive literacy; processes of successful literacy coaching; and methods of supporting teachers and other school personnel in planning, implementing, and evaluating literacy instruction for all students.

C I 556: Integrating Technology into Literacy
(Dual-listed with C I 456). (3-0) Cr. 3. F.SS.
Prereq: C I 201 or C I 202, C I 377
Methods and strategies used to integrate technology into K-8 literacy. Examination of the use and evaluation of technology appropriate for elementary literacy classrooms.

C I 558: Perspectives on Reading Comprehension
(3-0) Cr. 3. F.
Prereq: Graduate standing
Critical examination of the topics central to the study of reading comprehension, including processes, development, contexts, motivation, teaching and learning, and assessment. Reading and discussion of research literature in reading comprehension and comprehension instruction.

C I 565: Literacy: Connecting Research, Policy and Practice
(3-0) Cr. 3. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: Graduate standing
Critical examination of current policy initiatives and reform efforts that affect how literacy is viewed, assessed, and practiced, as well as how literacy professionals are prepared for their roles in public schools and colleges.

C I 567: Teaching Mathematics to Struggling Secondary Learners
(Cross-listed with SP ED). (3-0) Cr. 3.
Prereq: Secondary teaching experience
Instructional methods and assessment techniques for secondary students struggling to learn mathematics. Particular emphasis on current research, practices, and trends in mathematics interventions for at-risk students and students with disabilities.

C I 568: New Media Literacies: Understanding Research and Practice
(3-0) Cr. 3. F.
Prereq: Graduate Standing
Designed to increase awareness and understanding of critical issues surrounding the evolving concept of literacy and examine the effect that technology has on the literacy we use every day, teach in our schools, and need in order to function as 21st century citizens.

C I 577: Historical Perspectives on Technology Equity: Implications for Policy and Practice
(3-0) Cr. 3. S.
Prereq: Graduate Status
Exploration of the historical, political, sociological, and economic factors that engender global inequities. Examination of the definition and origin of the "digital divide" and its relationship to the histories of racism, sexism, classism, and imperialism/globalization. Exploration and analysis of research-based alternative approaches to alleviating technology inequities in educational settings.

C I 578: Pedagogy, Equality of Opportunity, and the Education of Blacks in the United States
(3-0) Cr. 3.
Prereq: Graduate or senior level status or permission of instructor
This course takes a nonlinear, reflective view of the historical, social, economic, political, and legal contexts of the education of African Americans in the U.S. Educational theories and philosophies, Critical Race Theory and Black Feminist Thought form the framework for investigating broad-based, multiple issues of education for African Americans in the U.S. as they are situated in the prevailing dominant views.

C I 588: Supervised Tutoring in Reading
(Dual-listed with C I 488). (2-2) Cr. 3. F.S.SS.
Prereq: concurrent enrollment in or completion of one course in corrective reading; diagnosis and correction of reading problems; graduate status required for C I 588
Using formal and informal diagnostic procedures to plan and implement individualized reading instruction. Field experience in tutoring and a related research project.

C I 590: Special Topics
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 590A: Special Topics: Curriculum
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 590B: Special Topics: Digital Learning
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 590C: Special Topics: Science Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 590D: Special Topics: Secondary Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 590F: Special Topics: Multicultural Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 590G: Special Topics: Mathematics Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 590I: Special Topics: Elementary Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 590J: Special Topics: World Language Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 590K: Special Topics: Educational Psychology
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 590L: Special Topics: Social Studies Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 590M: Special Topics: Literacy Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 591: Graduate Level Pre-Student Teaching Experience
(0-2) Cr. 1-4. Repeatable, maximum of 3 times. F.S.
Prereq: 15 graduate credits in special area; admission to teacher education.
Supervised pre-student teaching experience in secondary schools. Supervision level 3.

C I 591C: Supervised Field Experience: Elementary Education
(0-2) Cr. 1-6. F.S.SS.
Prereq: 15 graduate credits in special area
Supervised on-the-job field experience in special area.

C I 591D: Graduate Level Pre-Student Teaching Experience: Secondary Science
(0-2) Cr. 1-4. Repeatable. F.S.
Prereq: 15 graduate credits in specialty area; admission to teacher education
Supervised pre-student teaching experience in secondary science education. Supervision level 3.

C I 591G: Graduate Level Pre-Student Teaching Experience: Secondary Mathematics Education
(0-2) Cr. 1-4. Repeatable. F.S.
Prereq: 15 graduate credits in specialty area; admission to teacher education
Supervised pre-student teaching experience in mathematics education. Supervision level 3.

C I 591M: Supervised Field Experience: Literacy
(0-2) Cr. 1-6. F.S.SS.
Prereq: 15 graduate credits in special area
Supervised on-the-job field experience in special area.

C I 593: Workshops
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 593A: Workshops: Curriculum
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 593B: Workshops: Digital Learning
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 593C: Workshops: Science Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 593D: Workshops: Secondary Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 593F: Workshops: Multicultural Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 593G: Workshops: Mathematics Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 593I: Workshops: Elementary Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 593J: Workshops: World Language Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 593K: Workshops: Educational Psychology
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 593L: Workshops: Social Studies Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 593M: Workshops: Literacy Education
Cr. 1-3. F.S.
Prereq: 9 graduate credits in education

C I 594: Contemporary Curriculum Theory and Principles
(3-0) Cr. 3. F.
Prereq: Graduate standing
Theoretical and historical perspectives of contemporary curriculum; social, cultural, and epistemological aspects of curriculum theory; diverse philosophical positions and approaches to understanding curriculum as it relates to educational settings.

C I 595: Content Area Reading and Literacy
(Dual-listed with C I 395). (3-0) Cr. 3. F.S.
Prereq: C I 204 and junior standing
Analysis and application of strategies to enhance students' literacy development in middle and secondary school settings.

C I 597: Teaching Secondary School Mathematics
(3-0) Cr. 3. F.
Prereq: 15 credits in college mathematics; and either in a teacher licensure program or in the process of applying, concurrent enrollment in C I 426 or C I 526
Theory and methods for teaching mathematics in grades 7-12. Includes critical examination of instructional strategies, curriculum materials, learning tools, assessment methods, National Standards in Mathematics Education, and equity issues.

C I 599: Creative Component
Cr. 1-3. F.S.SS.
Prereq: 9 graduate credits in education

C I 599A: Creative Component: Curriculum
Cr. 1-3. F.S.SS.
Prereq: 9 graduate credits in education

C I 599B: Creative Component: Digital Learning
Cr. 1-3. F.S.SS.
Prereq: 9 graduate credits in education

C I 599C: Creative Component: Science Education
Cr. 1-3. F.S.SS.
Prereq: 9 graduate credits in education

C I 599D: Creative Component: Secondary Education
Cr. 1-3. F.S.SS.
Prereq: 9 graduate credits in education

C I 599F: Creative Component: Multicultural Education
Cr. 1-3. F.S.SS.
Prereq: 9 graduate credits in education

C I 599G: Creative Component: Mathematics Education
Cr. 1-3. F.S.SS.
Prereq: 9 graduate credits in education

C I 599I: Creative Component: Elementary Education
Cr. 1-3. F.S.SS.
Prereq: 9 graduate credits in education

C I 599J: Creative Component: World Language Education
Cr. 1-3. F.S.SS.
Prereq: 9 graduate credits in education

C I 599K: Creative Component: Educational Psychology
Cr. 1-3. F.S.SS.
Prereq: 9 graduate credits in education

C I 599L: Creative Component: Social Studies Education
Cr. 1-3. F.S.SS.
Prereq: 9 graduate credits in education

C I 599M: Creative Component: Literacy Education
Cr. 1-3. F.S.SS.
Prereq: 9 graduate credits in education

Courses for graduate students:

C I 601: Foundations of Educational Inquiry
(3-0) Cr. 3. F.
Prereq: Admission to a Ph.D. program
First of a two-course sequence designed to welcome new Curriculum and Instruction Ph.D. students into the community of educational scholars. Inquiry into (1) the history of education as an academic field of study; (2() the philosophical underpinnings of social scientific and educational inquiry; and (3) the contemporary landscape of the field of education.

C I 602: Educational Inquiry in Action
(3-0) Cr. 3. S.
Prereq: C I 601
Opportunities to learn about a variety of faculty research in the School of Education, engage faculty in conversation about their research, and continue reflecting on the theory and practice of educational inquiry. Offered on a satisfactory-fail basis only.

C I 603: Advanced Learning Environments Design
(Cross-listed with HCI). (3-0) Cr. 3. S.
Prereq: C I 503
Exploration of advanced aspects of the instructional design process. Application of analysis, design, development and production, evaluation, implementation, and project management principles. Focus on the production and use of instructional technology with an emphasis on the instructional design consulting process. Theory and research in instructional technology provides the foundation for design decisions.

C I 610: Digital Learning in Teacher Education
(2-0) Cr. 2. F.
Prereq: C I 505
Research on using technology in teacher education programs. Application examples studied. Field component involving relating material from class to a teacher education situation.

C I 611: Philosophical Foundations of Digital Learning
(3-0) Cr. 3.
Prereq: 12 graduate credits in curriculum and instruction
Exploration of philosophies of science that serve as foundations for research and practice in instructional technology, including positivism, post-positivism, interpretivism/constructivism, and critical theory. The roles of language, nature of truth and reality, and acceptable ways of knowing are explored in terms of their implications for instructional technology design, delivery, research, and scholarship.

C I 612: Socio-psychological Foundations of Digital Learning
(3-0) Cr. 3.
Prereq: 12 graduate credits in curriculum and instruction
Exploration of theories of learning and associated instructional models that are the foundation for research and practice in education and educational technology, including behaviorism, information processing theory, and cognitive science. Emphasis on cognitive and social constructivist paradigms and the creation and use of constructivist learning environments supported by technology.

C I 615: Seminar
(0-2) Cr. 1. F.S.
Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research.

C I 615A: Seminar: Curriculum
(0-2) Cr. 1. F.S.
Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research.

C I 615B: Seminar: Digital Learning
(0-2) Cr. 1. F.S.
Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research.

C I 615C: Seminar: Science Education
(0-2) Cr. 1. F.S.
Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research.

C I 615D: Seminar: Secondary Education
(0-2) Cr. 1. F.S.
Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research.

C I 615F: Seminar: Multicultural Education
(0-2) Cr. 1. F.S.
Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research.

C I 615G: Seminar: Mathematics Education
(0-2) Cr. 1. F.S.
Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research.

C I 615I: Seminar: Elementary Education
(0-2) Cr. 1. F.S.
Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research.

C I 615J: Seminar: World Language Education
(0-2) Cr. 1. F.S.
Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research.

C I 615K: Seminar: Educational Psychology
(0-2) Cr. 1. F.S.
Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research.

C I 615L: Seminar: Social Studies Education
(0-2) Cr. 1. F.S.
Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research.

C I 615M: Seminar: Literacy Education
(0-2) Cr. 1. F.S.
Selected topics in curriculum and instruction; an analysis of research potential; evaluation of impact upon the profession; implications for additional research.

C I 690: Advanced Special Topics
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 690A: Advanced Special Topics: Curriculum
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 690B: Advanced Special Topics: Digital Learning
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 690C: Advanced Special Topics: Science Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 690D: Advanced Special Topics: Secondary Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 690F: Advanced Special Topics: Multicultural Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 690G: Advanced Special Topics: Mathematics Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 690I: Advanced Special Topics: Elementary Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 690J: Advanced Special Topics: World Language Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 690K: Advanced Special Topics: Educational Psychology
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 690L: Advanced Special Topics: Social Studies Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 690M: Advanced Special Topics: Literacy Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 699: Research
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 699A: Research: Curriculum
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 699B: Research: Digital Learning
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 699C: Research: Science Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 699D: Research: Secondary Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 699F: Research: Multicultural Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 699G: Research: Mathematics Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 699I: Research: Elementary Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 699J: Research: World Language Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 699K: Research: Educational Psychology
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 699L: Research: Social Studies Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

C I 699M: Research: Literacy Education
Cr. arr. Repeatable.
Prereq: 9 graduate credits in education

Dance (DANCE)

Courses primarily for undergraduates:

DANCE 120: Modern Dance I
(0-3) Cr. 1. F.S.
Introduction and practice of basic dance concepts, including preparatory techniques and guided creativity problems. No previous modern dance experience required. Offered on a satisfactory-fail basis only.

DANCE 130: Ballet I
(0-3) Cr. 1. F.S.
Introduction to the basic skills, vocabulary, and tradition of ballet with concentration on control and proper alignment. No previous ballet experience required. Offered on a satisfactory-fail basis only.

DANCE 140: Jazz I
(0-3) Cr. 1. F.S.
Introduction to the modern jazz style with concentration on isolation and syncopation. No previous jazz experience required. Offered on a satisfactory-fail basis only.

DANCE 150: Tap Dance I
(0-3) Cr. 1. F.
Instruction and practice in basic tap technique and terminology. No previous tap experience required. Offered on a satisfactory-fail basis only.

DANCE 160: Ballroom Dance I
(0-2) Cr. 1. F.S.
Instruction and practice in foxtrot, waltz, swing, cha cha, rhumba, tango, and selected contemporary dances. Offered on a satisfactory-fail basis only.

DANCE 199: Dance Continuum
Cr. 0.5-2. Repeatable, maximum of 6 credits. F.S.
Prereq: Permission of instructor
Advance registration required. Continued instruction and practice in either modern dance, recreational dance, ballet, jazz and/or compositional skills. Offered on a satisfactory-fail basis only.

DANCE 211: Fundamentals and Methods of Social and World Dance
(1-3) Cr. 1. S.
Skill enhancement, teaching, progressions with emphasis on world and social dance. Designed for kinesiology and health majors, open to others.

DANCE 220: Modern Dance Composition
(1-3) Cr. 2. F.
Prereq: DANCE 120 or previous modern dance experience
Theory and practice of the creative skills involved in solo and small group composition.

DANCE 222: Modern Dance II
(0-3) Cr. 1. F.
Prereq: DANCE 120 or previous modern dance experience
Dance techniques emphasizing strength, balance, endurance, rhythmic activity and extended combinations.

DANCE 223: Modern Dance III
(0-3) Cr. 1. S.
Prereq: DANCE 222
Continued experience in dance techniques and extended combinations. Emphasis on maturation of skill and artistry. Exposure to a variety of modern dance technical styles.

DANCE 224: Concert and Theatre Dance
(Cross-listed with THTRE). (0-3) Cr. 0.5-2. Repeatable, maximum of 6 credits. F.S.
Prereq: By audition only
Choreography, rehearsal, and performance in campus dance concerts and/or musical theatre productions. Offered on a satisfactory-fail basis only.

DANCE 232: Ballet II
(0-3) Cr. 1. S.
Prereq: Previous ballet experience
Technical skills in the classical movement vocabulary. Emphasis on alignment, techniques, sequence development, and performing quality.

DANCE 233: Ballet III
(0-3) Cr. 1. F.
Prereq: DANCE 232
Concentration on technical proficiency at the intermediate level. Pointe work and partnering opportunities available.

DANCE 242: Jazz II
(0-3) Cr. 1. S.
Prereq: Previous jazz dance experience
Dance concepts within the jazz idiom. Instruction in extended movement sequences and artistic interpretation.

DANCE 270: Dance Appreciation
(3-0) Cr. 3. F.S.SS.
Introduction to the many forms and functions of dance in world cultures. Develop abilities to distinguish and analyze various dance styles. No dance experience required.
Meets International Perspectives Requirement.

DANCE 320: Sound and Movement
(2-2) Cr. 3. S.
Prereq: DANCE 220
Intermediate composition based on the relationship of movement to improvised sounds, rhythmic scores, and the musical works of composers from various periods.

DANCE 360: History and Philosophy of Dance
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: DANCE 270
Study of the history of dance from early to modern times with emphasis on the theories and philosophies of contemporary modern dance, dancers, and dance educators.

DANCE 370: Advanced Studies in Dance
Cr. 1-3. Repeatable, maximum of 8 credits. F.S.
Prereq: 2 credits in dance
Advance registration required. Designed to meet special interests and talents of students to include both group and independent study in various aspects of dance as a performing art including production, choreography, and performance.

DANCE 384: Teaching Children's Dance
(1-3) Cr. 2. S.
Content, experiences, and methods of a comprehensive dance program at the elementary school level. Theories and practice in guiding elementary school children in expressive movement experiences.

DANCE 385: Methods of Teaching Dance
(1-3) Cr. 2. F.
Methods and techniques of teaching social and world dance forms. Introduction to teaching educational modern dance.

DANCE 386: Teaching Dance Technique and Composition
(1-3) Cr. 2.
Prereq: DANCE 320
Teaching yoga, body therapies, mindfulness and dance composition to enhance the physical and mental performance of the individual.

DANCE 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in dance and permission of coordinator
Independent study of problems or areas of interest in dance.

DANCE 490A: Independent Study: Dance
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: 6 credits in dance and permission of coordinator
Independent study of problems or areas of interest in dance.

DANCE 490H: Independent Study in Dance - Honors
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: 6 credits in dance and permission of coordinator
Independent study of problems or areas of interest in dance for those admitted to the honors program.

Design (DES)

Courses primarily for undergraduates:

DES 230: Design Thinking
(3-0) Cr. 3. F.S.
Introduction to the phenomenon of design thinking as it appears in various design fields, including methodologies of reasoning and problem solving; patterns of creativity and individual style; and the interaction of art, science, and technology.

DES 240: Design Studio I
(0-8) Cr. 2. Repeatable.
Prereq: DSN S 102, DSN S 131 and DSN S 183
Half-semester course. Studio projects develop students' ability to generate ideas and communicate those ideas visually, orally, and through writing. Emphasis on representation and conceptualization of interdisciplinary work.

DES 250: Design Forum
(2-0) Cr. 2. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: DSN S 102, DSN S 131, DSN S 183 and credit or concurrent enrollment in DES 230
Introduction of themes and issues that are relevant to the design fields through theoretical readings, case studies, and visiting lecturers.

DES 259: Design Field Study
Cr. R. Repeatable.
Prereq: Enrollment in or 2 credits of DES 240.
Off-campus tours of areas of interest within the design professions such as design offices, museums, buildings, and neighborhoods. Offered on a satisfactory-fail basis only.

DES 330: Visual Literacy for Design Critique
(3-0) Cr. 3. S.
Prereq: DSN S 102 or DSN S 183 or 3 credits of ART H or equivalent.
Students will learn to interpret, analyze and evaluate visual materials, use images and text effectively to communicate ideas, and understand issues surrounding the creation and use of images and visual media for design critique. Precedent study and critique of sample student design work to understand principles of visual literacy and how to apply them to the presentation of design work. Emphasis on peer-to-peer discussion and in-class participation. Lecture and discussion format.

DES 340: Design Studio II
(0-8) Cr. 2. Repeatable.
Prereq: 4 credits of DES 240 or equivalent.
Half-semester course. Studio projects of increasing complexity requiring interdisciplinary approaches to contemporary challenges and opportunities. Continued development of students' abilities to generate ideas and communicate those ideas visually, orally, and through writing. Field trip.

DES 491: Portfolio and Professional Preparation
(2-4) Cr. 4. F.
Prereq: classification as DES major; 4 credits of DES 240
Preparation of printed and online portfolio of student work and materials for job search and/or graduate school applications. Guidance for interviewing, professional networking, business etiquette, and resume writing. Workshops and lectures.

DES 495: Capstone Experience
(1-6) Cr. 4. S.
Prereq: classification as DES major; 2 credits of DES 340
Individual projects designed by students in consultation with faculty instructor and mentor. Demonstration of student skill sets and knowledge of project planning and development.

Design Studies (DSN S)

Courses primarily for undergraduates:

DSN S 102: Design Studio I
(1-6) Cr. 4.
A core design studio course exploring the interaction of two-and three-dimensional design. Emphasis on fundamental skills and ideas shared across design disciplines. Investigation of creative process, visual order and materials, and development of critical thinking through studio projects and lectures. Includes study of precedents, contemporary design practices and disciplines in their cultural contexts.

DSN S 110: Design Exchange Seminar I
(0-2) Cr. 1. F.
Prereq: Member of Design Exchange Learning Community
Orientation to the College of Design. Introduction to the design disciplines and studio pedagogy. Offered on a satisfactory-fail basis only.

DSN S 111: Design Exchange Seminar II
(0-2) Cr. 1. S.
Prereq: Member of the Design Exchange Learning Community
Development and clarification of career and academic plans. Offered on a satisfactory-fail basis only.

DSN S 115: Design Collaborative Seminar
(1-0) Cr. 0.5.
Prereq: Member of Design Collaborative Learning Community
Orientation to the College of Design. Introduction to the design disciplines and studio pedagogy. Offered on a satisfactory-fail basis only.

DSN S 131: Design Representation
(1-6) Cr. 4.
An introduction to methods of visual thinking and drawing through studio experiences and lectures. All design fields utilize visual communication and drawing. Focus on the use of drawing as a method for creative problem solving, design development and visual communication. Explore, from observation and imagination, the use of fast sketching and in-depth drawing, using various scales, mediums and processes.

DSN S 183: Design Cultures
(3-0) Cr. 3.
A broad-based exploration of the dynamic relationship between design and culture, employing case study method to investigate particular examples of cultural production in contemporary society. Design processes and design works are presented as culturally, economically, environmentally, historically, ideologically, politically, and socially grounded events and artifacts.

DSN S 232: Digital Design Communications
(3-0) Cr. 3.
Introductory investigations of various digital design media to develop multi-dimensional problem solving, digital communication skills and perceptual sensitivity. Open to all university majors.

DSN S 301: Study Abroad Preparation Seminar
(1-0) Cr. 1. Repeatable.
Cultural introduction to host country, introduction to faculty sponsor and program of study, the particulars of traveling and living abroad, and financial and logistical preparations. Guest lectures. Required of all students planning to participate in a College of Design study abroad program for 9 or more credits. Offered on a satisfactory-fail basis only.

DSN S 302: Design Leadership Seminar
(1-2) Cr. 2. Repeatable, maximum of 4 credits.
Prereq: Selection as a peer mentor for the Core Design program.
For students serving as peer mentors for the Core Design Program, under faculty supervision. Development of teaching and leadership skills within the context of design education experiences. Offered on a satisfactory-fail basis only.

DSN S 303: Design Ambassadors
(1-2) Cr. 1-2. Repeatable, maximum of 4 credits.
Prereq: Admittance into one of the professional programs in the College of Design
Opportunity to strengthen leadership, communication and presentation skills. Introduction to student development theory. Students participate in collaborative projects focused on prospective design students. Offered on a satisfactory-fail basis only.

DSN S 310: Practical Experience
Cr. R.
Prereq: Permission of adviser or Coordinator of Design Studies
Independent educational enrichment through practical experience. Students must register for this course prior to commencing each term. Available only to students taking course loads of eleven credits or less. Offered on a satisfactory-fail basis only.

DSN S 332: Multi-Dimensional Digital Design Communication
Cr. 3.
Prereq: Arch 230, ARTGR 275, DSN S 232, or permission of the instructor
Investigations if interoperable digital-design tools, techniques and methods directed at human scale interactive hybrid design from ideation to visualization, synthesis to analysis, and realization to fabrication.

DSN S 445: Public Art/Public Space
(3-0) Cr. 3.
Prereq: Junior Standing, DSN S 102, DSN S 131, DSN S 183
Exploration of the history, precedents, and practice of public art and public space with a focus on developments since 1970 in the United States and abroad. Course includes development of a proposal for a site specific work of art.
Meets U.S. Diversity Requirement

DSN S 446: Interdisciplinary Design Studio
(0-12) Cr. 4-6. Repeatable, maximum of 18 credits.
Prereq: Junior classification in a curriculum in the College of Design and permission of instructor
Advanced interdisciplinary design projects.

DSN S 446H: Interdisciplinary Design Studio: Honors
(0-12) Cr. 5-7. Repeatable, maximum of 18 credits.
Prereq: Junior classification in a curriculum in the College of Design and permission of instructor
Advanced interdisciplinary design projects.

DSN S 490: Independent Study
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490A: Independent Study: History
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490B: Independent Study: Technology
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490C: Independent Study: Communications
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490D: Independent Study: Design
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490E: Independent Study: Entrepreneurship
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490F: Independent Study: Social/Behavioral
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490G: Independent Study: Outreach
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment.
Independent investigation of a topic of special interest to the student.

DSN S 490H: Independent Study: Honors
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490I: Independent Study: Sustainability
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment.
Independent investigation of a topic of special interest to the student.
Offered on a satisfactory-fail basis only.

DSN S 492: Introduction to Italian Culture
(1-0) Cr. 1. Repeatable, maximum of 3 credits.
Prereq: Enrollment in the College of Design Rome Study Abroad Program
Introduction to Italian contemporary culture for design students, including food, religion, fashion, politics, media, and social mores.

Courses primarily for graduate students, open to qualified undergraduates:

DSN S 546: Interdisciplinary Design Studio
(0-12) Cr. 4-6. Repeatable, maximum of 18 credits.
Prereq: Graduate or senior standing in the College of Design and permission of instructor
Advanced interdisciplinary design projects.

DSN S 578: Topical Studies in Landscape Architecture
(Dual-listed with DSN S 478). (3-0) Cr. 2-3. Repeatable. F.S.SS.
Prereq: Senior Classification or graduate standing
Offerings vary with each term; check with department for available sections. Course contact hours can range from (2-0) to (3-0) depending on number of credits.

DSN S 585: Renaissance Art
(Cross-listed with ART H). (3-0) Cr. 3.
Prereq: Graduate classification and permission of instructor
European art including painting, sculpture, architecture, and crafts; thirteenth through sixteenth centuries.

DSN S 590: Special Topics
Cr. 1-4. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

Dietetics (DIET)

Courses primarily for graduate students, open to qualified undergraduates:

DIET 511: Research Methods
(3-0) Cr. 3. F.S.
Prereq: Enrollment in GP-IDEA MFCS in Dietetics
An overview of diverse research approaches focusing on methods for collecting and analyzing quantitative and qualitative data. www only. Only one of DIET 511 or FCEDS 511 may count toward graduation.

DIET 524: Financial Management and Cost Controls
(3-0) Cr. 3. SS.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Overview of the fundamental knowledge of financial management, managerial accounting, and operational cost controls for dietetics professionals. Topics include a review of managerial accounting concepts for not- for-profit organizations and for-profit organizations based on the Uniform System of Accounts, value and risk analysis, budgeting, asset management, franchising and management contracts, cost-volume-profit analyses, and operational applications for financial performance.

DIET 526: Obesity Across the Lifespan
(3-0) Cr. 3. F.
Exploration of the affects that obesity has on public health, the healthcare system, and society in general. Overview of strategies to prevent obesity across the lifespan.

DIET 527: Food Writing for Professionals
(3-0) Cr. 3. F.
Prereq: Enrollment in GP-IDEA MFCS in Dietetics
Understanding and appreciating how to communicate effectively in writing about food and food-related topics. Hands-on experience in research and writing for various audiences and types of media.

DIET 530: Nutrition in Wellness
(3-0) Cr. 3. SS.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Addresses wellness promotion through nutrition. Nutritional risk and protective factors will be examined in relation to public health and individual nutrition. www only.

DIET 532: Maternal and Child Nutrition
(3-0) Cr. 3. SS.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Critical examination of behavioral, physiological, and public health issues impacting dietary and nutritional factors that support normal growth and development. Content focuses on early stages of the life cycle: gestation, lactation, infancy, preschool, school age, and adolescence. www only.

DIET 538: Nutrition: A Focus on Life Stages
(3-0) Cr. 3. Alt. F., offered irregularly.Alt. SS., offered irregularly.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Explores influence of normal physiological stresses on nutritional needs throughout the life span. Evaluates dietary intake and identification of appropriate community nutrition services in on-line discussions. Specific considerations, such as the influence of age and cultural heritage, are incorporated. www only.

DIET 540: Nutrition and Physical Activity in Aging
(Cross-listed with GERON). (3-0) Cr. 3. F.
WWW only. Basic physiologic changes during aging and their impacts in health and disease. The focus will be on successful aging with special emphasis on physical activity and nutrition. Practical application to community settings is addressed.

DIET 544: Pediatric Clinical Nutrition
(3-0) Cr. 3. F.
Prereq: enrollment in GP-IDEA MFCS in dietetics
Examines the physiological, biochemical and nutritional aspects of disease processes relevant to infants and children up to 18 years of age. Discussion of medical nutrition therapy for a variety of medical conditions in this population including inborn errors of metabolism, food hypersensitivity, obesity, and diseases of the major organ systems. www only.

DIET 546: Phytochemicals
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Overview of phytochemicals (non-nutritive biologically active compounds) from fruits, vegetables, cereals and oilseeds. Covers recent findings of chemistry, physiological functions, and potential health implications of phytochemicals. www only.

DIET 547: Functional Foods in Chronic Disease Prevention
(3-0) Cr. 3.
Examination of nutritional science, food science, regulatory principles, and nutrient metabolism to understand and explain functional foods, nutraceuticals, and dietary supplements. Additionally students will evaluate the biochemical basis, technologies, legal requirements, and clinical assessment in the marketplace.

DIET 550: Finance and Cost Controls
(3-0) Cr. 3. F.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Overview of the fundamental knowledge of hospitality managerial accounting, cost controls, and financial management. Important topics include financial statement analysis, cost concepts, cost-volume-profit analysis, calculating and controlling food and beverage costs, pricing, and capital budgeting. www only.

DIET 554: Statistics
(3-0) Cr. 3. Alt. F., offered irregularly.Alt. S., offered irregularly.Alt. SS., offered irregularly.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Tools used to make statistical decisions. Major emphasis on explanation and understanding of important concepts involved; basic theme is understanding of data and methods used to analyze such data. www only. Only one of DIET 554 or Stat 401, 495, 542 may count toward graduation by students in the GPIDEA Dietetics program.

DIET 556: Advanced Nutrition: Micronutrients
(3-0) Cr. 3. S.SS.
Prereq: BBMB 404 or BBMB 420 or equivalent; enrollment in GP-IDEA MFCS in Dietetics
Integration of the molecular, cellular and physiological aspects of vitamins and minerals in mammalian systems. Interactions among nutrients, metabolic consequences of deficiencies or excesses, relevant polymorphisms, major research methodologies, and current topics related to micronutrients and non-nutrient components. www only. Only one of DIET 556 or NUTRS 502 may count toward graduation.

DIET 558: Advanced Nutrition: Macronutrients
(3-0) Cr. 3. F.
Prereq: BBMB 404 or BBMB 420 or equivalent; enrollment in GP-IDEA MFCS in Dietetics
Integration of the molecular, cellular and physiological aspects of macronutrients and energy metabolism in mammalian systems. Dietary energy, carbohydrates, fiber, lipids, proteins, their interactions, metabolic consequences, and major research methodologies. www only. Only one of DIET 558 or NUTRS 501 may count toward graduation.

DIET 560: Advanced Medical Nutrition Therapy
(3-0) Cr. 3. SS.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Pathophysiology of selected acute and chronic disease states and their associated medical problems. Specific attention directed to medical nutrition needs of patients in the treatment of each disease state. www only. Only two of DIET 560 or NUTRS 561, 564 may count toward graduation.

DIET 565: International Nutrition and World Hunger
(3-0) Cr. 3. F.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Identification and assessment of malnutrition in low-income countries. Social, cultural, political, economic, and geographic determinants of malnutrition. Protein-energy malnutrition, vitamin and mineral deficiencies. Intervention approaches; international efforts and local sustainability. www only.

DIET 566: Nutrition Counseling and Education Methods
(Cross-listed with FS HN). (2-2) Cr. 3. F.
Prereq: FS HN 361 and FS HN 362
Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories.

DIET 567: Nutrition for Dietitians
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: DIET 360; BBMB 301, undergraduate course in physiology; enrollment in GP-IDEA MFCS in Dietetics
Study of the current scientific literature to evaluate current trends and issues in nutrition science and dietetic practice. Emerging areas of research investigating the role of nutrients in health and disease in humans will be explored. Emphasis on the impact of emerging research on nutrition recommendations and interventions designed to promote human health. www only.

DIET 568: Entrepreneurship Theory and Practice
(3-0) Cr. 3. Alt. SS., offered odd-numbered years.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Definition and discussion of entrepreneurship and its importance to economic and business environment. www only.

DIET 569: Dietary and Herbal Supplements
(3-0) Cr. 3. Alt. SS., offered odd-numbered years.
Prereq: Enrollment in GP-IDEA MFCS in Dietetics
Develop skills to partner with patients in making dietary supplement decisions. Explore the safe, efficacious use of botanicals and supplements in nutritional support of aging, maternal health and wellness. Discussions on supplementation in the prevention and treatment of chronic disease include: arthritis, cancer, cardiovascular, diabetes, digestive, liver and renal disorders.

DIET 570: Nutrition and Human Performance
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Develop an understanding of nutrition based on knowledge of the biochemical and physiological process and functions of specific nutrients in meeting nutritional requirements. Emphasis on the relationship of optimal nutrition and physical efficiency and performance. www only.

DIET 571: Leadership in Dietetics
(3-0) Cr. 3. SS.
Using leadership theories to develop the fundamental concepts and skills to bridge the gap between theory and practice. Students will be able to successfully evaluate classic and contemporary leadership theories, investigate current leadership trends and identify positive applications in the dietetics community.

DIET 572: Environmental Scanning and Analysis of Current Issues in Dietetics
(3-0) Cr. 3. F.S.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Overview of current topics, issues, and trends in dietetics practice. www only.

DIET 573: Healthcare Administration
(3-0) Cr. 3. SS.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
A comprehensive review of today's health care institutions and their response to the economics, social, ethical, political, legal, technological, and ecological environments. www only.

DIET 574: Nutrition and Immunology
(3-0) Cr. 3. F.
Principles and issues related to nutrition and immunology. Impact of nutrients and nutritional status on immune responses. Impact of disease states on nutritional status.

DIET 595: Grant Writing for the Professional
(3-0) Cr. 3. SS.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Grant writing, identifying external funding, managing grants, preparing manuscripts for peer-reviewed publication, and preparing papers and poster for presentation at professional meetings.

DIET 597: Nutritional Aspects of Oncology
(Cross-listed with FS HN, NUTRS). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: B.S. in nutrition, dietetics, biology, or related discipline.
Understanding of basic cancer biology and methodology used to study nutrition and cancer relationships. Using current research as a basis, the role of nutrition in specific cancers will be explored. Students will learn about sources of information for cancer prevention programs, and how to apply this information to clinical patient management.

DIET 598: Clinical Aspects of Nutrition Support
(3-0) Cr. 3. S.
Prereq: Enrollment in GPIDEA - Dietetics program
Specialized nutrition assessment and support. Review of energy expenditure and substrate utilization in specific disease states. Current Methods for the initiation and management of enteral and parenteral nutrition therapy including access, metabolic and mechanical complications. Evaluation of nutrition support methodology in selected disease states.

DIET 599: Creative Component
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in GPIDEA MS Dietetics
For non-thesis option only.

Early Childcare Education and Programming (E C P)

Courses primarily for undergraduates:

E C P 201: Child Development – Ages Birth to 3
(3-0) Cr. 3. F.S.
Prereq: HD FS 102
Development from birth to age three. Major theories and research on development will be covered including growth patterns, the influences of disabilities and risk factors, environmental factors and their effects on attachment styles, language acquisition, brain development, cognitive development, social-emotional development, and perceptual and sensory motor skills. (on-line course offering via Distance Education).

E C P 202: Child Development – Ages 4 to 8
(3-0) Cr. 3. F.S.
Prereq: HD FS 102
Development from ages four through eight. Major theories and research on development will be covered including growth patterns, the influences of disabilities and risk factors, environmental factors and their effects on attachment styles, language acquisition, brain development, cognitive development, social-emotional development, and perceptual and sensory motor skills. (on-line course offering via Distance Education).

E C P 305: Introduction to Early Care and Education for a Mobile Society
(3-0) Cr. 3. F.S.
Prereq: HD FS 102
Exploring the role of a professional as a teacher, administrator or advocate in early childhood programming. Students will learn about professionalism and ethics, identifying child abuse, and applying universal precautions. Discussion of qualities of the early childhood educator role, program models, and working with children and professional colleagues. (on-line course offering via Distance Education).

E C P 306: Health, Safety, and Nutrition
(3-0) Cr. 3. F.S.
Prereq: HD FS 102
Important elements for planning, promoting and maintaining healthy and safe learning/care environments, understanding childhood illnesses and establishing healthy lifestyles, first aid, and care providers maintaining their own health. Maintaining safe relationships with others, including identifying and reporting abuse, neglect, and exploitation of children. Exploration of nutrients for life and feeding, food preparation and safety policies and guidelines, food allergies and intolerances, appropriate feeding practices. (on-line course offering via Distance Education).

E C P 307: Child Guidance and Classroom Environments
(3-0) Cr. 3. F.S.
Prereq: HD FS 102
Working knowledge of developmentally appropriate practice in child guidance. This goal will be accomplished through review of current guidance methods and programs in order to familiarize students with successful guidance techniques. By the end of this course, students will develop their own approach to guidance based upon practices best suited to their own unique skills and strengths. (on-line course offering via Distance Education).

E C P 320: Practicum I – Child Observations in Classroom Environments
(0-6) Cr. 3.
Prereq: E C P 201, E C P 202, E C P 305, E C P 306, E C P 307, HD FS 103
Practicum in Early Childhood Education is an opportunity for ECP teacher candidates to have a guided learning experience in a professional agency that provides services to children and families. It is expected that learning experiences and projects at the practicum site will provide teacher candidates with the opportunity to utilize and implement theories and practices learned in other ECP classes. (on-line course offering via Distance Education).

E C P 322: Diversity in the Lives of Young Children and Families
(3-0) Cr. 3. F.S.
Prereq: HD FS 102
Exploration of cultural diversity in daily life and beliefs in families with young children. The focus is on U.S. families, with attention to the multiple cultures from which they come. (on-line course offering via Distance Education).
Meets U.S. Diversity Requirement

E C P 323: Working with Families
(3-0) Cr. 3. F.S.
Prereq: HD FS 102
Application of an ecological model to the understanding of variation in parental roles, perspectives, relationships, approaches, and challenges. (on-line course offering via Distance Education).

E C P 324: Technology and Young Children
(3-0) Cr. 3. F.S.
Prereq: HD FS 102
Impact of electronic technology on the development of young children in educational, home, and community environments, and how technology can be used to enhance teaching and learning. Students will be critical thinkers and informed consumers of technology related to young children. (on-line course offering via Distance Education).

E C P 412: Development of Curriculum for Children Ages Birth to 3
(3-0) Cr. 3. F.S.
Prereq: E C P 201, E C P 202, E C P 305, E C P 306, E C P 307, E C P 320
Curriculum development related to children from birth to age 3: (1) learn and utilize assessment and documentation to inform curriculum, (2) plan and evaluate developmentally appropriate activities, and (3) learn about effective ways to share curriculum information with families. All areas of developmental domains and content areas; issues related to diversity in family composition, culture, and individual abilities will also be addressed. (on-line course offering via Distance Education).

E C P 413: Development of Curriculum for Children Ages 4 to 8
(3-0) Cr. 3. F.S.
Prereq: E C P 201, E C P 202, E C P 305, E C P 306, E C P 307, E C P 320
Development of curriculum for children ages 4 to 8 years: (1) learn and utilize assessment and documentation to inform curriculum, (2) plan and evaluate developmentally appropriate activities, and (3) learn about effective ways to share curriculum information with families. This course addresses all areas of developmental domains and content areas, and issues related to diversity in family composition, culture, and individual abilities will also be addressed. (on-line course offering via Distance Education).

E C P 424: Assessing Young Children and Their Environments to Enhance Development
(3-0) Cr. 3. F.S.
Prereq: E C P 201, E C P 202, E C P 305, E C P 306, E C P 307, E C P 320
Students will learn to select, evaluate, and use appropriate assessment tools for children birth to age 8. Students will use assessment data to inform decisions about teaching (environments and practice) and intervention. There will be an emphasis on the ethical use of assessments, validity of assessments, multicultural sensitivity, and assessments for children with special needs. (on-line course offering via Distance Education).

E C P 425: Understanding and Adapting for Developmental Differences
(3-0) Cr. 3. F.S.
Prereq: E C P 201, E C P 202, E C P 305, E C P 306, E C P 307, E C P 320
Knowledge of disability conditions, assessment and identification, interventions in inclusive environments, and collaborations among family members and service providers. (on-line course offering via Distance Education).

E C P 440: Practicum II – Curriculum Development and Implementation
(0-6) Cr. 3. F.S.
Prereq: E C P 412, E C P 413, E C P 424, E C P 425
Practicum in Early Childhood Education is an opportunity for ECE teacher candidates to have a guided learning experience in a professional agency that provides services to children and families. It is expected that learning experiences and projects at the practicum site will provide teacher candidates with the opportunity to utilize and implement theories and practices learned in other required classes. (on-line course offering via Distance Education).

E C P 442: Administration and Supervision in Early Childhood Settings
(3-0) Cr. 3. F.S.
Prereq: HD FS 102
Exploration of issues surrounding the administration of early childhood programs including identification of community needs, analysis of business opportunities, the evaluation and appropriate use of space and quality programming, consideration of policy and legal responsibilities, and professionalism in the field. In addition, the course explores best practices in staff selection, training, coaching, and supervision. (on-line course offering via Distance Education).

E C P 460: Practicum III – Capstone Experience
(0-12) Cr. 6. F.S.
Prereq: E C P 322, E C P 323, E C P 324, E C P 440, E C P 442
Professional practicum as a 15 week experience designed to allow the student to demonstrate practical application of developmentally appropriate early childhood teaching techniques and skills, actual teaching experience and developmental feedback. Practicum students will be involved in observation and evaluation of classroom experiences, environmental design, classroom management, and parent communication. (on-line course offering via Distance Education).

Ecology and Evolutionary Biology (EEB)

Courses primarily for graduate students, open to qualified undergraduates:

EEB 511: Conceptual Foundations in Ecology and Evolutionary Biology
(3-2) Cr. 4. F.
Prereq: Graduate classification
Introduction to key figures and ideas that have shaped the development of ecology and evolutionary biology. Covers major developments in ecology and evolutionary biology at five levels of biological organization: Genome, Organism, Population, Community, and Ecosystem. Impacts of these developments on current approaches to investigation and argument formulation. Effects of technological advances on the direction of scientific investigations. Introduction to analytical skills important for critical thinking in ecology and evolutionary biology and the impact of accepted lines of scientific reasoning on the objectives and conduct of research, such as explanation and prediction, design of studies as experimentation, and structured or unstructured observation.

EEB 585: Extended Field Trip
(1-6) Cr. 2. Repeatable. Alt. F., offered irregularly.Alt. S., offered irregularly.Alt. SS., offered irregularly.
Prereq: Graduate classification, permission of instructor
Extended field trip to study major terrestrial and aquatic ecosystems. Location and duration vary. Report required.

EEB 585A: Extended Field Trip: Pre-Trip Lecture
(1-0) Cr. 1. Repeatable. Alt. F., offered irregularly.Alt. S., offered irregularly.Alt. SS., offered irregularly.
Prereq: Graduate classification, permission of instructor
Extended field trip to study major terrestrial and aquatic ecosystems. Location and duration vary. Report required.

EEB 585B: Extended Field Trip: Travel
(0-6) Cr. 1. Repeatable. Alt. F., offered irregularly.Alt. S., offered irregularly.Alt. SS., offered irregularly.
Prereq: Graduate classification, EEB 585A and permission of instructor.
Extended field trip to study major terrestrial and aquatic ecosystems. Location and duration vary. Report required.

EEB 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and permission of instructor
For students wishing to conduct in-depth study of a particular topic in ecology and evolutionary biology.

Courses for graduate students:

EEB 698: Seminar
(1-0) Cr. 1. Repeatable. F.S.
Reports and discussion of recent research and literature.

EEB 699: Research
Cr. arr. Repeatable. F.S.SS.
Thesis and dissertation research.

Ecology, Evolution, and Organismal Biology (EEOB)

The department offers graduate work leading to both Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees. Each EEOB faculty member is affiliated with one or more interdepartmental majors, and EEOB students major in one of these programs. These interdepartmental programs include:

- Bioinformatics and Computational Biology (http://www.bcb.iastate.edu)
- Ecology and Evolutionary Biology (http://www.eeb.iastate.edu)
- Environmental Science (https://enscigrad.iastate.edu)
- Genetics and Genomics (http://www.genetics.iastate.edu)
- Interdisciplinary Graduate Studies (http://www.grad-college.iastate.edu/igs/admission.html)
- Microbiology (http://www.micrograd.iastate.edu)
- Plant Biology (http://www.ipb.iastate.edu)
- Sustainable Agriculture (https://susag.iastate.edu)

The department offers graduate work leading to both Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees.

Courses primarily for graduate students, open to qualified undergraduates:

EEOB 507: Advanced Animal Behavior
(3-0) Cr. 3. S.
Prereq: Graduate standing, BIOL 354, or permission of instructor
Analysis of current research in animal behavior. Topics covered may include behavioral ecology, mechanisms of behavior, evolution of behavior, applications of animal behavior to conservation biology, and applications of animal behavior to wild animals in captivity.

EEOB 514: Life History and Reproductive Strategies
(Dual-listed with BIOL 414). (3-0) Cr. 3. F.
Prereq: BIOL 315 or equivalent recommended.
Evolution of ecological adaptations at the individual, population, and species level. Emphasis is on evolutionary mechanisms and adaptive strategies related to life histories and reproduction; age and size at maturity; lifespan and senescense; offspring size/number trade-offs; sex and mating systems; sex determination and sex ratios.

EEOB 531: Conservation Biology
(Cross-listed with A ECL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 312; BIOL 313 or graduate standing
Examination of conservation issues from a population and a community perspective. Population-level analysis will focus on the role of genetics, demography, and environment in determining population viability. Community perspectives will focus on topics such as habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology.

EEOB 531I: Conservation Biology
(Cross-listed with A ECL, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: IA LL 312I
Population-and community-level examination of factors influencing the viability of plant and animal populations from both demographic and genetic perspectives; assessment of biodiversity; design and management of preserves.

EEOB 534: Endocrinology
(Dual-listed with BIOL 434). (3-0) Cr. 3. S.
Prereq: BIOL 211, BIOL 212
Chemical integration of vertebrate organisms. The structure, development, and evolution of the endocrine glands and the function and structure of their hormones.

EEOB 535: Restoration Ecology
(Cross-listed with ENSCI, NREM). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 366 or BIOL 474 or graduate standing
Theory and practice of restoring animal and plant diversity, structure and function of disturbed ecosystems. Restored freshwater wetlands, forests, prairies and reintroduced species populations will be used as case studies.

EEOB 535I: Restoration Ecology
(Cross-listed with A ECL, ENSCI, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: A course in ecology
Ecological principles for the restoration of native ecosystems; establishment (site preparation, selection of seed mixes, planting techniques) and management (fire, mowing, weed control) of native vegetation; evaluation of restorations. Emphasis on the restoration of prairie and wetland vegetation.

EEOB 539: Environmental Physiology
(Dual-listed with BIOL 439). Cr. 3-4. Alt. S., offered even-numbered years.
Prereq: BIOL 335; physics recommended
Physiological adaptations to the environment with an emphasis on vertebrates.

EEOB 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

EEOB 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

EEOB 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

EEOB 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

EEOB 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

EEOB 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

EEOB 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

EEOB 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

EEOB 551: Plant Evolution and Phylogeny
(Dual-listed with BIOL 451). (3-3) Cr. 4. F.
Prereq: BIOL 315 or equivalent.
Survey of land plant evolution; phylogenetic comparison of anatomical, reproductive, and life history specializations. Relationships among bryophytes, lycophytes, pteridophytes, gymnosperms, and angiosperms emphasizing significant evolutionary changes documented by paleobotanical, morphological, and molecular studies.

EEOB 553: Agrostology
(2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BIOL 366
Structure, identification, classification, phylogeny, and economic aspects of grasses and related families.

EEOB 555: Bryophyte and Lichen Biodiversity
(Dual-listed with BIOL 455). Cr. 3.
Prereq: BIOL 211, BIOL 211L
Introduction to the biology and ecology of mosses, liverworts, and lichens. Emphasis on identification and diversity of local representatives of these three groups of organisms. Required field trips and service-learning.

EEOB 558: Ornithology
(Cross-listed with A ECL). (2-0) Cr. 2. S.
Prereq: A ECL 365 or BIOL 351
Dual-listed with Biol 458. Biology, ecology, evolution, and taxonomy of birds. Emphasis on structure, physiology, behavior, communication, navigation, reproduction, and conservation.

EEOB 559: Mammalogy
(Dual-listed with BIOL 459). (2-0) Cr. 2. S.
Prereq: BIOL 351 or A ECL 365
Biology, ecology, and evolution of mammals. Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of mammals in ecosystems, and conservation.

EEOB 561: Evolutionary and Ecological Genomics
(3-0) Cr. 3. S.
Prereq: Permission of instructor; BCBIO 444 recommended.
Use of genomic and other "omic" data in evolution and ecology. Review of data-generation platforms, computational methods, and examples of how phylogenomics, metagenomics, epigenomics, and population genomics are transforming the disciplines of evolution and ecology.

EEOB 562: Evolutionary Genetics
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Seminar/discussion course covering the genetic basis of evolutionary processes in multicellular organisms.

EEOB 563: Molecular Phylogenetics
(2-3) Cr. 3. F.
Prereq: BIOL 313 and BIOL 315
An overview of the theory underlying phylogenetic analysis and the application of phylogenetic methods to molecular datasets. The course emphasizes a hands-on approach to molecular phylogenetics and combines lecture presentations with computer exercises and discussion of original scientific literature.

EEOB 564: Wetland Ecology
(Dual-listed with BIOL 464). (Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: 15 credits in biological sciences.
Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands.

EEOB 564I: Wetland Ecology
(Cross-listed with ENSCI, IA LL). Cr. 4. SS.
Prereq: Ia LL 312I
Ecology, classification, creation, restoration, and management of wetlands. Field studies will examine the composition, structure and functions of local natural wetlands and restored prairie pothole wetlands. Individual or group projects.

EEOB 566: Molecular Evolution
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Permission of instructor
Seminar/discussion course covering the fundamentals of molecular evolution. Emphasis is placed on original scientific literature and current topics, including rates and patterns of genetic divergence; nucleotide and allelic diversity; molecular clocks; gene duplications; genome structure; organellar genomes; polyploidy; transposable elements; and modes and mechanisms of gene and genome evolution.

EEOB 567: Empirical Population Genetics
(3-0) Cr. 3. F.
Prereq: Permission of instructor
An overview of fundamental population genetic theory and the ecological and evolutionary factors underlying the distribution of genetic variation within and among natural populations. Emphasis on the analysis of inbreeding, breeding systems, parentage, relatedness, spatial autocorrelation, effective population size, hierarchial population models, and phylogeography.

EEOB 568: Advanced Systematics
(Cross-listed with ENT). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Principles and practice of systematic biology; taxonomy, nomenclature and classification of plants and animals; sources and interpretation of systematic data; speciation; fundamentals of phylogenetic systematics.

EEOB 569: Biogeography
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 315 or equivalent; permission of instructor
Principles underlying the geographic distribution of organisms throughout the world; biological influences of geological history and tectonic movements; role of climate, migration, dispersal, habitat, and phylogeny on past and present organismal distribution patterns; biogeographic methods.

EEOB 570: Landscape Ecology
(Cross-listed with A ECL). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Permission of instructor; EEOB 588; a course in calculus
The study of ecological and evolutionary processes within a spatial context with emphasis on behavior, population, and community dynamics.

EEOB 573: Techniques for Biology Teaching
(Cross-listed with A ECL, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573A: Techniques for Biology Teaching : Animal Biology
(Cross-listed with A ECL, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573B: Techniques for Biology Teaching: Plant Biology
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573C: Techniques for Biology Teaching: Fungi and Lichens
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573D: Techniques for Biology Teaching: Aquatic Ecology
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573E: Techniques for Biology Teaching: Prairie Ecology
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573F: Techniques for Biology Teaching: Wetland Ecology
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573G: Techniques for Biology Teaching: Limnology
(Cross-listed with A ECL, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573H: Techniques for Biology Teaching: Animal Behavior
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573I: Techniques for Biology Teaching: Insect Ecology
(Cross-listed with A ECL, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573J: Techniques for Biology Teaching: Biology of Invertebrates
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573K: Techniques for Biology Teaching: Non-invasive Use of Living Organisms
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573W: Techniques for Biology Teaching: Project WET
(Cross-listed with A ECL, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 575I: Field Mycology
(Cross-listed with IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Identification and classification of the common fungi; techniques for identification, preservation, and culture practiced with members of the various fungi groups.

EEOB 576: Functional Ecology
(Dual-listed with BIOL 476). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312
The nature of adaptations to physical and biotic environments. Biophysical, biomechanical, and physiological bases of the structure, form, growth, distribution, and abundance of organisms.

EEOB 577: Concepts in Theoretical Ecology and Evolution
(2-0) Cr. 1. Alt. F., offered even-numbered years.
Readings and discussion of influential ideas in ecological and evolutionary theory, with an emphasis on how models are used as conceptual tools for building synthetic paradigms. Topics are chosen according to student interests; may include spatial ecology, behavioral theory, chaos, community assembly and biodiversity, and others.

EEOB 578: Foundations of Theoretical Ecology and Evolution
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 1 semester of calculus or permission of instructor.
Quantitative exploration of classic models and results in ecological and evolutionary theory. Introduction to conceptual, mathematical, and programming tools needed to build and analyze models.

EEOB 580I: Ecology and Systematics of Diatoms
(Cross-listed with IA LL). Cr. 4. SS.
Field and laboratory study of freshwater diatoms; techniques in collection, preparation, and identification of diatom samples; study of environmental factors affecting growth, distribution, taxonomic characters; project design and execution including construction of reference and voucher collections and data organization and analysis.

EEOB 581: Environmental Systems I: Introduction to Environmental Systems
(Dual-listed with BIOL 381). (Cross-listed with ENSCI). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

EEOB 582: Environmental Systems II: Analysis of Environmental Systems
(Dual-listed with BIOL 382). (Cross-listed with ENSCI). (2-2) Cr. 3. S.
Prereq: ENSCI 381
Continuation of EnSci 381. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

EEOB 584: Advanced Ecosystem Ecology
(Cross-listed with ENSCI). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Combined 12 credits in biology, chemistry, and physics.
Advanced studies of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations and modern approaches to ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues.

EEOB 585: Advanced Community Ecology
(2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BIOL 312
Factors controlling species diversity, species abundance, and the structure and function of communities in space and time. Relationships between species diversity and ecosystem process rates and community stability.

EEOB 586: Aquatic Ecology
(Dual-listed with BIOL 486). (Cross-listed with A ECL, ENSCI). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

EEOB 586L: Aquatic Ecology Laboratory
(Dual-listed with BIOL 486L). (Cross-listed with A ECL, ENSCI). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

EEOB 587: Microbial Ecology
(Dual-listed with BIOL 487). (Cross-listed with ENSCI, MICRO). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

EEOB 589: Population Ecology
(Dual-listed with BIOL 489). (Cross-listed with A ECL). (2-2) Cr. 3. F.
Prereq: BIOL 312, STAT 101 or STAT 104, a course in calculus, or graduate standing
Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation.

EEOB 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: 10 credits in biology, permission of instructor

EEOB 590A: Special Topics: Current Topics in Ecology
Cr. 1-3. Repeatable.
Prereq: 10 credits in biology, permission of instructor

EEOB 590B: Special Topics: Current Topics in Evolutionary Biology
Cr. 1-3. Repeatable.
Prereq: 10 credits in biology, permission of instructor

EEOB 590C: Special Topics: Current Topics in Organismal Biology
Cr. 1-3. Repeatable.
Prereq: 10 credits in biology, permission of instructor

EEOB 590I: Special Topics: Graduate Independent Study
(Cross-listed with A ECL, ANTHR, IA LL). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

EEOB 596: Ecology and Society
(Cross-listed with PHIL). (3-0) Cr. 3.
Prereq: Graduate classification in biological or environmental sciences/ studies with at least one course in ecology
Analysis of conceptual and methodological debates in ecology. Historical development of competing research traditions and philosophies. Topics include i) methodological issues in ecological science, ii) conceptual issues in theoretical ecology, iii) conceptual issues in applied ecology, iv) relation of ecology to environmental and social issues.

EEOB 599: Creative Component
Cr. arr.
Research toward nonthesis master's degree.

Courses for graduate students:

EEOB 611: Analysis of Populations
(Cross-listed with A ECL). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 312; STAT 401; a course in calculus
Quantitative techniques for analyzing vertebrate population data to estimate parameters such as density and survival. Emphasis on statistical inference and computing.

EEOB 698: Seminar
Cr. 1. Repeatable.
Meetings of graduate students and faculty to discuss recent literature and problems under investigation.

EEOB 699: Research
Cr. arr. Repeatable.
Research for thesis or dissertation. Offered on a satisfactory-fail basis only.

EEOB 699I: Iowa Lakeside Laboratory. (Cross-listed with Ia LL 699I)
(Cross-listed with A ECL, ANTHR, GDCB, IA LL). Cr. arr. Repeatable.
Research for thesis or dissertation. Offered on a satisfactory-fail basis only.

Economics (ECON)

Courses primarily for undergraduates:

ECON 101: Principles of Microeconomics
(3-0) Cr. 3. F.S.SS.
Resource allocation, opportunity cost, comparative and absolute advantage. Supply and demand. Marginal analysis. Theories of production and consumption, pricing, and the market system. Perfect and imperfect competition and strategic behavior. Factor markets. Present discounted value.

ECON 101H: Principles of Microeconomics: Honors
(3-0) Cr. 3.
Prereq: Honors program students only
Resource allocation, opportunity cost, comparative and absolute advantage. Supply and demand. Marginal analysis. Theories of production and consumption, pricing, and the market system. Perfect and imperfect competition and strategic behavior. Factor markets. Present discounted value.

ECON 101L: Laboratory in Principles of Microeconomics
(0-2) Cr. 1. F.
Prereq: Concurrent enrollment in the appropriate section of ECON 101
Discussion of material typically covered in Econ 101. Application of economic principles to real world problems. Economic principles and basic business management concepts applied to decision-making in agribusiness operations.

ECON 102: Principles of Macroeconomics
(3-0) Cr. 3. F.S.SS.
Prereq: ECON 101 recommended
Measurement of macro variables and general macro identities. Classical models of full employment. Production and growth. Savings and investment. Employment and unemployment. Money, inflation, and price levels. Operation of the U.S. banking system. Fiscal and monetary policy. Elements of international finance.

ECON 102H: Principles of Macroeconomics: Honors
(3-0) Cr. 3.
Prereq: ECON 101 recommended; admission to the Honors program.
Measurement of macro variables and general macro identities. Classical models of full employment. Production and growth. Savings and investment. Employment and unemployment. Money, inflation, and price levels. Operation of the U.S. banking system. Fiscal and monetary policy. Elements of international finance.

ECON 110: Orientation in Agricultural Business
(1-0) Cr. 1. F.
Orientation course for freshman and new transfer students in agricultural business.

ECON 207: Applied Economic Optimization
(2-2) Cr. 3. F.S.
Prereq: MATH 151, MATH 160, MATH 165 or equivalent
Application of linear algebra, calculus and unconstrained and constrained optimization techniques to economic problems. Learning outcomes include the ability to (i) identify the objective, decision variables and constraints in economic decision problems, (ii) represent elements of an economic problem in simple mathematical models, (iii) identify and apply mathematical tools that can be used to solve the problems, (iv) identify the strengths and limitations of the solution method, and (v) interpret the economic meaning and implications of the solution.

ECON 230: Farm Business Management
(2-2) Cr. 3. F.S.
Prereq: ECON 101; ACCT 284
Business and economic principles applied to decision making and problem solving in the management of a farm business. Cash flow, partial, enterprise, and whole farm budgeting. Information systems for farm accounting, analysis, and control. Obtaining and managing land, capital, and labor resources. Alternatives for farm business organization and risk management.

ECON 234: Small Business Management
(3-0) Cr. 3.
Prereq: ECON 101
An introduction to small business management, entrepreneurship, and economics utilizing a series of case studies. Exploration of issues related to starting or acquiring a new business and development of knowledge and skills for successful management of a small business, with an emphasis on agricultural business.

ECON 235: Introduction to Agricultural Markets
(3-0) Cr. 3. F.S.
Prereq: ECON 101
Basic concepts and economics principles related to markets for agricultural inputs and products. Overview of current marketing problems faced by farms and agribusinesses, farm and retail price behavior, structure of markets, food marketing channels, food quality and food safety, and the role of agriculture in the general economy. The implications of consumer preferences at the farm level. Introduction to hedging, futures, and other risk management tools.

ECON 292: Career Seminar
(1-0) Cr. 1.
Prereq: Classification in economics or agricultural business
Career opportunities in the various industries and government institutions. Required training and skills needed to perform successfully in different types of careers. Factors important in finding and obtaining employment either before or after graduation including personal resumes, interviewing, and letter writing. Only one of ECON 292, 292A, and 292B can be used toward graduation.

ECON 292A: Career Seminar: Agricultural Business
(1-0) Cr. 1.
Prereq: Classification in economics or agricultural business
Career opportunities in the various industries and government institutions. Required training and skills needed to perform successfully in different types of careers. Factors important in finding and obtaining employment either before or after graduation including personal resumes, interviewing, and letter writing. Only one of ECON 292, 292A, and 292B can be used toward graduation.

ECON 292B: Career Seminar: Economics and Business Economics
(1-0) Cr. 1.
Prereq: Classification in economics or agricultural business
Career opportunities in the various industries and government institutions. Required training and skills needed to perform successfully in different types of careers. Factors important in finding and obtaining employment either before or after graduation including personal resumes, interviewing, and letter writing. Only one of ECON 292, 292A, and 292B can be used toward graduation.

ECON 297: Internship
Cr. 2. Repeatable, maximum of 4 credits.
Prereq: Permission of instructor and classification in agricultural business or economics
Students complete a research report, based on their internship or approved work experience, that examines chosen topics in management, marketing or finance. Offered on a satisfactory-fail basis only.

ECON 298: Cooperative Education
Cr. R. Repeatable.
Prereq: Permission of the department cooperative education coordinator; sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

ECON 301: Intermediate Microeconomics
(3-0) Cr. 3-4. F.S.SS.
Prereq: ECON 101; ECON 207 or MATH 166
Theory of consumer and business behavior; optimal consumption choices and demand; theory of firm behavior; costs, production, and supply; competitive and imperfectly competitive markets; theory of demand for and supply of factors of production; general equilibrium analysis. Recitation required for 4 credits.

ECON 301H: Intermediate Microeconomics: Honors
(3-0) Cr. 3-4.
Prereq: ECON 101; ECON 207 or MATH 166
Theory of consumer and business behavior; optimal consumption choices and demand; theory of firm behavior; costs, production, and supply; competitive and imperfectly competitive markets; theory of demand for and supply of factors of production; general equilibrium analysis. Recitation required for 4 credits.

ECON 302: Intermediate Macroeconomics
(3-0) Cr. 3. F.S.
Prereq: ECON 101, ECON 102; MATH 160 or MATH 165
Theory of income, employment, interest rates, and the price level; fiscal and monetary policy; budget and trade deficits; money and capital inflows, interest rates, and inflation.

ECON 302H: Intermediate Macroeconomics: Honors
(3-0) Cr. 3.
Prereq: ECON 101, ECON 102; MATH 160 or MATH 165
Theory of income, employment, interest rates, and the price level; fiscal and monetary policy; budget and trade deficits; money and capital inflows, interest rates, and inflation.

ECON 313: Economics of Sports
(3-0) Cr. 3.
Prereq: ECON 101
Application of economics to issues in sports, including franchising; rival leagues and barriers to entry; cooperative, competitive, and collusive behavior; player productivity and compensation; contracts, unions, and discrimination; antitrust, taxation, and subsidies. Economic concepts include supply and demand, labor economics, pricing, public finance, production, game theory, and industrial organization.

ECON 320: Labor Economics
(3-0) Cr. 3.
Prereq: ECON 101
Economic analysis of contemporary domestic and international labor market issues including labor supply and demand, unemployment, and employment in the U.S. and elsewhere; investments in and returns to education, training, health, immigration and migration; income inequality; labor productivity; out-sourcing and global competitiveness; work incentives; compensation including benefits; and labor policies such as minimum wages, over-time pay, discrimination, unions, and immigration. Examples drawn from the U.S. and other developed countries with reference to developing countries where relevant.
Meets International Perspectives Requirement.

ECON 321: Economics of Discrimination
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: ECON 101
Economic theories of discrimination. Analysis of the economic problems of women and minorities in such areas as earnings, occupations, and unemployment. Public policy concerning discrimination. Poverty measurement and antipoverty programs in the U.S.
Meets U.S. Diversity Requirement

ECON 330: Advanced Farm Business Management
(3-0) Cr. 3.
Prereq: ECON 230
Effective use of strategic planning, decision methods, and computer assistance for solving farm problems. Applications of economic and management theory to analyze farm business decisions using efficiency measures to assess current resource use and direct the farm business analysis, planning, and tax process.

ECON 332: Cooperatives
(3-0) Cr. 3.
Prereq: ECON 101
Survey of cooperative business structure, including historical developments in the United States, principles of cooperation, state and federal authorization for cooperative activity, economic motivations and foundations, governance, marketing and pricing strategies, and financing, capitalization and taxation considerations. Students will learn how the cooperative model is applied in a variety of markets.

ECON 334: Entrepreneurship in Agriculture
(3-0) Cr. 3. F.S.
Prereq: ECON 101
Introduction to the process of entrepreneurship within the agricultural and food sectors. Emphasis on opportunity recognition and assessment, resource acquisition and feasibility analysis for both private and social enterprises. Students will develop a comprehensive feasibility study for a new business or non-profit organization.

ECON 335: The Economics of Global Agricultural Food and Bio-energy
(Cross-listed with GLOBE). (3-0) Cr. 3.
Prereq: ECON 101
Applied economic analysis of the determinants of world agricultural production, marketing, and use in feed, food, fiber, biofuel, and other applications, and global food processing and consumption. Analysis of market case studies and various data on global agricultural production and transformation, land and resource use, demography, economic activity, nutrition and health trends.
Meets International Perspectives Requirement.

ECON 336: Agricultural Selling
(3-0) Cr. 3.
Prereq: ECON 101
Principles of selling with application to agricultural and food related businesses. Attitudes, value systems, and behavioral patterns that relate to agricultural sales. Electronic marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Analysis of the buying or purchasing process. Evaluation of agri-selling as a possible career choice.

ECON 337: Agricultural Marketing
(2-2) Cr. 3.
Prereq: ECON 101 required, ECON 235 recommended
Understanding of agricultural commodity markets for grain, livestock and dairy with emphasis on marketing decisions and risk management for farmers and processors. Lab will provide hands-on applications of marketing and management tools via market simulations.

ECON 344: Public Finance
(3-0) Cr. 3.
Prereq: ECON 101
The economic role of governments in market economies. Public goods, externalities, income distribution, and income maintenance programs. The effect of taxes on economic behavior, descriptions of the structure of the principal U.S. taxes, and current reform proposals.

ECON 353: Money, Banking, and Financial Institutions
(3-0) Cr. 3. F.S.
Prereq: ECON 101, ECON 102
Theoretical and applied analysis of money, banking, and financial markets; interest rates and portfolio choice; the banking industry in transition; the money supply process; the Federal Reserve System and the conduct of monetary policy; macro implications of monetary policy; international finance.

ECON 355: International Trade and Finance
(3-0) Cr. 3.
Prereq: ECON 101, ECON 102
Explanations of causes of international trade and the impact of trade on welfare and employment patterns. Analysis of government policies towards trade, such as tariffs, quotas, and free trade areas. Theory of balance of payments and exchange rate determination, and the role of government policies. Examination of alternative international monetary arrangements.
Meets International Perspectives Requirement.

ECON 362: Applied Ethics in Agriculture
(Cross-listed with SOC). (3-0) Cr. 3.
Prereq: ECON 101 or SOC 134, junior or senior status in the College of Agriculture
Identify major ethical issues and dilemmas in the conduct of agricultural and agribusiness management and decision making. Discuss and debate proper ethical behavior in these issues and situations and the relationship between business and personal ethical behavior.

ECON 364: Rural Property Appraisal
(3-0) Cr. 3.
Prereq: ECON 101
Use of income capitalization, sales comparison and cost appraisal concepts in appraising agricultural resources. Application of underlying economic/business/management principles, especially present value, as they relate to farmland appraisal. Determination and estimation of economic impacts of special consideration and property use factors. Evaluate feasibility and profitability of investment in rural property.

ECON 371: Introductory Econometrics
(4-0) Cr. 4. F.S.
Prereq: ECON 301, ECON 302 OR ECON 353, STAT 326
Introduction to the models and methods used to estimate relationships and test hypotheses pertaining to economic variables. Among the topics covered in the course are: Single and multiple regression analysis; functional forms; omitted variable analysis; multicollinearity; heteroskedasticity; autocorrelation; simultaneous equations; and dynamic models.

ECON 376: Rural, Urban and Regional Economics
(Cross-listed with C R P). (3-0) Cr. 3.
Prereq: ECON 101
Firm location with respect to regional resources, transport, scale economies, externalities, and policies. Measures of local comparative advantage and specialization. Spatial markets. Population location considering jobs, wages, commuting, and local amenities. Business, residential, and farm land use and value. Migration. Other topics may include market failure, regulation, the product cycle, theories of rural and urban development, developmental policy, firm recruiting, local public goods and public finance, schools, poverty, segregation, and crime.

ECON 378: Retirement Planning and Employee Benefits
(Cross-listed with GERON, HD FS). (3-0) Cr. 3. S.
Prereq: 3 credits in Principles of Economics and 3 credits in Human Development and Family Studies
Economic well-being in the context of demographic change, the present and future of Social Security, family retirement needs analysis, investment strategies and characteristics of retirement plans, helping others to work towards financial security, family economic issues for retired persons. Overview of employee and retirement benefits.
Meets U.S. Diversity Requirement

ECON 380: Energy, Environmental and Resource Economics
(Cross-listed with ENV S). (3-0) Cr. 3.
Prereq: ECON 101
Natural resource availability, use, conservation, and government policy, with emphasis on energy issues. Environmental quality and pollution control policies.

ECON 385: Economic Development
(Cross-listed with GLOBE). (3-0) Cr. 3.
Prereq: ECON 101, ECON 102
Current problems of developing countries, theories of economic development, agriculture, and economic development, measurement and prediction of economic performance of developing countries, alternative policies and reforms required for satisfying basic needs of Third World countries, interrelationships between industrialized countries and the developing countries, including foreign aid.
Meets International Perspectives Requirement.

ECON 387: Economies of China and India
(3-0) Cr. 3.
Prereq: ECON 101
The economic development of China and India within the larger historical, political, and socioeconomic contexts. The characteristics of the development paths of major industries. The drivers of and impediments for future economic development. The two economies' connections with the world economy.
Meets International Perspectives Requirement.

ECON 398: Cooperative Education

Cr. R.

Prereq: Permission of the department cooperative education coordinator; junior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

ECON 401: Topics in Microeconomics

(3-0) Cr. 3.

Prereq: ECON 301, STAT 226

Advanced treatment of selected topics from one or more of the following areas: household production models, factor markets, game theory and imperfect competition, general equilibrium, intertemporal choice, asset markets, income distribution, externalities and public goods, etc.

ECON 402: Topics in Macroeconomics

(3-0) Cr. 3.

Prereq: ECON 301, ECON 302, STAT 226

Advanced treatment of selected topics from one or more of the following areas: business cycle theory, growth theory, fiscal and monetary policy, coordination issues, open economy macroeconomics, and financial economics.

ECON 416: Industrial Organization

(3-0) Cr. 3.

Prereq: ECON 301

Study of the structure of firms and markets and of their interaction, with emphasis on imperfectly competitive markets. Behavior of firms in strategic settings and insights of basic game-theoretic models. Welfare implications of alternative market organizations, consequences of market power, and scope for government regulation and antitrust/competition policies. Topics include monopoly and price discrimination, oligopoly models, product quality, product differentiation, vertical integration, information and advertising, patents, R&D and innovation, and regulation.

ECON 418: Introduction to Game Theory

(3-0) Cr. 3.

Prereq: ECON 301

Systematic introduction to game theory and its uses in economics. Develops the basic framework, models and tools necessary to analyze games of strategy, including: Strategic and extensive-form representations of games; best response functions and Nash equilibrium, mixed strategies backward induction and subgame-perfect equilibrium, imperfect and incomplete information, Bayesian and sequential equilibria. Examples and applications taken from economics, business, political science, law and biology.

ECON 431: Managerial Economics

(3-0) Cr. 3.

Prereq: ECON 301

Theory of the firm; organizational incentives and efficiency; moral hazard; role of information and decision making under uncertainty; ownership and control; business investment.

ECON 437: Commodity Marketing and Risk Management

(3-0) Cr. 3.

Prereq: ECON 235, ECON 301, STAT 326

The purpose and performance of commodity markets. How commodity marketing institutions function. Merchandising arrangements. Distinguishing features of agricultural commodities. Hedging, arbitrage, and speculation in commodity spot, forward, futures, and options markets. Valuation theory.

ECON 455: International Trade

(3-0) Cr. 3.

Prereq: ECON 301

Rigorous treatment of theories of international trade and international factor movements. Examination of the impact of trade and labor migration on domestic and world welfare and on the distribution of income. Theoretical analysis of government policies towards trade and factor movements, including quotas, tariffs, free trade areas and immigration restrictions. Discussion of contemporary issues and controversies concerning globalization, including multinational firms and labor migration.

Meets International Perspectives Requirement.

ECON 457: International Finance

(3-0) Cr. 3.

Prereq: ECON 302

National income accounting and balance of payments; foreign exchange rates and exchange rate markets; money, interest rates, and exchange rate determination; prices, exchange rates, and output in the short run; international monetary arrangements; fixed versus flexible exchange rates; optimal currency areas; international capital flows; currency and financial crises in emerging markets.

Meets International Perspectives Requirement.

ECON 458: Economic Systems for Electric Power Planning

(Cross-listed with E E). (3-0) Cr. 3.

Prereq: E E 303 or ECON 301

Evolution of electric power industry. Power system operation and planning and related information systems. Linear and integer optimization methods. Short-term electricity markets and locational marginal prices. Risk management and financial derivatives. Basics of public good economics. Cost recovery models including tax treatment for transmission investments.

ECON 460: Agricultural, Food, and Trade Policy
(Dual-listed with ECON 560). (3-0) Cr. 3.
Prereq: ECON 301 or ECON 501
Description and analysis of economic problems of U.S. agriculture. Explanation and economic analysis of government policies and programs to develop agriculture, conserve agricultural resources, address consumer food concerns, stabilize farm prices, and raise farm incomes. The influence of macropolicy, world economy, international trade, and bioenergy on U.S. agriculture.

ECON 466: Agricultural Finance
(3-0) Cr. 3.
Prereq: ECON 301, STAT 226, FIN 301 and ECON 353 (recommended)
Financial analysis of agricultural businesses; liquidity, capital structure, and growth and risk of agricultural firms; capital budgeting methods; analysis of land investments, leasing, and costs of credit; financial intermediation and major financial institutions for agriculture; borrower-lender relationships, and asset-liability management techniques by financial intermediaries; public policies affecting agricultural credit markets.

ECON 480: Intermediate Environmental and Resource Economics
(Dual-listed with ECON 580). (3-0) Cr. 3.
Prereq: ECON 301 or ECON 501
Theories of natural resource utilization and allocation. Externalities, public goods, and environmental quality. Renewable energy, biofuels, land use change and life cycle analysis of carbon, and sustainability and resource conservation. Methodologies for analyzing natural resource and environmental problems and evaluating resource policies.

ECON 490: Independent Study
Cr. 1-5. Repeatable, maximum of 6 credits.
Prereq: Junior or senior classification, 14 credits in economics
Offered on a satisfactory-fail basis only. No more than 9 credits of Econ 490 may be used toward graduation

ECON 490E: Independent Study: Entrepreneurship
Cr. 1-5. Repeatable, maximum of 6 credits.
Prereq: Junior or senior classification, 14 credits in economics
Offered on a satisfactory-fail basis only. No more than 9 credits of Econ 490 may be used toward graduation

ECON 490H: Independent Study: Honors
Cr. 1-5. Repeatable, maximum of 6 credits.
Prereq: Junior or senior classification, 14 credits in economics
Offered on a satisfactory-fail basis only. No more than 9 credits of Econ 490 may be used toward graduation

ECON 492: Graduating Senior Survey
Cr. R.
Prereq: Graduating senior
Final preparations for graduation. The final stages of job searching, interviewing, letter writing, and resume preparation. Outcomes assessment information from graduating seniors including opinion surveys, instructor/advisor/course evaluations, exit interviews, student accomplishment surveys, job placement surveys, and comprehensive skills examinations. Departmental recognition of graduating seniors. Life as an alumnus - expectations and obligations. Convocation and commencement information. Offered on a satisfactory-fail basis only.

ECON 495: Economics Domestic Travel Course
Cr. 1-3.
Prereq: Sophomore status. Permission of instructor
Tour and study of domestic businesses, markets, and economic institutions located outside Iowa to expose students to the diversity of activities within the U.S. economy. Pre-trip sessions arranged. Locations and duration of tours will vary.

ECON 496: Economics International Travel Course
Cr. 1-3. Repeatable.
Prereq: Sophomore status; permission of instructor.
Tour and study of international agricultural and/or nonagricultural economies, markets, and institutions. Locations and duration of tours will vary. Limited enrollment.
Meets International Perspectives Requirement.

ECON 498: Cooperative Education
Cr. R.
Prereq: Permission of the department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

ECON 500: Quantitative Methods in Economic Analysis I
(4-0) Cr. 4. F.
Prereq: ECON 301, 1 year of calculus, STAT 401, and permission of Director of Graduate Education
Economic applications of selected mathematical and statistical concepts: linear models and matrix algebra; differential calculus and optimization; integral calculus and economic dynamics; probability distributions, estimation, and hypothesis testing in the analysis of economic data.

ECON 501: Microeconomics
(4-0) Cr. 4. F.
Prereq: ECON 301, credit or enrollment in ECON 500 or equivalent background in calculus and statistics
The theory of the consumer, theory of the firm, perfect and imperfect competition, welfare economics, and selected topics in general equilibrium and uncertainty.

ECON 502: Macroeconomics
(4-0) Cr. 4. F.
Prereq: ECON 302, credit or enrollment in ECON 500 or equivalent background in calculus and statistics
Models of aggregate supply and demand, theories of consumption and investment, money supply and demand, inflation, rational expectations, stabilization policy, financial markets, and international finance.

ECON 509: Applied Numerical Methods in Economics
(3-0) Cr. 3.
Prereq: ECON 500, ECON 501; or ECON 600, ECON 601
Use of numerical techniques to solve economic problems. Numerical differentiation and integration numeric solutions of systems of equations, static and dynamic optimization problems including unconstrained optimization, maximum likelihood methods, general nonlinear programming methods, dynamic programming and optimal control, numerical methods for solving functional equations.

ECON 510: Experimental Economics
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 601
Introduction to experimental economics and major subject areas addressed by laboratory and field experiments. Exploration of experimental methods by concentrating on series of experiments. Applications include individual decision-making, behavioral game theory, markets, behavioral labor, public and development economics, social network, and neuroeconomics. Research project.

ECON 520: Labor Supply and Human Capital Formation
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 601
Labor supply decisions and empirical analysis for agricultural operators and other self-employed and wage-earning households; multiple job holding; resource allocation in productive households; human capital formation by households, firms, and public institutions, which includes schooling, on-the-job training, migration, health, research, raising of children, and implications for household income and welfare; applications to problems in rural areas of developing and developed countries.

ECON 521: Labor Markets
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 601
Analysis of labor demand and market determination of wages and employment; analysis of distortions in labor markets due to non-competitive forces, legislation, and discrimination; wage inequality, compensation and work incentives; compensating differentials; microeconomic analysis of unemployment and job search.

ECON 532: Managerial Economics for the Global Organization
(3-0) Cr. 3.
Prereq: ECON 101 and enrollment in MBA or BAS program; not for economics majors
Applications of microeconomic theory and decision analysis for firms operating in U.S. and internationally. Topics include demand & supply, consumer choice theory, production and cost theory, short run and long run business decisions, input cost and human capital differences across countries, empirical estimation of demand and supply, pricing, exchange rates, government and business, market structures and strategy.

ECON 537: Commodity Markets: Analysis and Strategy
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 532 or ECON 601, ECON 571 or STAT 326
Analysis of exchange-traded and over-the-counter commodity markets, their functions and performance. Evaluation of hedging, speculation, and arbitrage strategies. Commodity transformation over space and time. Valuation of derivatives and comparison with derivatives on financial assets. Efficiency and the role of information in commodity markets. Market regulation.

ECON 545: Public Economics
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 601
Optimal taxation; excess burden; partial and general equilibrium analysis of tax incidence; social insurance; effects of taxation on labor supply and savings; economics of the health sector.

ECON 560: Agricultural, Food, and Trade Policy
(Dual-listed with ECON 460). (3-0) Cr. 3.
Prereq: ECON 301 or ECON 501
Description and analysis of economic problems of U.S. agriculture. Explanation and economic analysis of government policies and programs to develop agriculture, conserve agricultural resources, address consumer food concerns, stabilize farm prices, and raise farm incomes. The influence of macropolicy, world economy, international trade, and bioenergy on U.S. agriculture.

ECON 571: Intermediate Econometrics
(3-0) Cr. 3. S.
Prereq: ECON 500
Single and multiple equation regression models; dummy explanatory variables; serial correlation; heteroskedasticity; distributed lags; qualitative dependent variables; simultaneity. Use of econometric models for tests of economic theories and forecasting.

ECON 576: Spatial Economics
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 601
Analysis of location choice by firms, employees, and households emphasizing the role of spatial variations in agglomeration economies, economies of scale, distance, transport, endowments, amenities, and local government. Models of land use, urban form, spatial competition, central place theory, and migration. Techniques of discrete choice analysis, statistical analysis of categorical data, urban system modeling, and interregional computable general equilibrium.

ECON 580: Intermediate Environmental and Resource Economics
(Dual-listed with ECON 480). (3-0) Cr. 3.
Prereq: ECON 301 or ECON 501
Theories of natural resource utilization and allocation. Externalities, public goods, and environmental quality. Renewable energy, biofuels, land use change and life cycle analysis of carbon, and sustainability and resource conservation. Methodologies for analyzing natural resource and environmental problems and evaluating resource policies.

ECON 581: Advanced Environmental Economics
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 601
Interrelationships of natural resource use and the environment. Applied welfare and benefit-cost analyses. Externalities and pollution abatement. Nonmarket valuation of resources. Property rights. Legal and social constraints. Policy approaches.

ECON 590: Special Topics
Cr. 1-5. Repeatable.
Offered on a satisfactory-fail basis only.

ECON 599: Creative Component
Cr. 1-5.
Offered on a satisfactory-fail basis only.

Courses for graduate students:

ECON 600: Quantitative Methods in Economic Analysis II
(4-1) Cr. 4. F.
Prereq: ECON 500
Unconstrained and equality- and inequality-constrained optimization; the Kuhn-Tucker formulation; abstract spaces; dynamic programming; dynamical systems.

ECON 601: Microeconomic Analysis I
(4-1) Cr. 4. F.
Prereq: ECON 301, previous or concurrent enrollment in 600 and permission of Director of Graduate Education
Economic theory and methodology; theory of consumer behavior, theory of the competitive firm, supply and factor demand; duality relations in consumer and producer theory, welfare change measures; partial equilibrium analysis, perfect competition, monopoly; choice under uncertainty, the expected utility model, risk aversion; insurance, portfolio and production decisions under risk.

ECON 602: Macroeconomic Analysis
(4-1) Cr. 4. S.
Prereq: ECON 301, ECON 302, previous or concurrent enrollment in 600 and permission of Director of Graduate Education
Neoclassical aggregate growth models; the overlapping generations model; endogenous growth models; equilibrium business cycle theories; equilibrium job search and matching; models of money; fiscal and monetary policy; income and wealth distribution.

ECON 603: Microeconomic Analysis II
(4-1) Cr. 4. S.
Prereq: ECON 601, ECON 602 and permission of Director of Graduate Education
General equilibrium analysis, efficiency, and welfare; market failures, externalities, and the theory of the second best; introduction to game theory; adverse selection, signaling, screening and moral hazard.

ECON 604: Advanced Macroeconomic Analysis
(4-1) Cr. 4. F.
Prereq: ECON 601, ECON 602 and permission of Director of Graduate Education
Topics will be selected from: new Keynesian approaches to business cycle theory; endogenously generated business cycles; models of credit and financial intermediation; mechanism design and time inconsistency issues; political economy models; heterogeneous-agent models with strategic interaction; path dependence, network effects, and lock-in; economies as evolving self-organizing systems.

ECON 606: Advanced Topics in Macroeconomics
(3-0) Cr. 3.
Prereq: ECON 603, and credit or current enrollment in ECON 604
Selected topics in macroeconomic theory of current significance to the profession.

ECON 615: Theoretical Industrial Organization
(3-0) Cr. 3.
Prereq: ECON 603
Theoretical analysis of traditional topics in industrial organization. Review of game theory. Monopoly and oligopoly theory, price discrimination, product differentiation, research and development, diffusion of innovation, network externalities, and asymmetric information.

ECON 618: Game Theory
(3-0) Cr. 3.
Prereq: ECON 603, or ECON 501 and permission of instructor
Theoretical analysis and applications of strategic games, extensive form games, and cooperative games. Nash equilibrium, correlated equilibrium, Bayesian games, subgame perfect equilibrium, the core, evolutionary equilibrium, repeated games with finite automata, and common knowledge.

ECON 641: Agricultural Economics I
(3-0) Cr. 3.
Prereq: ECON 603
Demand and supply for agricultural products, market equilibrium models, implications of government policies on the agricultural sector, evaluation of research and development policies in agriculture, and biofuel and energy policy analysis. Commodity promotion programs, food safety and consumers' valuation of product attributes.

ECON 642: Agricultural Economics II
(3-0) Cr. 3.
Prereq: ECON 603
Advanced treatment of topics and models in agricultural economics with emphasis on stochastic models. Topics will include analysis of risk in decision making by consumers, firms and farms; analysis of risk management strategies for farmers; the economics of commodity storage; analysis of the impact of biofuels on commodity prices; and models of agricultural inputs and outputs.

ECON 653: Financial Economics
(3-0) Cr. 3.
Prereq: ECON 603, ECON 672. Recommended: ECON 674, StAT 551
Review of decision-making under uncertainty. Portfolio Theory. Theoretical foundations of asset valuation models: capital asset pricing model (CAPM), arbitrage pricing theory (APT), representative agent models, pricing of derivative securities. Complete and incomplete asset markets, credit markets, financial intermediaries, the role of government in the financial sector. Market frictions, crashes, bubbles. Applications of asset valuation models, with emphasis on their testable implications.

ECON 655: International Trade
(3-0) Cr. 3.
Prereq: ECON 603
Theories of international trade; welfare and distributional aspects of trade and commercial policies. Optimal trade policies in the presence of domestic distortions; strategic trade policy; international trade and economic growth.

ECON 657: International Finance
(3-0) Cr. 3.
Prereq: ECON 602
The intertemporal approach to current account determination; non-traded goods and the real exchange rate; fiscal policy in the open economy; monetary approach to balance of payments and exchange rate determination; sticky price models of the open economy; exchange-rate based stabilizations; capital inflows; financial and balance of payments crises; international business cycles.

ECON 671: Econometrics I
(4-1) Cr. 4. F.
Prereq: ECON 501 and STAT 447 or STAT 542
Probability and distribution theory for univariate and multivariate normal random variables, introduction to the theory of estimators for linear models, hypothesis testing and inference, introduction to large sample properties of estimators; derivation of common estimators and their properties for the classical and general multiple regression models, hypothesis testing, forecasting, implications of specification errors - missing data, left-out regressors, measurement error, stochastic regressors.

ECON 672: Econometrics II
(4-1) Cr. 4. S.
Prereq: ECON 671
Identification, estimation, and evaluation of systems of simultaneous equations; qualitative choice and limited dependent variable models; introduction to time series methods and applications, including alternative variance specifications.

ECON 673: Microeconometrics
(3-0) Cr. 3.
Prereq: ECON 672, ECON 601
Econometric treatment of models arising in microeconometric applications. Methods are primarily concerned with the analysis of cross-section data. Topics may include: systems of demand equations in panel data settings, random utility models of discrete choices, production possibilities frontier estimation, and discrete/continuous models of participation and consumption.

ECON 674: Macroeconometrics
(3-0) Cr. 3.
Prereq: ECON 672, ECON 602
Time-series econometric techniques and their application to macroeconomics and financial markets. Techniques may include GARCH and ARCH-M models, unit-root tests, nonlinear adjustment models, structural VARs, and cointegration tests.

ECON 680: Advanced Resource Economics
(3-0) Cr. 3.
Prereq: ECON 603
Dynamic allocation of scarce, exhaustible, and renewable natural resources, including minerals and energy, soil, water, forests, and fish. Social versus private decisions. Market and nonmarket considerations. Technological change. Regulation. Dynamics and uncertainty.

ECON 690: Advanced Topics
Cr. 1-5. Repeatable.
Offered on a satisfactory-fail basis only.

ECON 691: Third-Year Paper
Cr. 3.
Under the direction of the major professor, Ph.D. students write a formal research paper as an introduction to the dissertation research process. Offered on a satisfactory-fail basis only.

ECON 693: Workshops
Cr. 3.
Workshop in economics. Offered on a satisfactory-fail basis only.

ECON 699: Research for Thesis or Dissertation
Cr. arr. Repeatable.
Offered on a satisfactory-fail basis only.

Educational Administration (EDADM)

Courses primarily for graduate students, open to qualified undergraduates:

EDADM 541: Principles of Inclusive Educational Leadership
(3-0) Cr. 3. F.S.SS.
Prereq: Teacher licensure and permission of instructor
Basic principles of educational organizations, including an understanding of organizational behavior and theoretical approaches to administration. Exploration of substantive elements related to school reform, such as the change process, current issues in education, and developing a shared vision and mission around inclusive leadership.

EDADM 551: Supervision for Learning Environments
(3-0) Cr. 3. F.S.SS.
Prereq: EDADM 541
Study of effective classroom instructional practices that reflect current principles of learning. Understanding and practice of supervisory techniques that support teachers in improving the teaching and learning process, including skills in observational data collection, data analysis, collaboration, and conferencing skills.

EDADM 552: Current Issues in Site-Level Leadership
(3-0) Cr. 3. F.S.SS.
Prereq: EDADM 541
Essential tasks of building-level leadership and management in contemporary school settings, including: curriculum and organizational structure, theory and practice of scheduling, financial management, roles and responsibilities of governance, communication and public relations skills, home/parental involvement and relationships, project and crisis management, technology integration, school climate and culture, effective student support programs such as counseling and guidance, attendance and discipline.

EDADM 554: Leading School Reform
(3-0) Cr. 3. F.S.SS.
Prereq: EDADM 541
Study of principles of transformational leadership and collaborative decision-making skills. Leadership activities that facilitate the development of a school culture that embraces change and school reforms that result in high quality schools dedicated to improved student achievement.

EDADM 556: School Systems as Learning Cultures
(3-0) Cr. 3. F.S.SS.
Prereq: EDADM 541
Practical and theoretical perspectives on school administrative problems from critical pedagogical studies and research. Exploration of related issues such as cultural literacy, forms of authority and control, and other historical problems of schools in dealing with minorities and culturally different persons.

EDADM 557: Human Resource Development for Learning
(3-0) Cr. 3. F.S.SS.
Prereq: EDADM 541
Leadership theory and practice that focuses on the professional development of school staff to promote improved student learning. Principles of school personnel evaluation; legal issues related to hiring, retention, and dismissal; evaluation models for professional and classified staff; and effective professional development models to support lifelong learning and reflective practice.

EDADM 558: Diverse Learning Needs
(3-0) Cr. 3. F.S.SS.
Prereq: EDADM 541
Practical and ethical dimensions of school leadership, especially related to disability status, race, gender, language status, and other minoritized statuses. Specific focus will be on the various ecological contexts of the school, the community, and the family as means of making effective use of multiple resources to enrich education.

EDADM 559: Curriculum Leadership
(3-0) Cr. 3. F.S.SS.
Prereq: EDADM 541
Generic administrative approaches to the design and delivery of elementary and secondary school curricula including the study of the organizations for learning; cognition and learning theories; validation; concepts of balance; school goals, student assessments and reporting of progress, alignment, and professional development; development of curriculum guides; mapping; employing national standards and benchmarks.

EDADM 575: Education Law and Ethics
(3-0) Cr. 3. F.S.SS.
Prereq: EDADM 541
Examination of constitutional, statutory, and judicial provisions as a basis for the legal operation of educational institutions. Rights and ethical responsibilities of school leaders are examined in relation to their roles and responsibilities with boards, other school personnel, and students.

EDADM 590: Special Topics
Cr. 1-4. Repeatable.
Prereq: 9 credits in education

EDADM 591: Supervised Field Experience
Cr. 1-6. Repeatable.
Prereq: EDADM 541 and admission to program and instructor's approval
Supervised on-the-job field experience in special areas.

EDADM 591A: Supervised Field Experience: Elementary Principal
Cr. 1-6. Repeatable.
Prereq: EDADM 541 and admission to program and instructor's approval
Supervised on-the-job field experience in special areas.

EDADM 591B: Supervised Field Experience: Secondary Principal
Cr. 1-6. Repeatable.
Prereq: EDADM 541 and admission to program and instructor's approval
Supervised on-the-job field experience in special areas.

EDADM 593: Workshops
Cr. 1-4.
Prereq: 9 credits in education

EDADM 599: Creative Component Development
Cr. 1-3.
Prereq: 9 credits in educational administration

Courses for graduate students:

EDADM 615: Seminar
Cr. 1-3. Repeatable.
In-depth study of administrative topics of contemporary interest and importance.

EDADM 615A: Seminar: Client Focus
Cr. 1-3. Repeatable.
In-depth study of administrative topics of contemporary interest and importance.

EDADM 615B: Seminar: Research
Cr. 1-3. Repeatable.
In-depth study of administrative topics of contemporary interest and importance.

EDADM 615C: Seminar: Quality Improvement
Cr. 1-3. Repeatable.
In-depth study of administrative topics of contemporary interest and importance.

EDADM 615D: Seminar: Special Services
Cr. 1-3. Repeatable.
In-depth study of administrative topics of contemporary interest and importance.

EDADM 615E: Seminar: Assessment
Cr. 1-3. Repeatable.
In-depth study of administrative topics of contemporary interest and importance.

EDADM 615F: Seminar: Leadership
Cr. 1-3. Repeatable.
In-depth study of administrative topics of contemporary interest and importance.

EDADM 620: Program Induction Leadership Seminar
(3-0) Cr. 3. SS.
Prereq: EDADM 541
Assessment of candidate skill areas, including communication, leadership, technology, and team facilitation for the development of an individualized learning plan for the program. Orientation to program expectations and leadership challenges in the context of schooling for a global society.

EDADM 621: Aligning the System for Student Achievement
(5-0) Cr. 5. F.
Prereq: EDADM 541
Alignment of system goals and leadership theory with student achievement, governance, systems thinking, and communication and collaboration with various publics.

EDADM 622: Maximizing Human and Financial Resources for Student Achievement
(3-0) Cr. 3. S.
Prereq: EDADM 541
Allocation of system resources to enhance student achievement; human resource development and negotiations; and coaching and evaluating the administrative team.

EDADM 623: Mid-Program Leadership Seminar
(1-0) Cr. 1. SS.
Prereq: EDADM 541
Mid-program assessment of candidate progress and exploration of leadership strategies for working with diverse populations.

EDADM 624: School Finance
(2-0) Cr. 2. SS.
Prereq: EDADM 541
General issues of school finance and managing a school district's financial responsibilities. Role of the federal, state and local governments in educational finance, tax issues, and structures; budgeting procedures; and financial analysis and accountability. Includes attendance at selected sessions of the Iowa School Business Management Academy in the spring and two additional class sessions during the summer.

EDADM 631: Achieving Results Through Accountability Strategies
(5-0) Cr. 5. F.
Prereq: EDADM 541
Accountability strategies for applying leadership theory to student achievement, governance, systems thinking, change agentry, and communication and collaboration with various publics.

EDADM 632: Using System Assets to Create a Culture of Learning
(3-0) Cr. 3. S.
Prereq: EDADM 541
Leadership strategies to promote a culture of high student achievement; effective human capital management, including recruitment and induction of new personnel; and effective communication with parents and other patrons.

EDADM 633: Career Induction Leadership Seminar
(1-0) Cr. 1. SS.
Prereq: EDADM 541
Development of entry plan for creating a culture of collaboration; professional growth plan for first year in new position; and authentic performance assessment of values and beliefs platform.

EDADM 634: School Business Management and Accountability
(2-0) Cr. 2. SS.
Prereq: EDADM 541
Management of school operations; accountability and ethical business practices; risk management; school plant operations, food service and student transportation. Includes attendance at selected sessions of the Iowa School Business Management Academy in the spring and two additional class sessions during the summer.

EDADM 651: Ethics, Spirituality, and Social Justice in Administrative Practice
(3-0) Cr. 3. Alt. SS., offered even-numbered years.
Exploration of ethical models and practice of educational administrators. Participants develop personal and professional codes of ethics: define concepts of care, spirituality, democracy, equity, diversity, and social justice; and explain how those concepts relate to students' academic and social success. Case studies offer opportunities to consider moral and legal consequences of decision-making. Participants develop their own vision of leadership.

EDADM 690: Advanced Special Topics
Cr. 1-3. Repeatable.
Prereq: 9 credits in educational administration

EDADM 691: Clinical Dilemmas of Practice
Cr. 1-3. Repeatable, maximum of 3 credits.
Prereq: EDADM 541, admission to program, and instructor's approval
Supervised on-the-job field leadership experience in clinical dilemmas of practice. Offered on a satisfactory-fail basis only.

EDADM 699: Dissertation Research
Cr. arr. Repeatable.
Prereq: 9 credits in education

Educational Leadership and Policy Studies (EL PS)

Courses primarily for graduate students, open to qualified undergraduates:

EL PS 591: Social Justice Field Experience
Cr. 1-3. F.S.SS.
Prereq: EL PS 620
Supervised field experience in equity and social justice inside/outside higher education.

Courses for graduate students:

EL PS 615: Thematic Seminars
Cr. 1. F.S.SS.
Prereq: Admission to educational leadership doctoral program

EL PS 615A: Thematic Seminars: Communication and Team Building
Cr. 1. F.S.SS.
Prereq: Admission to educational leadership doctoral program

EL PS 615B: Thematic Seminars: Governance, Politics and Policies
Cr. 1. F.S.SS.
Prereq: Admission to educational leadership doctoral program

EL PS 615C: Thematic Seminars: Law, Equity, Equality
Cr. 1. F.S.SS.
Prereq: Admission to educational leadership doctoral program

EL PS 615D: Thematic Seminars: Ethics, Justice, and Caring
Cr. 1. F.S.SS.
Prereq: Admission to educational leadership doctoral program

EL PS 615E: Thematic Seminars: Problem Solving and Planning
Cr. 1. F.S.SS.
Prereq: Admission to educational leadership doctoral program

EL PS 615F: Thematic Seminars: Critical and Creative Thinking
Cr. 1. F.S.SS.
Prereq: Admission to educational leadership doctoral program

EL PS 616: Capstone Experience
Cr. 3. F.S.
Prereq: 4 credits of EL PS 615
This experience is designed to explore a topic addressed in one of the thematic seminars. The product of the capstone experience is a written paper of sufficient quality to be submitted to a scholarly journal for review.

EL PS 620: Education for Social Justice
(3-0) Cr. 3. F.
Introduction to social justice theory, research, and practice from a variety of theoretical perspectives in the context of higher education and broader society.

EL PS 621: Pedagogies of Dissent
(Cross-listed with W S). (3-0) Cr. 3. S.
Prereq: EL PS 620
Critical examination of the philosophical foundations of education that seek to challenge the status quo and advance radical educational change. Exploration of macro-level (and some micro-level) issues relevant to educational change, in relation to how they inform practices of dissent and every day social relations.

EL PS 622: Decolonizing Praxis
(3-0) Cr. 3. S.
Prereq: EL PS 620
Critically probes the philosophical and historical foundations of anti/post-colonial theory. Examination of policy, social, theoretical and educational issues from an anti/post-colonial perspective.

EL PS 624: Critical Race Theory in Education
(3-0) Cr. 3. SS.
Exploration of the central tenets of critical race theory. Examination of policy, social and educational issues from a critical race perspective.

EL PS 625: Gender and Sexuality in Education
(3-0) Cr. 3. SS.
Exploration of gender and sexuality in education.

EL PS 626: Social Justice and Social Change in Education
(3-0) Cr. 3. F.
Prereq: EL PS 621
An examination of how changes in the interest of social justice have occurred historically in education. Exploration of social movements and theories of social change.

Electrical Engineering (E E)

Courses primarily for undergraduates:

E E 166: Professional Programs Orientation
(Cross-listed with CPR E). Cr. R. F.S.
(1-0) Overview of the nature and scope of electrical engineering and computer engineering professions. Overview of portfolios. Departmental rules, advising center operations, degree requirements, program of study planning, career options, and student organizations.

E E 185: Introduction to Electrical Engineering and Problem-Solving I
(2-2) Cr. 3. F.S.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Project based examples from electrical engineering. Systematic thinking process for engineering problem solving. Group problem solving. Mathematical, conceptual and computer based projects. Solving engineering problems and presenting solutions through technical reports and oral presentations. Solutions of engineering problems using computation tools and basic programming.

E E 186: Introduction to Electrical Engineering and Problem Solving II
(0-2) Cr. 1. S.
Prereq: E E 185
Project based and hands on continuation of 185. Group skills needed to work effectively in teams. Individual interactive skills for small and large groups. Learning to use tools and methods for solving electrical engineering problems.

E E 188: Bio-Electrical Engineering Fundamentals Laboratory
(1-3) Cr. 2.
Prereq: E E 185 or equivalent
Fundamental laboratory based course in bio-electrical engineering with an emphasis on acquiring and analyzing biomedical signals to obtain relevant information. Topics covered include an overview of basic medical terminology and anatomy, labs illustrating data acquisition from different body systems, and an introduction to statistical significance and its relationship to biological variability.

E E 201: Electric Circuits
(3-3) Cr. 4. F.S.
Prereq: Credit or enrollment in MATH 267 and PHYS 222
Emphasis on mathematical tools. Circuit elements (resistors, inductors, capacitors) and analysis methods including power and energy relationships. Network theorems. DC, sinusoidal steady-state, and transient analysis. AC power. Frequency response. Two port models. Diodes, PSPICE. Laboratory instrumentation and experimentation. Credit for only E E 201 or 442 may be used towards graduation.

E E 224: Signals and Systems I
(3-3) Cr. 4. F.S.
Prereq: E E 201, MATH 267, PHYS 222
Mathematical preliminaries. Introduction to signals and systems. Signal manipulations. System properties. LTI systems, impulse response and convolution. Fourier Series representation and properties. Continuous and discrete-time Fourier Transforms and properties. Sampling and reconstruction. Modulation and demodulation. Applications and demonstrations using Matlab.

E E 230: Electronic Circuits and Systems
(3-3) Cr. 4. F.S.
Prereq: E E 201, MATH 267, PHYS 222
Frequency domain characterization of electronic circuits and systems, transfer functions, sinusoidal steady state response. Time domain models of linear and nonlinear electronic circuits, linearization, small signal analysis. Stability and feedback circuits. Operational amplifiers, device models, linear and nonlinear applications, transfer function realizations. A/D and D/A converters, sources of distortions, converter linearity and spectral characterization, applications. Design and laboratory instrumentation and measurements.

E E 261: Transfer Orientation
(Cross-listed with CPR E). Cr. R.
Introduction to the College of Engineering and the engineering profession specifically for transfer students. Information concerning university and college policies, procedures, and resources. Offered on a satisfactory-fail basis only.

E E 285: Problem Solving Methods and Tools for Electrical Engineering
(3-3) Cr. 4.
Integration of field-specific computational tools for practically solving electrical engineering problems. Methods for systematically reducing problems into sequential steps compatible with computer based tools. Structuring computer programs for efficiency and maintainability. Integration of multi-platform operating systems and multi-vendor tools for solving engineering problems. Hands-on laboratory experiences using Matlab, C, and other computational tools.

E E 294: Program Discovery
(Cross-listed with CPR E). Cr. R.
Prereq: CPR E 166 or E E 166
The roles of professionals in computer and electrical engineering. Relationship of coursework to industry and academic careers. Issues relevant to today's world. Offered on a satisfactory-fail basis only.

E E 303: Energy Systems and Power Electronics
(3-0) Cr. 3. F.S.
Prereq: MATH 267, PHYS 222; credit or enrollment in E E 224 and E E 230
Structure of competitive electric energy systems. System operation and economic optimization. Mutual inductance, transformers. Synchronous generators. Balanced three-phase circuit analysis and power calculations. Network calculations and associated numerical algorithms. Two-port circuits. Voltage regulation. Resonance and power factor correction. DC and induction motors. Power electronic circuit applications to power supplies and motor drives.

E E 311: Electromagnetic Fields and Waves
(4-0) Cr. 4. F.S.
Prereq: E E 201, MATH 265, PHYS 222, credit or enrollment in MATH 267
Fundamentals and applications of electric and magnetic fields and materials. Electrostatics and magentostatics, potentials, capacitance and inductance, energy, force, torque. Uniform plane electromagnetic waves, Poynting vector. Transmission lines: transient and sinusoidal steady-state conditions, reflection coefficient.

E E 314: Electromagnetics for non Electrical Engineers
(3-0) Cr. 3.
Prereq: PHYS 222, PHYS 112, or equivalent
Conceptual study of electomagnetism and its application in engineering and related fields. EM fundamentals, EM spectrum, radiation, radiating systems, wireless, modern concepts of physics, quantum computing, transmission lines, high speed effects, waveguides, GPS and other related phenomena will be discussed and explained with the application in mind.

E E 321: Communication Systems I
(3-0) Cr. 3. F.
Prereq: E E 224
Frequency domain analysis, spectral filtering, bandwidth. Linear modulation systems. Angle modulation systems. Phase locked loop, super-heterodyne receiver. Sampling and pulse code modulation. Digital data transmission, line coding, pulse shaping, multiplexing.

E E 322: Probabilistic Methods for Electrical Engineers
(Cross-listed with STAT). (3-0) Cr. 3. F.S.
Prereq: E E 224
Introduction to probability with applications to electrical engineers. Sets and events, probability space, conditional probability, total probability and Bayes' rule. Discrete and continuous random variables, cumulative distribution function, probability mass and density functions, expectation, moments, moment generating function, multiple random variables, functions of random variables. Elements of statistics, hypothesis testing, confidence intervals, least squares. Introduction to random processes.

E E 324: Signals and Systems II
(3-3) Cr. 4. F.S.
Prereq: E E 224
Laplace and z-Transforms, properties and inverses. Applications to LTI systems and analog/digital filters. Feedback systems and stability. State-space representation and analysis.

E E 330: Integrated Electronics
(Cross-listed with CPR E). (3-3) Cr. 4.
Prereq: E E 201, credit or enrollment in E E 230, CPR E 281
Semiconductor technology for integrated circuits. Modeling of integrated devices including diodes, BJTs, and MOSFETs. Physical layout. Circuit simulation. Digital building blocks and digital circuit synthesis. Analysis and design of analog building blocks. Laboratory exercises and design projects with CAD tools and standard cells.

E E 332: Semiconductor Materials and Devices
(Cross-listed with MAT E). (3-0) Cr. 3. S.
Prereq: PHYS 222; MAT E majors: MAT E 317; CPR E and E E majors: E E 230
Introduction to semiconductor material and device physics. Quantum mechanics and band theory of semiconductors. Charge carrier distributions, generation/recombination, transport properties. Physical and electrical properties and fabrication of semiconductor devices such as MOSFETs, bipolar transistors, laser diodes and LED's.

E E 333: Electronic Systems Design
(3-3) Cr. 4. F.
Prereq: E E 230, credit or enrollment in CPR E 288
Further topics in electronic systems design: Use of sensors and actuators. High-power amplifying and switching components. Linear and switched-mode power supplies. Linear and switched-mode amplifiers. Interfacing electronic components with programmable microcontrollers. Printed circuit board technology and design tools. Laboratory exercises and design projects incorporating printed circuit technology.

E E 336: Biomedical Instrumentation
(2-2) Cr. 3.
Prereq: E E 188, E E 224, E E 230
Principles and practices of biomedical instrumentation. Topics include: the physics and measurement of biopotentials including electrocardiography (EKG), electromyohgraphy (EMG) and electro-occulography (EOG), mechanical and chemical sensors, amplifiers and filters, recording and processing biological signals from nerve cells, muscles and human body, electrode polarization, surface electrodes, power line interference, heart sound sensors, respiratory gas concentration, blood-gas sensors, noninvasive blood-gas sensors.

E E 351: Analysis of Energy Systems
(3-0) Cr. 3.
Prereq: PHYS 222
Energy-scientific, engineering and economic foundations. Energy utilization-global and national. Sectoral analysis of energy consumption. Relationship of energy consumption and production to economic growth and environment. Technology for energy production. Economic evaluation of energy utilization and production. Scientific basis for global warming. Environmental impact of energy production and utilization. Renewable energy.
Meets International Perspectives Requirement.

E E 388: Sustainable Engineering and International Development
(Cross-listed with A B E, C E). (2-2) Cr. 3. F.
Prereq: Junior classification in engineering
Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report.
Meets International Perspectives Requirement.

E E 391: Open Laboratory and Design Studio
(2-2) Cr. 2.
Prereq: E E 224
Studio-based activity (guided problem-based learning and design) focusing on elements of design, measurement, data capture, and data interpretation. Team building, engineering professionalism, engineering process of review and critique, and presentation. Open design activities that may include working with other studios.

E E 394: Program Exploration
(Cross-listed with CPR E). Cr. R.
Prereq: CPR E 294 or E E 294
Exploration of academic and career fields for electrical and computer engineers. Examination of professionalism in the context of engineering and technology with competencies based skills. Introduction to professional portfolio development and construction. Offered on a satisfactory-fail basis only.

E E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

E E 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

E E 414: Microwave Engineering
(Dual-listed with E E 514). (3-3) Cr. 4. F.
Prereq: E E 230, E E 311
Principles, analyses, and instrumentation used in the microwave portion of the electromagnetic spectrum. Wave theory in relation to circuit parameters. S parameters, couplers, discontinuities, and microwave device equivalent circuits. RF amplifier design, microwave sources, optimum noise figure and maximum power designs. Microwave filters and oscillators.

E E 417: Electromagnetic Radiation, Antennas, and Propagation
(Dual-listed with E E 517). (3-3) Cr. 4. S.
Prereq: E E 311
Fundamental antenna concepts. Radiation from wire-and aperture-type sources. Radio transmission formulas. Wave and antenna polarization. Antenna arrays. Modern antenna topics. Practical antenna design. Antenna noise. Radiowave propagation in the presence of the earth and its atmosphere. Antenna measurements and computer aided analysis.

E E 418: High Speed System Engineering Measurement and Testing
(Cross-listed with CPR E). (3-2) Cr. 4. F.
Prereq: E E 230 and E E 311
Measurement of high speed systems and mixed signal systems. Measurement accuracy and error. Network analysis and spectrum analysis used in high speed measurement and testing. Test specification process and parametric measurement. Sampling and digital signal processing concepts. Design for testability. Testing equipment. Applications.

E E 422: Communication Systems II
(3-0) Cr. 3.
Prereq: E E 321 and enrollment in E E 423
Introduction to probability and random processes; Performance of analog systems with noise; Performance of digital communication with noise; optimum receivers, transmission impairments, and error rates; Introduction to information theory and coding: source coding, channel coding, channel capacity.

E E 423: Communication Systems Laboratory
(0-3) Cr. 1.
Prereq: E E 321, enrollment in E E 422
Construction and evaluation of modulators, demodulators and other components for analog and digital communications. Design, simulate,and evaluate wireless communication systems and their key components. Noise measurement.

E E 424: Introduction to Digital Signal Processing
(3-3) Cr. 4.
Prereq: E E 224
Sampling and reconstruction. Concepts and mathematical tools in discrete-time signal processing with examples from digital signal processing and communications. Discrete-time correlation and matched-filter receivers. Discrete Fourier transform (DFT). Fast Fourier algorithms. Z transforms. Design of finite impulse response (FIR) and infinite impulse response (IIR) filters. Realizations of discrete-time systems and quantization effects. Multi-rate signal processing. Laboratory experiments illustrating DSP implementations and applications.

E E 432: Microelectronics Fabrication Techniques
(Dual-listed with E E 532). (Cross-listed with MAT E). (2-4) Cr. 4.
Prereq: credit or enrollment in E E 332
Techniques used in modern integrated circuit fabrication, including diffusion, oxidation, ion implantation, lithography, evaporation, sputtering, chemical-vapor deposition, and etching. Process integration. Process evaluation and final device testing. Extensive laboratory exercises utilizing fabrication methods to build electronic devices. Use of computer simulation tools for predicting processing outcomes. Recent advances in processing CMOS ICs and micro-electro-mechanical systems (MEMS).

E E 435: Analog VLSI Circuit Design
(Cross-listed with CPR E). (3-3) Cr. 4. S.
Prereq: E E 324, E E 330, E E 332, and either E E 322 or STAT 330
Basic analog integrated circuit and system design including design space exploration, performance enhancement strategies, operational amplifiers, references, integrated filters, and data converters.

E E 438: Optoelectronic Devices and Applications
(Dual-listed with E E 538). (3-0) Cr. 3.
Prereq: E E 311, E E 332
Transmission and reflection of electromagnetic plane waves. Propagation in dielectric and fiber optic waveguides. LED and laser operating principles and applications. Photodetectors and solar cells. Optical modulation and switching.

E E 439: Nanoelectronics
(3-0) Cr. 3. S.
Prereq: E E 332 or MAT E 334
Concepts of quantum mechanics relevant to nanoelectronic devices, including quantization, tunneling, and transport; overview of some of the leading technologies for nanoelectronics, including carbon nanotubes, quantum dots, and molecular transistors; fabrication methods for building nanoelectronic devices.

E E 442: Introduction to Circuits and Instruments
(3-2) Cr. 2. F.S.
Prereq: PHYS 222, MATH 267
Half-semester course. Basic circuit analysis using network theorems with time domain and Laplace transform techniques for resistive, resistive-inductive, resistive-capacitive, and resistive- inductive-capacitive circuits. Transient circuit behavior. Basic operational amplifiers and applications. Familiarization with common E E instrumentation and demonstration of basic principles. Credit for only 201 or 442 may be counted toward graduation; credit for 442 will not count toward graduation for E E or Cpr E majors.

E E 448: Introduction to AC Circuits and Motors
(3-2) Cr. 2. F.S.
Prereq: E E 442
Half-semester course. Basics of DC machines, stepper motors, AC induction motors, and synchronous generators. AC steady state analysis, transformers, and three-phase circuit analysis.

E E 450: Biosensing
(Cross-listed with B M E). (3-0) Cr. 3.
Prereq: B M E 220
Overview of biosensors and bioanalytical challenges; designing for performance including various analytical problems, ion-selective membranes, characteristics of enzymes and basics of bioaffinity sensing; fundamentals of bioselective layers including depositing films and membranes, surfaces for immobilization and bioselective agents; survey of different biosensing technologies including electroanalytical, biomembrane, optical, and acoustic-wave based sensors.

E E 450L: Biosensing Laboratory
(Cross-listed with B M E). (0-3) Cr. 1.
Prereq: B M E 220, concurrent enrollment in B M E 450
Laboratory course accompanying B M E 450. Design, fabrication, and characterization of various electrical, chemical, polymer, optical and acoustic sensors.

E E 451: Engineering Acoustics
(Cross-listed with E M, M E). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: PHYS 221 and MATH 266 or MATH 267
Properties of sounds waves and noise metrics (pressure, power levels, etc). Sound sources and propagation. Principles of wave propagation in one-, two-, and three-dimensions. Wave reflection and transmission. Wave propagation in rectangular, cylindrical, and annular ducts. Acoustics fields for model noise sources. Introduction to aerodynamic noise sources in aircraft, aircraft engines, and wind turbines. Selected laboratory experiments.

E E 452: Electrical Machines and Power Electronic Drives
(2-3) Cr. 3. S.
Prereq: E E 303, E E 324
Basic concepts of electromagnetic energy conversion. DC motors and three-phase induction motors. Basic introduction to power electronics. Adjustable speed drives used for control of DC, induction, and AC motors. Experiments with converter topologies, DC motors, AC motors and adjustable speed drives.

E E 455: Introduction to Energy Distribution Systems
(3-0) Cr. 3. F.
Prereq: E E 303, credit or registration in E E 324
Overhead and underground distribution system descriptions and characteristics, load descriptions and characteristics, overhead line and underground cable models, distribution transformers, power flow and fault analysis, overcurrent protection, power factor correction, system planning and automation, and economics in a deregulated environment.

E E 456: Power System Analysis I
(3-0) Cr. 3. F.
Prereq: E E 303, credit or registration in E E 324
Power transmission lines and transformers, synchronous machine modeling, network analysis, power system representation, load flow.

E E 457: Power System Analysis II
(3-0) Cr. 3. S.
Prereq: E E 303, credit or registration in E E 324
Power system protection, symmetrical components, faults, stability. Power system operations including the new utility environment.

E E 458: Economic Systems for Electric Power Planning
(Cross-listed with ECON). (3-0) Cr. 3.
Prereq: E E 303 or ECON 301
Evolution of electric power industry. Power system operation and planning and related information systems. Linear and integer optimization methods. Short-term electricity markets and locational marginal prices. Risk management and financial derivatives. Basics of public good economics. Cost recovery models including tax treatment for transmission investments.

E E 459: Electromechanical Wind Energy Conversion and Grid Integration
(Dual-listed with E E 559). (3-0) Cr. 3.
Prereq: Credit or enrollment in E E 452, E E 456
Summary of industry status and expected growth; power extraction from the air stream; operation and modeling of electric machines, and power electronics topologies for wind energy conversion; analysis of machine-grid power electronic circuits, controller interface, and collector (distribution) networks; treatment of harmonics, flicker, over/under-voltages, filters, low-voltage ride-through, and reactive compensation; relaying; effects on transmission expansion, planning and grid operation and coordination including variability, frequency control, reserves, and electricity markets; overview of storage technologies and hybrid configurations.

E E 465: Digital VLSI Design
(Cross-listed with CPR E). (3-3) Cr. 4. S.
Prereq: E E 330
Digital design of integrated circuits employing very large scale integration (VLSI) methodologies. Technology considerations in design. High level hardware design languages, CMOS logic design styles, area-energy-delay design space characterization, datapath blocks: arithmetic and memory, architectures and systems on a chip (SOC) considerations. VLSI chip hardware design project.

E E 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, AER E, B M E, CPR E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

E E 467: Multidisciplinary Engineering Design II

(Cross-listed with AER E, CPR E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.

Prereq: Student must be within two semesters of graduation or receive permission of instructor.

Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

E E 475: Automatic Control Systems

(3-0) Cr. 3. F.

Prereq: E E 324

Stability and performance analysis of automatic control systems. The state space, root locus, and frequency response methods for control systems design. PID control and lead-lag compensation. Computer tools for control system analysis and design.

E E 476: Control System Simulation

(2-3) Cr. 3. S.

Prereq: E E 475

Computer aided techniques for feedback control system design, simulation, and implementation.

E E 488: Eddy Current Nondestructive Evaluation

(Dual-listed with E E 588). (Cross-listed with MAT E). (3-0) Cr. 3. Alt. F., offered odd-numbered years.

Prereq: MATH 265 and (MAT E 216 or MAT E 273 or E E 311 or PHYS 364)

Electromagnetic fields of various eddy current probes. Probe field interaction with conductors, cracks and other material defects. Ferromagnetic materials. Layered conductors. Elementary inversion of probe signals to characterize defects. Special techniques including remote-field, transient, potential drop nondestructive evaluation and the use of Hall sensors. Practical assignments using a 'virtual' eddy current instrument will demonstrate key concepts.

E E 489: Survey of Remote Sensing Technologies

(Dual-listed with E E 589). (Cross-listed with GEOL, MTEOR, NREM). (3-0) Cr. 3. F.

Prereq: Four courses in physical or biological sciences or engineering

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

E E 489L: Satellite Remote Sensing Laboratory

(Dual-listed with E E 589L). (Cross-listed with GEOL, MTEOR, NREM). (0-3) Cr. 1. S.

Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589

Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

E E 490: Independent Study

Cr. arr. Repeatable.

Prereq: Senior classification in electrical engineering

Investigation of an approved topic commensurate with the student's prerequisites.

E E 490H: Independent Study: Honors

Cr. arr.

Prereq: Senior classification in electrical engineering

Investigation of an approved topic commensurate with the student's prerequisites.

E E 491: Senior Design Project I and Professionalism

(Cross-listed with CPR E). (2-3) Cr. 3. F.S.

Prereq: E E 322 or CPR E 308, completion of 24 credits in the E E core professional program or 29 credits in the Cpr E core professional program, ENGL 314

Preparing for entry to the workplace. Selected professional topics. Use of technical writing skills in developing project plan and design report; design review presentation. First of two-semester team-oriented, project design and implementation experience.

E E 492: Senior Design Project II

(Cross-listed with CPR E). (1-3) Cr. 2. F.S.

Prereq: CPR E 491 or E E 491

Second semester of a team design project experience. Emphasis on the successful implementation and demonstration of the design completed in E E 491 or Cpr E 491 and the evaluation of project results. Technical writing of final project report; oral presentation of project achievements; project poster.

E E 494: Portfolio Assessment

(Cross-listed with CPR E). Cr. R.

Prereq: CPR E 394 or E E 394, credit or enrollment in CPR E 491 or E E 491

Portfolio update and evaluation. Portfolios as a tool to enhance career opportunities.

E E 496: Modern Optics
(Cross-listed with PHYS). (3-0) Cr. 3. S.
Prereq: Credit or enrollment in PHYS 322, PHYS 365, and PHYS 480
Review of wave and electromagnetic theory; topics selected from: reflection/refraction, interference, geometrical optics, Fourier analysis, dispersion, coherence, Fraunhofer and Fresnel diffraction, holography, quantum optics, nonlinear optics.

Courses primarily for graduate students, open to qualified undergraduates:

E E 501: Analog and Mixed-Signal VLSI Circuit Design Techniques
(Cross-listed with CPR E). (3-3) Cr. 4. F.
Prereq: E E 435
Design techniques for analog and mixed-signal VLSI circuits. Amplifiers; operational amplifiers, transconductance amplifiers, finite gain amplifiers and current amplifiers. Linear building blocks; differential amplifiers, current mirrors, references, cascading and buffering. Performance characterization of linear integrated circuits; offset, noise, sensitivity and stability. Layout considerations, simulation, yield and modeling for high-performance linear integrated circuits.

E E 504: Power Management for VLSI Systems
(Cross-listed with CPR E). (3-3) Cr. 4.
Prereq: E E 435, Credit or Registration for E E 501
Theory, design and applications of power management and regulation circuits (Linear and switching regulators, battery chargers, and reference circuits) including: Architectures, Performance metrics and characterization, Noise and stability analysis, Practical implementation and on-chip integration issues, design considerations for portable, wireless, and RF SoCs.

E E 505: CMOS and BiCMOS Data Conversion Circuits
(Cross-listed with CPR E). (3-3) Cr. 4. Alt. S., offered even-numbered years.
Prereq: E E 501
Theory, design and applications of data conversion circuits (A/D and D/A converters) including: architectures, characterization, quantization effects, conversion algorithms, spectral performance, element matching, design for yield, and practical comparators, implementation issues.

E E 506: Design of CMOS Phase-Locked Loops
(Cross-listed with CPR E). (3-3) Cr. 4.
Prereq: E E 435 or E E 501 or instructor approval
Analysis and design of phase-locked loops implemented in modern CMOS processes including: architectures, performance metrics, and characterization; noise and stability analysis; and design issues of phase-frequency detectors, charge pumps, loop filters (passive and active), voltage controlled oscillators, and frequency dividers.

E E 507: VLSI Communication Circuits
(Cross-listed with CPR E). (3-3) Cr. 4. Alt. S., offered odd-numbered years.
Prereq: E E 435 or E E 501
Phase-locked loops, frequency synthesizers, clock and data recovery circuits, theory and implementation of adaptive filters, low-noise amplifiers, mixers, power amplifiers, transmitter and receiver architectures.

E E 508: Filter Design and Applications
(3-3) Cr. 4.
Prereq: E E 501
Filter design concepts. Approximation and synthesis. Transformations. Continuous-time and discrete time filters. Discrete, active and integrated synthesis techniques.

E E 509: Mixed-Signal IC Testing and Built In Self Test
(3-0) Cr. 3.
Prereq: E E 424 or equivalent and E E 435 or E E 501
Introduction to mixed-signal IC testing; measurement uncertainty and test validity; IEEE standard test algorithms; high performance test and built-in self test challenges; new mixed-signal test algorithms and techniques to reduce data acquisition to relax instrumentation requirements, to simplify test setup, to improve test validity, and/or to enable co-testing of heterogeneous functions.

E E 510: Topics in Electromagnetics
Cr. 1-3. Repeatable.
Prereq: E E 311

E E 511: Modern Optical Communications
(3-0) Cr. 3. S.
Prereq: E E 311
Propagation in optical media. Optical fibers. Optical sources and detectors. Fiber optic communications systems. DWDM considerations.

E E 512: Advanced Electromagnetic Field Theory I
(3-0) Cr. 3. F.
Prereq: E E 311
Review of static electric and magnetic fields. Maxwell's equations. Circuit concepts and impedance elements. Propagation and reflection of plane waves in isotropic media. Guided electromagnetic wave. Characteristics of common waveguides and transmission lines. Propagation in anisotropic media. Special theorems and concepts. Radiation and scattering.

E E 513: Advanced Electromagnetic Field Theory II
(3-0) Cr. 3. S.
Prereq: E E 512
Green's functions, perturbational and variational techniques. Analysis of microstrip lines and interconnects. Spectral domain approach, waves in layered media. Integral equations and method of moments. Inverse scattering. Electromagnetic applications.

E E 514: Microwave Engineering
(Dual-listed with E E 414). (3-3) Cr. 4. F.
Prereq: E E 230, E E 311
Principles, analyses, and instrumentation used in the microwave portion of the electromagnetic spectrum. Wave theory in relation to circuit parameters. S parameters, couplers, discontinuities, and microwave device equivalent circuits. RF amplifier design, microwave sources, optimum noise figure and maximum power designs. Microwave filters and oscillators.

E E 516: Computational Methods in Electromagnetics
(3-0) Cr. 3. S.
Prereq: E E 311
Maxwell's equations. Differential equation based methods. Finite difference and finite difference time domain methods, boundary conditions. Finite element method and applications to the analysis of practical devices. Integral equation based methods. Electric and magnetic field integral equations. Matrix solvers. Fast solution methods.

E E 517: Electromagnetic Radiation, Antennas, and Propagation
(Dual-listed with E E 417). (3-3) Cr. 4. S.
Prereq: E E 311
Fundamental antenna concepts. Radiation from wire-and aperture-type sources. Radio transmission formulas. Wave and antenna polarization. Antenna arrays. Modern antenna topics. Practical antenna design. Antenna noise. Radiowave propagation in the presence of the earth and its atmosphere. Antenna measurements and computer aided analysis.

E E 518: Microwave Remote Sensing
(Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Math 265 or equivalent
Microwave remote sensing of Earth's surface and atmosphere using satellite-based or ground-based instruments. Specific examples include remote sensing of atmospheric temperature and water vapor, precipitation, ocean salinity, and soil moisture.

E E 519: Magnetism and Magnetic Materials
(Cross-listed with M S E). (3-0) Cr. 3. F.
Prereq: E E 311 or MAT E 317 or PHYS 364
Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, magnetic measurements of properties for materials evaluation.

E E 520: Selected Topics in Communications and Signal Processing
(3-0) Cr. 3. Repeatable.

E E 521: Advanced Communications
(3-0) Cr. 3. F.
Prereq: E E 422, credit or enrollment in E E 523
Digital communication systems overview. Characterization of communication channels. Digital modulation and demodulation design and performance analysis. Channel capacity and error-control coding concepts. Waveform design for band-limited channels. Equalization. Wireless fading channels and performance.

E E 522: Cognitive Radio Networks
(Cross-listed with CPR E). (3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: Permission of instructor
Topics on cognitive radio networks: Cognitive Radio Networks Architecture; Software Defined Radio Architecture; Spectrum Sensing; Spectrum Management; Spectrum Sharing; Spectrum Mobility; Applications of Cognitive Radio Networks.

E E 523: Random Processes for Communications and Signal Processing
(3-0) Cr. 3.
Prereq: E E 322, MATH 317
Axioms of probability; Repeated trials; Functions of a random variable and multiple random variables: covariance matrix, conditional distribution, joint distribution, moments, and joint moment generating function; Mean square estimation; stochastic convergence; Some important stochastic processes: Random walk, Poisson, Wiener, and shot noise; Markov chaines; Power spectral analysis; Selected applications.

E E 524: Digital Signal Processing
(3-0) Cr. 3. F.
Prereq: E E 322, E E 424, MATH 317
Review: sampling and reconstruction of signals; discrete-time signals, systems, and transforms. Multi-rate digital signal processing and introduction to filter banks. Optimal linear filtering and prediction. Introductions to adaptive filtering and spectral estimation. Applications.

E E 527: Detection and Estimation Theory
(3-0) Cr. 3. S.
Prereq: E E 422
Statistical estimation theory and performance measures: maximum likelihood estimation, Cramer-Rao bound, Bayesian estimation, optimal demodulation, signal design. Introduction to graphical models. Hidden Markov models and Kalman filter. Classical statistical decision theory, decision criteria, binary and composite hypothesis tests. Error probability and Chernoff bound. Applications.

E E 528: Digital Image Processing
(3-0) Cr. 3. S.
Prereq: E E 322, E E 424
Review of sampling, linear algebra and probability. Classical image processing topics such as image sampling and quantization, image transforms (2D Fourier, KLT, DCT, etc), image enhancement, restoration and filtering. Image analysis topics including edge detection, segmentation, registration and tracking (uses least squares estimation, EM, Kalman filter). Medical image reconstruction from tomographic projections (Radon transform, Fourier slice theorem and reconstruction algorithms using them) and Magnetic Resonance Imaging (MRI). Basic introduction to image and video compression methods.

E E 530: Selected Topics in Electronics, Microelectronics and Photonics
(3-0) Cr. 3. Repeatable.
Prereq: E E 332

E E 532: Microelectronics Fabrication Techniques
(Dual-listed with E E 432). (Cross-listed with M S E). (2-4) Cr. 4.
Prereq: credit or enrollment in E E 332
Techniques used in modern integrated circuit fabrication, including diffusion, oxidation, ion implantation, lithography, evaporation, sputtering, chemical-vapor deposition, and etching. Process integration. Process evaluation and final device testing. Extensive laboratory exercises utilizing fabrication methods to build electronic devices. Use of computer simulation tools for predicting processing outcomes. Recent advances in processing CMOS ICs and micro-electro-mechanical systems (MEMS).

E E 535: Physics of Semiconductors
(Cross-listed with PHYS). (3-3) Cr. 4.
Prereq: E E 311 and E E 332
Basic elements of quantum theory, Fermi statistics, motion of electrons in periodic structures, crystal structure, energy bands, equilibrium carrier concentration and doping, excess carriers and recombination, carrier transport at low and high fields, space charge limited current, photo-conductivity in solids, phonons, optical properties, amorphous semiconductors, heterostructures, and surface effects. Laboratory experiments on optical properties, carrier lifetimes, mobility, defect density, doping density, photo-conductivity, diffusion length of carriers.

E E 536: Physics of Semiconductor Devices
(Cross-listed with PHYS). (3-0) Cr. 3.
Prereq: E E 535
P-n junctions, band-bending theory, tunneling phenomena, Schottky barriers, heterojunctions, bipolar transistors, field-effect transistors, negative-resistance devices and optoelectronic devices.

E E 538: Optoelectronic Devices and Applications
(Dual-listed with E E 438). (3-0) Cr. 3.
Prereq: E E 311, E E 332
Transmission and reflection of electromagnetic plane waves. Propagation in dielectric and fiber optic waveguides. LED and laser operating principles and applications. Photodetectors and solar cells. Optical modulation and switching.

E E 547: Pattern Recognition
(3-0) Cr. 3. F.
Prereq: E E 324
Mathematical formulation of pattern recognition problems and decision functions. Statistical approaches: Bayes classifier, probability density function estimation and expectation minimization. Clustering (supervised and unsupervised), learning, and neural network algorithms. Fuzzy recognition systems. Feature selection systems. Classifier comparison. Current applications.

E E 552: Energy System Planning
(3-0) Cr. 3.
Prereq: E E 456, E E 457 or equivalent
Characteristics of bulk energy conversion, storage, and transport technologies. Environmental legislation. Modeling of electricity markets. Evaluation of sustainability and resiliency. Types of planning analyses: economic, multi-sector, long-term, national. Planning tools and associated optimization methods.

E E 553: Steady State Analysis
(3-0) Cr. 3. F.
Prereq: E E 456, E E 457
Power flow, economic dispatch, unit commitment, electricity markets, automatic generation control, sparse matrix techniques, interconnected operation, voltage control.

E E 554: Power System Dynamics
(3-0) Cr. 3. S.
Prereq: E E 456, E E 457, E E 475
Dynamic performance of power systems with emphasis on stability. Modeling of system components and control equipment. Analysis of the dynamic behavior of the system in response to small and large disturbances.

E E 555: Advanced Energy Distribution Systems
(3-0) Cr. 3.
Prereq: E E 455
Transient models of distribution components, automated system planning and distribution automation, surge protection, reliability, power quality, power electronics and intelligent systems applications.

E E 556: Power Electronic Systems
(3-0) Cr. 3.
Prereq: E E 452
Converter topologies, AC/DC, DC/DC, DC/AC, AC/AC. Converter applications to do motor drives, power supplies, AC motor drives, power system utility applications (var compensators) and power quality.

E E 559: Electromechanical Wind Energy Conversion and Grid Integration
(Dual-listed with E E 459). (3-0) Cr. 3.
Prereq: Credit or enrollment in E E 452, E E 456
Summary of industry status and expected growth; power extraction from the air stream; operation and modeling of electric machines, and power electronics topologies for wind energy conversion; analysis of machine-grid power electronic circuits, controller interface, and collector (distribution) networks; treatment of harmonics, flicker, over/under-voltages, filters, low-voltage ride-through, and reactive compensation; relaying; effects on transmission expansion, planning and grid operation and coordination including variability, frequency control, reserves, and electricity markets; overview of storage technologies and hybrid configurations.

E E 565: Systems Engineering and Analysis
(Cross-listed with AER E, I E). (3-0) Cr. 3.
Prereq: Coursework in basic statistics
Introduction to organized multidisciplinary approach to designing and developing systems. Concepts, principles, and practice of systems engineering as applied to large integrated systems. Life-cycle costing, scheduling, risk management, functional analysis, conceptual and detail design, test, evaluation and systems engineering planning and organization. Not available for degrees in industrial engineering.

E E 566: Avionics Systems Engineering
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: E E 565
Avionics functions. Applications of systems engineering principles to avionics. Top down design of avionics systems. Automated design tools.

E E 570: Systems Engineering Analysis and Design
(3-0) Cr. 3.
Prereq: E E 475, E E 577
Selected topics in abstract algebra, linear algebra, real analysis, functional analysis, and optimization methods in electrical engineering.

E E 571: Introduction to Convex Optimization
(3-0) Cr. 3.
Introduction to convex optimization problems emerging in electrical engineering. Efficiently solving convex optimization problems with the use of interior point algorithms software. Review of linear algebra, convex functions, convex sets, convex optimization problems, duality, disciplined convex programming, applications to optimal filtering, estimation, control and resources allocations, sensor network, distributed systems.

E E 573: Random Signal Analysis and Kalman Filtering
(Cross-listed with AER E, M E). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or M E 370 or M E 411 or MATH 341
Elementary notions of probability. Random processes. Autocorrelation and spectral functions. Estimation of spectrum from finite data. Response of linear systems to random inputs. Discrete and continuous Kalman filter theory and applications. Smoothing and prediction. Linearization of nonlinear dynamics.

E E 574: Optimal Control
(Cross-listed with AER E, M E). (3-0) Cr. 3. S.
Prereq: E E 577
The optimal control problem. Variational approach. Pontryagin's principle, Hamilton-Jacobi equation. Dynamic programming. Time-optimal, minimum fuel, minimum energy control systems. The regulator problem. Structures and properties of optimal controls.

E E 575: Introduction to Robust Control
(Cross-listed with AER E, M E). (3-0) Cr. 3.
Prereq: E E 577
Introduction to modern robust control. Model and signal uncertainty in control systems. Uncertainty description. Stability and performance robustness to uncertainty. Solutions to the H2, Hoo, and I1 control problems. Tools for robustness analysis and synthesis.

E E 576: Digital Feedback Control Systems
(Cross-listed with AER E, M E). (3-0) Cr. 3. F.
Prereq: E E 475 or AER E 432 or M E 411 or MATH 415; and MATH 267
Sampled data, discrete data, and the z-transform. Design of digital control systems using transform methods: root locus, frequency response and direct design methods. Design using state-space methods. Controllability, observability, pole placement, state estimators. Digital filters in control systems. Microcomputer implementation of digital filters. Finite wordlength effects. Linear quadratic optimal control in digital control systems. Simulation of digital control systems.

E E 577: Linear Systems
(Cross-listed with AER E, M E, MATH). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or MATH 415; and MATH 207
Linear algebra review. Least square method and singular value decomposition. State space modeling of linear continuous-time systems. Solution of linear systems. Controllability and observability. Canonical description of linear equations. Stability of linear systems. State feedback and pole placements. Observer design for linear systems.

E E 578: Nonlinear Systems
(Cross-listed with AER E, M E, MATH). (3-0) Cr. 3. S.
Prereq: E E 577
Linear vs nonlinear systems. Phase plane analysis. Bifurcation and center manifold theory. Lyapunov stability. Absolute stability of feedback systems. Input-output stability. Passivity theory and feedback linearization. Nonlinear control design techniques.

E E 588: Eddy Current Nondestructive Evaluation
(Dual-listed with E E 488). (Cross-listed with M S E). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 265 and (MAT E 216 or MAT E 273 or E E 311 or PHYS 364)
Electromagnetic fields of various eddy current probes. Probe field interaction with conductors, cracks and other material defects. Ferromagnetic materials. Layered conductors. Elementary inversion of probe signals to characterize defects. Special techniques including remote-field, transient, potential drop nondestructive evaluation and the use of Hall sensors. Practical assignments using a 'virtual' eddy current instrument will demonstrate key concepts.

E E 589: Survey of Remote Sensing Technologies
(Dual-listed with E E 489). (Cross-listed with GEOL, MTEOR, NREM). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

E E 589L: Satellite Remote Sensing Laboratory
(Dual-listed with E E 489L). (Cross-listed with MTEOR, NREM). (0-3) Cr. 1. S.
Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589
Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

E E 590: Special Topics
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590A: Special Topics: Electromagnetic Theory
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590B: Special Topics: Control Systems
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590C: Special Topics: Communication Systems
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590E: Special Topics: Computer Engineering
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590F: Special Topics: Electric Power
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590G: Special Topics: Electrical Materials
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590H: Special Topics: Electronic Devices and Circuits
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590I: Special Topics: Signal Processing
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 591: Seminar in Electronics, Microelectronics, and Photonics
Cr. 1-3. Repeatable.

E E 594: Seminar in Electric Power
Cr. 1-3. Repeatable.

E E 596: Seminar in Control Systems
Cr. 1-3. Repeatable.

E E 597: Seminar in Communications and Signal Processing
Cr. 1. Repeatable.
Offered on a satisfactory-fail basis only.

E E 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

E E 621: Coding Theory
(3-0) Cr. 3.
Prereq: E E 521
Fundamentals of error-control coding techniques: coding gain, linear block codes. Galois fields. Cyclic codes: BCH, Reed-Solomon. Convolutional codes and the Viterbi algorithm. Trellis-coded modulation. Iterative decoding. Recent developments in coding theory.

E E 622: Information Theory
(3-0) Cr. 3.
Prereq: E E 521, E E 523
Information system overview. Entropy and mutual information. Data Compression and source encoding. Discrete memoryless channel capacity. Noisy channel coding theorem. Rate distortion theory. Waveform channels. Advanced topics in information theory.

E E 653: Advanced Topics in Electric Power System Engineering
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Advanced topics of current interest in electric power system engineering.

E E 674: Advanced Topics in Systems Engineering
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Advanced topics of current interest in the areas of control theory, stochastic processes, digital signal processing, and image processing.

E E 697: Engineering Internship
(Cross-listed with CPR E). Cr. R. Repeatable.
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

E E 699: Research
Cr. arr. Repeatable.

Engineering (ENGR)

Courses primarily for undergraduates:

ENGR 101: Engineering Orientation
Cr. R. F.S.
Introduction to the College of Engineering and the engineering profession. Information concerning university and college policies, procedures, and resources. Undeclared sections: Considerations in choosing an engineering curriculum. Opportunities to interact with departments. Declared sections: Introduction to major-specific topics. Offered on a satisfactory-fail basis only.

ENGR 104: LEAD Program Orientation
(1-0) Cr. 1. F.
Orientation for LEAD Learning/Living Community participants. Introduction to college and university resources, tools and techniques to promote academic, professional and social/cultural development and success. Focus on building support networks with peers, faculty, and staff. Introduction to core engineering competencies including but not limited to initiative, communication, teamwork, and cultural adaptability. Offered on a satisfactory-fail basis only.

ENGR 105: LEAD Program Seminar
(1-0) Cr. 1. S.
Seminar for LEAD Learning/Living Community participants. Focus on professional development and exposure to various engineering disciplines through hands-on lab experiences, industry visits and networking opportunities with alumni, faculty, and staff. Development of core competencies: engineering/technical knowledge, communication and teamwork. Offered on a satisfactory-fail basis only.

ENGR 121: Learning Skills for Engineering
Cr. R. F.S.
Exploration of personal and academic strategies that promote academic and career success. Offered on a satisfactory-fail basis only.

ENGR 131: Learning Community Seminar
Cr. R. F.S.
Peer-mentored review of course topics in engineering undeclared learning communities. Offered on a satisfactory-fail basis only.

ENGR 150: Foundations of Leadership Development and Learning
(1-0) Cr. 1. F.S.
Leadership development with focus on global context and awareness of events shaping the context. Exposure to theory of leadership with examples. Necessary characteristics of a leader, and strategies for leadership skills development. Exposure to non-traditional career paths for engineers. Outline of personalized leadership development. Offered on a satisfactory-fail basis only.

ENGR 155: Leadership in Engineering Student Organizations
(1-0) Cr. 1. F.S.
Development of leadership skills of student organization leaders in the College of Engineering. Introduction to organizational leadership concepts and analyze organization purpose and function. Students practice mentoring and learn how their campus leadership experiences transfer to the field of engineering.

ENGR 160: Engineering Problems with Computer Applications Laboratory
(2-2) Cr. 3. F.S.SS.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Solving engineering problems and presenting solutions through technical reports. Significant figures. Use of SI units. Graphing and curve-fitting. Flowcharting. Introduction to mechanics, statistics and engineering economics. Use of spreadsheet programs to solve and present engineering problems. Solution of engineering problems using computer programming languages. (The honors section includes application of programming to mobile robotics).

ENGR 160H: Engineering Problems with Computer Applications Laboratory
(2-2) Cr. 3. F.S.SS.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Solving engineering problems and presenting solutions through technical reports. Significant figures. Use of SI units. Graphing and curve-fitting. Flowcharting. Introduction to mechanics, statistics and engineering economics. Use of spreadsheet programs to solve and present engineering problems. Solution of engineering problems using computer programming languages. (The honors section includes application of programming to mobile robotics).

ENGR 250: Leadership in Engineering Teams
(1-0) Cr. 1. F.S.
Building and sustaining decision-making engineering teams. Students will explore the interrelated processes of discerning purpose, thinking systemically, developing reflective judgment, and exercising leadership by mobilizing and setting the direction for adaptive change within a team. Industry based examples and information from engineering and natural resource sciences will be infused into the course.

ENGR 260: Engineering: Getting from Thought to Thing
(Cross-listed with IND D). (3-0) Cr. 3. F.S.
What is engineering, technology and their roles in society? Investigation of engineering methods through case studies of everyday objects. Explore questions about the impact of technology in society. Apply engineering methods to design and failure analysis.

ENGR 265: Survey of the Impacts of Engineering Activity
(3-0) Cr. 3. F.S.
Survey of the economic, environmental, societal, and political benefits and problems resulting from engineering activity. Effects of engineering projects on human health, social structures, and the environment. Examination of improvements in economic opportunities and quality of life resulting from engineering activity. Case studies of the effects of engineering activity.

ENGR 270: Survey of How Things Work
(Cross-listed with IND D). (3-0) Cr. 3. F.S.
Removing mysteries surrounding science and technology. Identify key concepts from applied science and technology to obtain better understanding on how things work. Review and explain the principles behind the technologies which define our modern way of life. A survey of broad range of technology could include: cell phones, GPS, radio, television, computers, ultrasound, microwave ovens, automobile, bioengineering and other industrial and consumer technologies. Common day technology examples illustrating scientific knowledge and applications.

ENGR 320: International Experience Report
Cr. 3. F.S.
Prereq: Satisfactory completion of international work experience of at least ten weeks or nine credits of approved course work taken abroad. Permission of student's department prior to departure
Critique of work/study abroad experience as it relates to professional development. Taken the semester after completion of work abroad or study abroad. Written report and presentation. Offered on a satisfactory-fail basis only.
Meets International Perspectives Requirement.

ENGR 327: Voices of Public Policy
(3-0) Cr. 3. F.
Prereq: Sophomore classification in engineering
Role and impact of legislative process, partisan politics, government, lobbyists, the media, expert testimony and grassroots activism on public policy. Critical analysis of context; of claims, assumptions, premises, and evidence of both sides; represented and disenfranchised populations; the ethical issues to develop personal position and courses of action to impact public policy process.

ENGR 340: Introduction to Wind Energy: System Design & Delivery
(3-0) Cr. 3. F.
Prereq: MATH 166, PHYS 222
Introduction to wind energy. Economic analysis related to wind energy. Electrical power generation, transmission, and grid operations. Tower, blade and nacelle materials and manufacturing. Tower design. Construction, transportation, supply chain and life cycle analysis for wind turbine components.

ENGR 350: Dean's Leadership Seminar
(1-0) Cr. 1. F.S.
Prereq: Selection based on demonstrated commitment to leadership development; for junior status or above.
Understanding the complexities of leadership in building an organization, decision-making styles, communication, managing change, building trust, shared responsibility leadership, creating legacy, prioritizing, effective use of authority, conflict, ethics, integrity, transparency, accountability. Offered on a satisfactory-fail basis only. May not apply toward a degree in Engineering

ENGR 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

ENGR 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

ENGR 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, AER E, B M E, CPR E, E E, I E, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

ENGR 467: Multidisciplinary Engineering Design II
(Cross-listed with AER E, CPR E, E E, I E, M E, MAT E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: Student must be within two semesters of graduation or receive permission of instructor.
Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

ENGR 490E: Entrepreneurship
Cr. 1-3. Repeatable, maximum of 3 credits.
Prereq: Junior or senior classification in engineering, college approval

ENGR 490L: Independent Study
Cr. 1-3. Repeatable, maximum of 3 credits. F.S.SS.
Leadership.

Engineering Mechanics (E M)

Courses primarily for undergraduates:

E M 274: Engineering Statics
(3-0) Cr. 3. F.S.SS.
Prereq: PHYS 221, credit or enrollment in MATH 166
Vector analysis; analysis of force systems; resultant in two and three dimensions; free-body diagrams; equilibrium; analysis of trusses, frames, and machines; friction, belts and pulleys; shear and bending moment in beams, centroid and center of mass; second moments of areas.

E M 324: Mechanics of Materials
(3-0) Cr. 3. F.S.SS.
Prereq: E M 274
Plane stress, plane strain, stress-strain relationships, and elements of material behavior. Application of stress and deformation analysis to members subject to centric, torsional, flexural, and combined loadings. Elementary considerations of theories of failure, buckling.

E M 327: Mechanics of Materials Laboratory
(0-2) Cr. 1. F.S.SS.
Prereq: E M 324
Experimental determination of mechanical properties of selected engineering materials. Experimental verification of assumptions made in 324. Use of strain measuring devices. Preparation of reports.

E M 345: Engineering Dynamics
(3-0) Cr. 3. F.S.SS.
Prereq: E M 274, credit or enrollment in MATH 266 or MATH 267
Particle and rigid body kinematics, Newton's laws of motion, kinetics of plane motion, rigid body problems using work-energy, linear, and angular impulse-momentum principles, vibrations.

E M 362: Principles of Nondestructive Testing
(Cross-listed with MAT E). (3-0) Cr. 3. S.
Prereq: PHYS 112 or PHYS 222
Radiography, ultrasonic testing, magnetic particle inspection, eddy current testing, dye penetrant inspection, and other techniques. Physical bases of tests, materials to which applicable, types of defects detectable, calibration standards, and reliability safety precautions.

E M 362L: Nondestructive Testing Laboratory
(Cross-listed with MAT E). (0-3) Cr. 1. S.
Prereq: Credit or enrollment in MAT E 362
Application of nondestructive testing techniques to the detection and sizing of flaws in materials and to the characterization of material's microstructure. Included are experiments in hardness, dye penetrant, magnetic particle, x-ray, ultrasonic and eddy current testing. Field trips to industrial laboratories.

E M 378: Mechanics of Fluids
(2-2) Cr. 3. F.S.SS.
Prereq: E M 274
Properties of fluids. Fluid statics. Kinematics and kinetics of fluid flow. Mass, momentum, and energy conservation laws; dimensional analysis; flow in pipes and channels. Selected laboratory experiments.

E M 417: Experimental Mechanics
(Dual-listed with E M 517). (Cross-listed with AER E). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324; MAT E 273
Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments.

E M 424: Intermediate Mechanics of Materials
(3-0) Cr. 3. F.S.
Prereq: E M 324
Analysis of stresses, strains, and deflections. Torsion and bending of unsymmetrical members. Analysis of thick wall pressure vessels and shrink fit problems. Dynamic load effects, fatigue and fracture mechanics introduction. Work-strain energy methods.

E M 425: Introduction to the Finite Element Method
(3-0) Cr. 3. S.
Prereq: E M 324, MATH 266 or MATH 267
Introduction of finite element analysis through applications to one-dimensional, steady-state problems such as elastic deformation, heat and fluid flow, consolidation, beam bending, and mass transport. Transient heat conduction and wave propagation. Two-dimensional triangular and quadrilateral elements. Plane problems of torsion, thermal and potential flow, stress analysis. Simple computer programs for one- and two-dimensional problems.

E M 451: Engineering Acoustics
(Cross-listed with E E, M E). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: PHYS 221 and MATH 266 or MATH 267
Properties of sounds waves and noise metrics (pressure, power levels, etc). Sound sources and propagation. Principles of wave propagation in one-, two-, and three-dimensions. Wave reflection and transmission. Wave propagation in rectangular, cylindrical, and annular ducts. Acoustics fields for model noise sources. Introduction to aerodynamic noise sources in aircraft, aircraft engines, and wind turbines. Selected laboratory experiments.

E M 480: Ultrasonic Nondestructive Evaluation
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: E M 324, MATH 266 or MATH 267, PHYS 222
Introduction to stress/strain, Hooke's law, and elastic wave propagation in two dimensions in isotropic media. Ultrasonic plane-wave reflection and transmission; and simple straight-crested guided waves. Transducer construction, behavior, and performance. Simple signal analysis and discrete signal processing. The last few weeks of the course are devoted to case studies.

E M 490: Independent Study
Cr. arr. Repeatable.
Prereq: Permission of instructor

E M 490H: Independent Study: Honors
Cr. arr. Repeatable.
Prereq: Permission of instructor

Courses primarily for graduate students, open to qualified undergraduates:

E M 510: Continuum Mechanics
(3-0) Cr. 3. F.
Prereq: MATH 385
Introduction to Cartesian tensors as linear vector transformations. Kinematics of continuous deformations, Lagrangian and Eulerian descriptions of motion. Fundamental equations or balance laws of continuous media, linear and angular momentum balance. Conservation laws of momentum and energy. Introduction to constitutive equations of classical elastic solids and simple fluids. Formulations and solutions of some canonical problems.

E M 514: Advanced Mechanics of Materials
(Cross-listed with AER E). (3-0) Cr. 3. F.
Prereq: E M 324
Theory of stress and strain, stress-strain relationships. Unsymmetrical bending, curved beams, shear center. Torsion of thin-walled noncircular sections. Equilibrium, compatibility equations. Airy stress functions. Membrane stresses in shells, thick-walled cylinders.

E M 516: Applied Elasticity and Mechanics of Deformable Solids
(3-0) Cr. 3. S.
Prereq: E M 510
Fundamental mechanics of linear elasticity, formulation and solution of simple elastostatic boundary value problems. Kinematics of small deformations, constitutive equations for isotropic and anisotropic media. Field equations for elastic solids, plane strain/plane stress and some classic analytical solutions such as Boussinesq, Hertz, Kirsch, Lamé, and Mitchell. Stress functions and potential methods and introduction to finite elements.

E M 517: Experimental Mechanics
(Dual-listed with E M 417). (Cross-listed with AER E). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324; MAT E 273
Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments.

E M 518: Waves in Elastic Solids with Applications to Ultrasonic Nondestructive Evaluation
(3-0) Cr. 3. F.
Prereq: MATH 385
Propagation of bulk waves, surface waves, and guided waves in isotropic and anisotropic elastic media. Transmission and reflection of waves at plane and curved interfaces. Radiation of sources with application to ultrasonic transducer beam modeling. Elastic wave scattering from cracks and inclusions. Reciprocity principles and their use in the development of an ultrasonic measurement model. Characterization and measurement of material attenuation.

E M 525: Finite Element Analysis
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: E M 425, MATH 385
Variational and weighted residual approach to finite element equations. Emphasis on two- and three-dimensional problems in solid mechanics. Isoparametric element formulation, higher order elements, numerical integration, imposition of constraints and penalty, convergence, and other more advanced topics. Use of two- and three-dimensional computer programs. Dynamic and vibrational problems, eigenvalues, and time integration. Introduction to geometric and material nonlinearities.

E M 526: Boundary Element Methods in Engineering
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 514 or E M 516
Introductory boundary element methods through plane problems. Singular integrals, Cauchy principal values, integral representations and boundary integrals in one dimension. Direct and indirect formulations. Plane potential and elastostatic problems. Higher order elements, numerical integration. Regularizations. Body forces and infinite regions. Specialized fundamental solutions, half-plane and axisymmetric problems. Diffusion and wave problems. Coupling with finite elements.

E M 543: Introduction to Random Vibrations and Nonlinear Dynamics
(Cross-listed with M E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Vibrations of continuous systems. Nonlinear vibration phenomena, perturbation expansions; methods of multiple time scales and slowly-varying amplitude and phase. Characteristics of random vibrations; random processes, probability distributions, spectral density and its significance, the normal or Gaussian random process. Transmission of random vibration, response of simple single and two-degree-of-freedom systems to stationary random excitation. Fatigue failure due to random excitation.

E M 548: Advanced Engineering Dynamics
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E M 345, MATH 266 or MATH 267
3-D kinematics and dynamics of particles and rigid bodies. Coordinate systems, calculus of variations. Lagrange's equations with constraints, modified Euler's equations, torque-free motion of rigid bodies in 3-D, moment equations with constraints.

E M 550: Nondestructive Evaluation
(Cross-listed with M S E). (3-2) Cr. 4. S.
Prereq: E M 324, MATH 385
Principles of five basic NDE methods and their application in engineering inspections. Materials behavior and simple failure analysis. NDE reliability, and damage-tolerant design. Advanced methods such as acoustic microscopy, laser ultrasonics, thermal waves, and computed tomography are analyzed. Computer-based experiments on a selection of methods: ultrasonics, eddy currents, x-rays are assigned for student completion.

E M 552: Advanced Acoustics
(Cross-listed with M E). (3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: E M 451
Theoretical acoustics: wave propagation in fluids; acoustic radiation, diffraction and scattering; nonlinear acoustics; radiation force; cavitation; and ray acoustics.

E M 564: Fracture and Fatigue
(Cross-listed with AER E, M E, M S E). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324 and either MAT E 216 or MAT E 273 or MAT E 392. Undergraduates: Permission of instructor
Materials and mechanics approach to fracture and fatigue.
Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue.

E M 566: Phase Transformation in Elastic Materials
(Cross-listed with M E). (3-0) Cr. 3. S.
Prereq: EM 510 or EM 516 or EM 514
Continuum thermodynamics and kinetics approaches to phase transformations. Phase field approach to stress- and temperature-induced martensitic transformations and twinning at the nanoscale. Nucleation and growth. Nanostructural evaluation. Analytical and numerical solutions. Surface stresses and energy. Surface-induced phase transformations. Large Strain formulation.

E M 569: Mechanics of Composite and Combined Materials
(Cross-listed with AER E, M S E). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E M 324
Mechanics of fiber-reinforced materials. Micromechanics of lamina. Macromechanical behavior of lamina and laminates. Strength and interlaminar stresses of laminates. Failure criteria. Stress analysis of laminates. Thermal moisture and residual stresses. Joints in composites.

E M 570: Wind Engineering
(Cross-listed with AER E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: E M 378, E M 345
Atmospheric circulations, atmospheric boundary layer wind, bluff-body aerodynamics, aeroelastic phenomena, wind-tunnel and full-scale testing, wind-load code and standards, effect of tornado and thunderstorm winds, design applications.

E M 590: Engineering Mechanics Special Topics
Cr. 1-4. Repeatable.
Prereq: Permission of instructor

E M 590F: Engineering Mechanics Special Topics: Introduction to Dislocation and Plasticity
Cr. 1-4. Repeatable.
Prereq: Permission of instructor

E M 590H: Engineering Mechanics Special Topics: Mechanics of Thin Films and Adhesives
Cr. 1-4. Repeatable.
Prereq: Permission of instructor

E M 590I: Engineering Mechanics Special Topics: Mechanics of Cellular and Porous Media
Cr. 1-4. Repeatable.
Prereq: Permission of instructor

E M 590J: Engineering Mechanics Special Topics: Other
Cr. 1-4. Repeatable.
Prereq: Permission of instructor

E M 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

E M 690: Engineering Mechanics Special Topics
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 690N: Engineering Mechanics Special Topics: Advanced Experimental Methods
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 690O: Engineering Mechanics Special Topics: Advanced Wave Propagation
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 690P: Engineering Mechanics Special Topics: Advanced Materials
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 690Q: Engineering Mechanics Special Topics: Advanced Computational Methods
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 690R: Engineering Mechanics Special Topics: Reliability and Failure
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 690S: Engineering Mechanics Special Topics: Other
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 697: Engineering Internship
Cr. R. Repeatable.
Prereq: Permission of DOGE (Director of Graduate Education), graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

E M 699: Research
Cr. arr. Repeatable.

English (ENGL)

Courses primarily for undergraduates:

ENGL 011: Intensive English and Orientation Program Reading
(5-0) Cr. 0. F.S.SS.
Study of English for speakers of other languages. Brochure available from the IEOP Office, 102 Landscape Architecture, or at www.ieop.iastate.edu.

ENGL 011A: Intensive English and Orientation Program Reading: Beginner
(5-0) Cr. 0. F.S.SS.
Academic reading classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 011B: Intensive English and Orientation Program Reading: Low Intermediate
(5-0) Cr. 0. F.S.SS.
Academic reading classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 011C: Intensive English and Orientation Program Reading: Intermediate
(5-0) Cr. 0. F.S.SS.
Academic reading classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 011D: Intensive English and Orientation Program Reading: High Intermediate
(5-0) Cr. 0. F.S.SS.
Academic reading classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 011E: Intensive English and Orientation Program Reading: High
(5-0) Cr. 0. F.S.SS.
Academic reading classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 011F: Intensive English and Orientation Program Reading: Advanced
(5-0) Cr. 0. F.S.SS.
Academic reading classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012: Intensive English and Orientation Program Writing
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012A: Intensive English and Orientation Program Writing: Beginner
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012B: Intensive English and Orientation Program Writing: Low Intermediate
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012C: Intensive English and Orientation Program Writing: Intermediate
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012D: Intensive English and Orientation Program Writing: High Intermediate
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012E: Intensive English and Orientation Program Writing: High
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012F: Intensive English and Orientation Program Writing: Advanced
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013: Intensive English and Orientation Program Listening and Speaking
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013A: Intensive English and Orientation Program Listening and Speaking: Beginner
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013B: Intensive English and Orientation Program Listening and Speaking: Low Intermediate
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013C: Intensive English and Orientation Program Listening and Speaking: Intermediate
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013D: Intensive English and Orientation Program Listening and Speaking: High Intermediate
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013E: Intensive English and Orientation Program Listening and Speaking: High
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013F: Intensive English and Orientation Program Listening and Speaking: Advanced
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014: Intensive English and Orientation Program Grammar
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014A: Intensive English and Orientation Program Grammar: Beginner
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014B: Intensive English and Orientation Program Grammar: Low Intermediate
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014C: Intensive English and Orientation Program Grammar: Intermediate
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014D: Intensive English and Orientation Program Grammar: High Intermediate
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014E: Intensive English and Orientation Program Grammar: High
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014F: Intensive English and Orientation Program Grammar: Advanced
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 015: Intensive English and Orientation Program Exit Academic Skills
(10-0) Cr. 0.
Academic Skills classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 016: Intensive English and Orientation Program Exit Orientation
(5-0) Cr. 0.
Academic Orientation classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 017: Intensive English and Orientation Program Exit Technology
(5-0) Cr. 0.
Academic Technology classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 018: Intensive English Orientation Program Business Oral English Communication: Listening and Speaking
(5-0) Cr. 0.
Academic English classes for speakers of other languages focusing on Business. More information available at www.ieop.iastate.edu.

ENGL 019: Intensive English Orientation Program Business Written English Communication: Reading and Writing
(10-0) Cr. 0.
Academic English classes for speakers of other languages focusing on Business. More information available at www.ieop.iastate.edu.

ENGL 020: Intensive English and Orientation Program Optional Seminar
(5-0) Cr. 0.
Customized academic English and cultural orientation for speakers of other languages.

ENGL 099: Strategies for Nonnative Speakers of English
Cr. 0. F.S.
Prereq: Recommendation of English Department; placement in sections L and R is determined by examination; section S is open to all interested international students. Available P/NP to graduate students at their department's option

ENGL 099L: Strategies for Nonnative Speakers of English: Strategies for Listening
Cr. 0. F.S.
Prereq: Recommendation of English Department; placement in sections L and R is determined by examination; section S is open to all interested international students. Available P/NP to graduate students at their department's option

ENGL 099R: Strategies for Nonnative Speakers of English: Strategies for Reading
Cr. 0. F.S.
Prereq: Recommendation of English Department; placement in sections L and R is determined by examination; section S is open to all interested international students. Available P/NP to graduate students at their department's option

ENGL 099S: Strategies for Nonnative Speakers of English: Academic Speaking and Pronunciation
Cr. 0. F.S.
Prereq: Recommendation of English Department; placement in sections L and R is determined by examination; section S is open to all interested international students. Available P/NP to graduate students at their department's option

ENGL 101: English for Native Speakers of Other Languages
(3-0) Cr. 3. F.S.
Prereq: Recommendation of English Department; placement in various sections is determined by examination. (See English Requirement for International Students in Index.)
For undergraduates: Completion of ENGL 101 requirement prepares students for ENGL 150. For graduates: Completion of ENGL 101 satisfies the English requirement of the Graduate College. ENGL 101 courses are limited to students who are nonnative speakers of English. Credit from ENGL 101 does not count toward graduation.

ENGL 101B: English for Native Speakers of Other Languages: Academic English
(3-0) Cr. 3. F.S.
Prereq: Recommendation of English Department; placement in various sections is determined by examination. (See English Requirement for International Students in Index.)
For undergraduates: Completion of ENGL 101 requirement prepares students for ENGL 150. For graduates: Completion of ENGL 101 satisfies the English requirement of the Graduate College. ENGL 101 courses are limited to students who are nonnative speakers of English. Credit from ENGL 101 does not count toward graduation.

ENGL 101C: English for Native Speakers of Other Languages: Academic English II--Undergraduates
(3-0) Cr. 3. F.S.
Prereq: Recommendation of English Department; placement in various sections is determined by examination. (See English Requirement for International Students in Index.)
For undergraduates: Completion of ENGL 101 requirement prepares students for ENGL 150. For graduates: Completion of ENGL 101 satisfies the English requirement of the Graduate College. ENGL 101 courses are limited to students who are nonnative speakers of English. Credit from ENGL 101 does not count toward graduation.

ENGL 101D: English for Native Speakers of Other Languages: Academic English II--Graduates
(3-0) Cr. 3. F.S.
Prereq: Recommendation of English Department; placement in various sections is determined by examination. (See English Requirement for International Students in Index.)
Available P/NP to graduate students at their department's option. For undergraduates: Completion of ENGL 101 requirement prepares students for ENGL 150. For graduates: Completion of ENGL 101 satisfies the English requirement of the Graduate College. ENGL 101 courses are limited to students who are nonnative speakers of English. Credit from ENGL 101 does not count toward graduation.

ENGL 120: Computers and Language
(Cross-listed with LING). (3-0) Cr. 3.
Introduction to the use of linguistic knowledge in computer applications today and the basic computational techniques used in such applications. The development of these techniques throughout the history of computational linguistics. How the study of language has contributed to the advancement of technology and how certain computational problems have influenced the way linguists study language.

ENGL 150: Critical Thinking and Communication
(3-0) Cr. 3. F.S.SS.
Prereq: Concurrent enrollment in LIB 160 is recommended.
Application of critical reading and thinking abilities to topics of civic and cultural importance. Introduction of basic oral, visual, and electronic communication principles to support writing development. Initiation of communication portfolio.

ENGL 180: Communication Skills for International Teaching Assistants
Cr. 1-3. Repeatable, maximum of 2 times. F.S.
Placement based upon OECT test results. Persons whose native language is English cannot take ENGL 180 for credit. No more than one section of ENGL 180 may be taken per semester; up to two sections total. Offered on a satisfactory-fail basis only. Credit for ENGL 180 does not apply toward graduation.

ENGL 180A: Communication Skills for International Teaching Assistants: Speaking Skills
Cr. 3. Repeatable, maximum of 2 times. F.S.
Emphasis on pronunciation improvement and greater fluency in spoken English. Placement based upon OECT test results. Persons whose native language is English cannot take ENGL 180 for credit. No more than one section of ENGL 180 may be taken per semester; up to two sections total. Offered on a satisfactory-fail basis only. Credit for ENGL 180 does not apply toward graduation.

ENGL 180B: Communication Skills for International Teaching Assistants: Intermediate Spoken English
Cr. 3. Repeatable, maximum of 2 times. F.S.
Placement based upon OECT test results. Persons whose native language is English cannot take ENGL 180 for credit. No more than one section of ENGL 180 may be taken per semester; up to two sections total. Offered on a satisfactory-fail basis only. Credit for ENGL 180 does not apply toward graduation.

ENGL 180C: Communication Skills for International Teaching Assistants: Advanced Spoken English
Cr. 3. Repeatable, maximum of 2 times. F.S.
For students who have completed ENGL 180A or ENGL 180b but have not reached the passing level on the OECT test. Placement based upon OECT test results. Persons whose native language is English cannot take ENGL 180 for credit. No more than one section of ENGL 180 may be taken per semester; up to two sections total. Offered on a satisfactory-fail basis only. Credit for ENGL 180 does not apply toward graduation.

ENGL 180D: Communication Skills for International Teaching Assistants: Presentation Skills
Cr. 3. Repeatable, maximum of 2 times. F.S.
Developing explanations, leading discussions and handling questions in a teaching environment. Placement based upon OECT test results. Persons whose native language is English cannot take ENGL 180 for credit. No more than one section of ENGL 180 may be taken per semester; up to two sections total. Offered on a satisfactory-fail basis only. Credit for ENGL 180 does not apply toward graduation.

ENGL 180E: Communication Skills for International Teaching Assistants: Supervised Independent Study
Cr. 1-3. Repeatable, maximum of 2 times. F.S.
Seminar with individual observation and consultation. Placement based upon OECT test results. Persons whose native language is English cannot take 180 for credit. No more than one section of ENGL 180 may be taken per semester; up to two sections total. Offered on a satisfactory-fail basis only. Credit for ENGL 180 does not apply toward graduation.

ENGL 201: Introduction to Literature
(3-0) Cr. 3.
Prereq: Credit in or exemption from 150
Study of selected examples of drama, poetry, short fiction, and the novel drawn from both British and American literature. Recommended for nonmajors.

ENGL 207: Introduction to Creative Writing
(3-0) Cr. 3. F.S.
Prereq: Credit in or exemption from 150
Course introduces students to the fundamentals of writing fiction, poetry, and creative nonfiction. Extensive readings in all three genres. Students learn creative processes through writing exercises, workshops, and conferences.

ENGL 214: Introduction to Technical Communication
Cr. 3. F.
Prereq: ENGL 150
A broad introduction to the culture of professional work as a technical communicator, with particular emphasis on principles and best practices for developing and managing technical information and digital media. Examination of user-centered design, the history of the discipline, cross-cultural communication, and the ethics of communicating complex information to lay audiences. Study and practice of team-based collaboration, project management, and technical editing.

ENGL 219: Introduction to Linguistics
(Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: Sophomore classification
Introduction to linguistic concepts and principles of linguistic analysis with English as the primary source of data. Sound and writing systems, sentence structure, vocabulary, and meaning. Issues in the study of usage, regional and social dialects, language acquisition, and language change.

ENGL 220: Descriptive English Grammar
(Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: ENGL 250
Overview of grammatical structures and functions. Parts of speech; phrase, clause, and sentence structure; sentence types and sentence analysis; rhetorical grammar and sentence style; terminology. Not a remedial, English composition, or ESL course.

ENGL 225: Survey of British Literature to 1800
(3-0) Cr. 3.
Prereq: ENGL 250
Representative works of British literature from the origins to 1800 in historical, cultural, and literary contexts. Will include multiple genres.

ENGL 226: Survey of British Literature since 1800
(3-0) Cr. 3.
Prereq: ENGL 250
Representative works from 1800 to the present in historical, cultural, and literary contexts. Will include multiple genres and may include texts that reflect and/or critique the impact and legacy of the British empire on its former colonies, i.e., postcolonial literature.

ENGL 227: Survey of American Literature to 1865
(3-0) Cr. 3.
Prereq: ENGL 250
Representative works of American literature from its origins (including indigenous and conquest literatures) through the end of the Civil War in historical, cultural, and literary contexts. Will include multiple genres.

ENGL 228: Survey of American Literature since 1865
(3-0) Cr. 3.
Prereq: ENGL 250
Representative works written in the United States since the Civil War in historical, cultural, and literary contexts, with attention to the cultural and ethnic diversity of Americans. Will include multiple genres.

ENGL 237: Survey of Film History
(3-0) Cr. 3. F.
Prereq: Credit in or exemption from 150
A survey of the history of film, both U.S. and international, from the beginnings in the late nineteenth century to the present.

ENGL 240: Introduction to American Indian Literature
(Cross-listed with AM IN). (3-0) Cr. 3. F.
Prereq: Credit in or exemption from ENGL 150
Appreciation of oral and written forms of American Indian literatures. Tropes and techniques in oral, visual and written texts. Focus on the role of American Indians in interdisciplinary approaches to modern social and environmental issues as expressed in literary works.
Meets U.S. Diversity Requirement

ENGL 250: Written, Oral, Visual, and Electronic Composition
(3-0) Cr. 3. F.S.SS.
Prereq: ENGL 150 or exemption from ENGL 150; sophomore classification or exemption from ENGL 150; credit for or concurrent enrollment in LIB 160
Analyzing, composing, and reflecting on written, oral, visual, and electronic (WOVE) discourse within academic, civic, and cultural contexts. Emphasis on supporting a claim and using primary and secondary sources. Continued development of communication portfolio.

ENGL 250H: Written, Oral, Visual, and Electronic Composition: Honors
(3-0) Cr. 3. F.
Prereq: Exemption from ENGL 150 and admission to Freshman Honors Program; credit for or concurrent enrollment in LIB 160
In-depth analysis, composition, and reflection on written, oral, visual, and electronic (WOVE) discourse within academic, civic, and cultural contexts. Emphasis on argumentation: developing claims, generating reasons, providing evidence. Individual sections organized by special topics. Development of communication portfolio.

ENGL 260: Introduction to Literary Study
(3-0) Cr. 3.
Prereq: Credit in or exemption from 150
Basic principles of literary study. Emphasis on writing of interpretive and critical essays. Particular attention to poetry. Designed for English majors.

ENGL 275: Analysis of Popular Culture Texts
(Cross-listed with SP CM). (3-0) Cr. 3. F.S.
Prereq: Credit in or equivalent of 250
Analysis of how information and entertainment forms persuade and manipulate audiences. Study of several forms that may include newspapers, speeches, television, film, advertising, fiction, and magazines. Special attention to verbal and visual devices.

ENGL 302: Business Communication
(3-0) Cr. 3. F.S.SS.
Prereq: ENGL 250, junior classification
Rhetorical concepts and processes to successfully communicate individually and collaboratively via written, oral, visual, and electronic modes across a range of business disciplines. Covers strategies for analyzing audiences internal and external to an organization in order to communicate positive, neutral, and negative messages clearly, completely, correctly, and ethically; save an audience's time; and create goodwill.

ENGL 302H: Business Communication: Honors
(3-0) Cr. 3. F.S.SS.
Prereq: ENGL 250, junior classification
Theory, principles and processes of effective written, oral, visual, and electronic communication typically encountered in business and the professions. Extensive practice in many areas of workplace communication, including letter, memo, and email correspondence; short proposals and reports; policies and procedures; job packet including letters of application and resumes; website analysis; brochures; and individual and team presentations.

ENGL 303: Free-Lance Writing for Popular Magazines
(3-0) Cr. 3. S.
Prereq: ENGL 250, not open to freshmen
Practical workshop in writing nonfiction articles for popular magazines. Emphasis on writing, market research, preparation of manuscripts, methods of submission. Major goal of the course is production of marketable material.

ENGL 304: Creative Writing: Fiction
(3-0) Cr. 3. F.S.
Prereq: ENGL 250, not open to freshmen
Progresses from practice in basic techniques of fiction writing to fully developed short stories. Emphasis on writing, analytical reading, workshop criticism, and individual conferences.

ENGL 305: Creative Writing: Nonfiction
(3-0) Cr. 3. F.S.
Prereq: ENGL 250, not open to freshmen
Workshop in writing imaginative essays, both critical and personal. Analytical reading, development of literary techniques. Individual and small group conferences.

ENGL 306: Creative Writing: Poetry
(3-0) Cr. 3. F.S.
Prereq: ENGL 250, not open to freshmen
Progresses from traditional to contemporary forms. Emphasis on writing, analytical reading, workshop criticism, and individual conferences.

ENGL 308: Write Like a Woman
(Cross-listed with W S). (3-0) Cr. 3. F.
Prereq: ENGL 250
Writing and reading interpretive fiction written by women. Emphasis on stories that embody a female literary life, gender-specific ways of creating characters and conflicts, analytical reading and writing, workshop criticism and shared commentaries. Includes multi-modal projects.

ENGL 309: Proposal and Report Writing
(3-0) Cr. 3. F.S.
Prereq: ENGL 250, junior classification
Rhetorical concepts and processes to individually and collaboratively develop proposals for business, governmental, nonprofit, or other organizations and to report on the work completed both orally and in writing. Emphasizes the structure and classification of proposal and report types, qualitative and quantitative research methods, audience analysis, document design, and data visualization.

ENGL 310: Rhetorical Analysis
(3-0) Cr. 3. F.S.
Prereq: ENGL 250
Fundamental principles of rhetorical criticism. Focus on selected theories for analyzing cultural texts, including essays, speeches, film, technical and scientific documents, and websites. Emphasis on identifying artifacts, formulating research questions, applying methodologies, and understanding and practicing critical analysis through discussion and in writing.

ENGL 312: Biological Communication
(3-0) Cr. 3. F.S.
Prereq: ENGL 250
Rhetorical concepts and processes to successfully communicate individually and collaboratively via written, oral, visual, and electronic modes in disciplines in and related to biological sciences. Emphasizes the strategies for analyzing and adapting to audiences in the biological sciences. Covers developing and designing documentation, presenting scientific data visually, and communicating results orally.

ENGL 313: Rhetorical Website Design
(3-0) Cr. 3.
Prereq: ENGL 250
Rhetorical principles of multimodal composing in hypertextual environments. Focus on writing according to web style guidelines, employing cascading stylesheets for layout and design, and using principles of information architecture to determine optimal site structure. Final project involves constructing interactive client site using latest web standards.

ENGL 314: Technical Communication
(3-0) Cr. 3. F.S.SS.
Prereq: ENGL 250, junior classification
Rhetorical concepts and processes to successfully communicate technical information individually and collaboratively via written, oral, visual, and electronic modes. Emphasizes the major strategies for analyzing expert and lay audiences and adapting information to those audiences. Covers developing and designing usable technical documentation, visualizing data, and presenting technical information orally.

ENGL 314H: Technical Communication: Honors
(3-0) Cr. 3. F.S.SS.
Prereq: ENGL 250, junior classification
Theories, principles, and processes of effective written, oral, visual, and electronic communication of technical information. Attention to major strategies for analyzing and adapting to audiences in various communication situations and composing technical discourse including organizing visual and verbal information. Extensive practice in many areas of technical communication, including instructions and procedures, proposals and reports, website analysis and design, and individual and team presentations.

ENGL 315: Creative Writing: Screenplays
(3-0) Cr. 3. F.
Prereq: ENGL 250, not open to freshmen
Stresses master scene technique of writing fully developed screenplays. Emphasis on movie techniques, writing, workshop criticism, analytical reading and viewing, and individual conferences.

ENGL 316: Creative Writing: Playwriting
(Cross-listed with THTRE). (3-0) Cr. 3. S.
Prereq: ENGL 250, not open to freshmen
Progresses from production of scenes to fully developed one-act plays. Emphasis on action, staging, writing, analytical reading, workshop criticism, and individual conferences.

ENGL 322: Language and Society
(Cross-listed with LING). Cr. 3. S.
Prereq: ENGL/LING 219
Introduction to variation in language use in society. Survey of factors affecting language use, including background characteristics of language users, location, and purpose of interaction in addition to institutional, state, and national language policies.

ENGL 324: Introduction to Teaching ESL Literacy
(Cross-listed with LING). Cr. 3. F.
Prereq: ENGL/LING 219
Introduction to the issues and methods involved in teaching literacy skills to English as a second language (ESL) learners. The nature of literacy and materials and methods for developing ESL literacy at the middle school, high school, and adult ages across multiple levels of competency.

ENGL 325: Teaching Methods for ESL Learners: Oral Communication Skills
(Cross-listed with LING). Cr. 3. S.
Prereq: ENGL/LING 219
Issues and methods in teaching oral communication skills (listening, speaking, pronunciation) to English as a second language (ESL) learners. The nature of oral language ability. Materials and Methods for developing oral communication skills at middle school, high school, and adult contexts.

ENGL 330: Science Fiction
(3-0) Cr. 3.
Prereq: ENGL 250
Study of science fiction from its origins in nineteenth-century to the present. May include study of specific types of science fiction, such as classic, cyberpunk, feminist, or apocalyptic narratives; and may include consideration of science fiction film and/or theory.

ENGL 332: Visual Communication of Quantitative Information
(Cross-listed with STAT). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 101, STAT 104, STAT 201 or STAT 226; ENGL 250
Communicating quantitative information using visual displays; visualizing data; interactive and dynamic data displays; evaluating current examples in the media; color, perception, and representation in graphs; interpreting data displays.

ENGL 335: Studies in Film
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250
Principles of film art and the traditional vocabulary of literature as applied to film. Influence of film on modes of thought and behavior.

ENGL 339: Literary Theory and Criticism
(3-0) Cr. 3.
Prereq: ENGL 260 and 3 additional credits in literature
Study of selected texts of literary criticism, with attention to the purposes and practices of criticism.

ENGL 340: Women's Literature
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: ENGL 250
Historical and thematic survey of literature by and about women. May include autobiographies, journals, letters, poetry, fiction, and drama.
Meets U.S. Diversity Requirement

ENGL 342: American Indian Women Writers
(Cross-listed with AM IN, W S). (3-0) Cr. 3.
Prereq: ENGL 250
Literature of American Indian women writers which examines their social, political, and cultural roles in the United States. Exploration of American Indian women's literary, philosophical, and artistic works aimed at recovering elements of identity, redescribing stereotypes, resisting colonization, and constructing femininity.
Meets U.S. Diversity Requirement

ENGL 344: U.S. Latino/a Literature
(Cross-listed with US LS). (3-0) Cr. 3. S.
Prereq: ENGL 250
An introduction to the literature of Mexican Americans, Puerto Ricans, Cuban Americans and other Latino/a sub-groups. Special emphasis on themes such as ethnic relations and comparisons with EuroAmerican literary traditions.
Meets U.S. Diversity Requirement

ENGL 345: Women and Literature: Selected Topics
(Cross-listed with W S). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250
Literature by women and/or dealing with the images of women, e.g., study of individual authors or related schools of authors; exploration of specific themes or genres in women's literature; analysis of recurrent images of women in literature.
Meets U.S. Diversity Requirement

ENGL 346: American Indian Literature
(Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ENGL 250
Survey of literature by Native Americans from pre-Columbian tales and songs to contemporary novels and poetry.
Meets U.S. Diversity Requirement

ENGL 347: Studies in African American Literature
(Cross-listed with AF AM). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250
Literature by African Americans, which may include study of individual authors, movements, themes, genres.
Meets U.S. Diversity Requirement

ENGL 349: Topics in Multicultural Literatures of the United States
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250
Literature by writers from U.S. multicultural groups. May include literature of several groups or focus upon one of the following: Asian Americans, African Americans, Latino/a Americans, American Indians.
Meets U.S. Diversity Requirement

ENGL 350: Rhetorical Traditions
(Cross-listed with CL ST, SP CM). (3-0) Cr. 3. S.
Prereq: ENGL 250
Ideas about the relationship between rhetoric and society in contemporary and historical contexts. An exploration of classical and contemporary rhetorical theories in relation to selected topics that may include politics, gender, race, ethics, education, science, or technology.

ENGL 352: Gay and Lesbian Literature
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: ENGL 250
Literary portrayals of gay and lesbian lives and relationships from many different genres. Attention to changing definitions and representations of sexual orientation and gender identity over time.
Meets U.S. Diversity Requirement

ENGL 353: World Literature: Western Foundations through Renaissance
(Cross-listed with CL ST). (3-0) Cr. 3. F.S.
Prereq: ENGL 250
Representative works from the drama, epics, poetry, and prose of the Ancient World through the late sixteenth century. May include Homer, Aeschylus, Sappho, Catullus, Dante, Marie de France, Boccaccio, Christine de Pizan, Cervantes, and others.
Meets International Perspectives Requirement.

ENGL 354: World Literature: Seventeenth Century to the Present
(3-0) Cr. 3. F.
Prereq: ENGL 250
Global literatures in their various cultural and aesthetic contexts. Representative works, oral and written literature, including poetry, fiction, nonfiction, and drama.
Meets International Perspectives Requirement.

ENGL 355: Literature and the Environment
(Cross-listed with ENV S). (3-0) Cr. 3.
Prereq: ENGL 250
Study of literary texts that address the following topics, among others: the relationship between people and natural/urban environments, ecocriticism, and the importance of place in the literary imagination.

ENGL 358: Myth and Fairytale
(3-0) Cr. 3.
Prereq: ENGL 250
Study of traditional fairytales, myths, and legends from diverse cultures.

ENGL 360: Studies in American Literature to 1800
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250; sophomore classification
Selected readings in American literature from its beginnings through the colonial period; may reflect themes, genres, or social and cultural contexts.

ENGL 362: Studies in 19th Century American Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250; sophomore classification
Selected readings in American literature of the 19th century; may reflect themes, genres, or social and cultural contexts.

ENGL 364: Studies in American Literature: 1900 to the Present
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250; sophomore classification
Selected readings in American literature since 1900; may reflect themes, genres, or social and cultural contexts.

ENGL 370: Shakespeare
(3-0) Cr. 3. F.S.
Prereq: ENGL 250
Reading and analysis of selected plays. Development of Shakespeare's dramatic art in its social and intellectual context.
Meets International Perspectives Requirement.

ENGL 373: Studies in British Literature: The Middle Ages
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250; sophomore classification
Selected readings in medieval literature from its beginnings through the fifteenth century; may reflect themes, genres, or social and cultural contexts.

ENGL 375: Studies in British Literature: The Restoration and 18th Century
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250; sophomore classification
Selected readings in British literature from 1660 to 1800; may reflect themes, genres, or social and cultural contexts.
Meets International Perspectives Requirement.

ENGL 376: Studies in British Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250; sophomore classification
Selected readings from British literature from the late eighteenth century to about 1900; may reflect themes, genres, or social and cultural contexts.
Meets International Perspectives Requirement.

ENGL 376A: Studies in British Literature: Romantic
(3-0) Cr. 3.
Prereq: ENGL 250; sophomore classification
Selected readings from British literature from the late eighteenth century to about 1900; may reflect themes, genres, or social and cultural contexts.
Meets International Perspectives Requirement.

ENGL 376B: Studies in British Literature: Victorian
(3-0) Cr. 3.
Prereq: ENGL 250; sophomore classification
Selected readings from British literature from the late eighteenth century to about 1900; may reflect themes, genres, or social and cultural contexts.
Meets International Perspectives Requirement.

ENGL 389: Postcolonial Literature
(3-0) Cr. 3.
Prereq: ENGL 250; sophomore classification
Historical, thematic and theoretical study of postcolonial literatures from one or more of the following areas: Africa, South Asia, the Caribbean, and the Middle East. Irish and immigrant British writers may also be included.
Meets International Perspectives Requirement.

ENGL 393: The History of Children's Literature
(3-0) Cr. 3. F.
Prereq: ENGL 250
Origin and development of English and American children's literature through the early twentieth century. Special emphasis on nature, structure, and enduring themes of fantasy literature.

ENGL 395: Study and Travel
Cr. arr. SS.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.
Meets International Perspectives Requirement.

ENGL 395A: Study and Travel: Literature
Cr. arr. SS.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.
Meets International Perspectives Requirement.

ENGL 395B: Study and Travel: Creative Writing
Cr. arr. SS.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.
Meets International Perspectives Requirement.

ENGL 395C: Study and Travel: Linguistics
Cr. arr. SS.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.
Meets International Perspectives Requirement.

ENGL 395D: Study and Travel: Rhetoric and Professional Communication
Cr. arr. SS.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.
Meets International Perspectives Requirement.

ENGL 395E: Study and Travel: Teacher Education
Cr. arr. SS.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.
Meets International Perspectives Requirement.

ENGL 396: Teaching the Reading of Young Adult Literature
(3-0) Cr. 3. F.S.
Prereq: ENGL 250
Critical study and evaluation of themes, genres, and cultures found in young adult literature. Strategies of effective reading; instructional strategies including discussion techniques and use of technology; matching texts to reader needs and proficiencies. Evaluation of fiction, nonfiction, and media-based materials for use in school programs. Lesson planning.

ENGL 397: Practice and Theory of Teaching Writing in the Secondary Schools
(3-0) Cr. 3. F.S.
Prereq: ENGL 219 or ENGL 220; application process initiated for admission to university teacher education program; concurrent enrollment in C I 280 (cr. 2); and background check initiated with state of Iowa Department of Criminal Investigation
Introduction to teaching secondary language arts. Current theories and practices in the teaching of writing to secondary school students. Theories of rhetoric, approaches to teaching, lesson design and planning. Evaluating writing. Professional portfolio preparation.

ENGL 404: Creative Writing Workshop: Fiction
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.
Prereq: ENGL 304
Individual projects in short fiction on a workshop and conference basis. Readings in short fiction. Discussion of elements of narrative such as plot, point of view, characterization, theme, setting.

ENGL 405: Creative Writing Workshop: Nonfiction
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.
Prereq: ENGL 305
Individual projects in memoir, immersion journalism, character studies, and/or the personal essay on a workshop and conference basis. Readings in creative nonfiction.

ENGL 406: Creative Writing Workshop--Poetry
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.
Prereq: ENGL 306
Individual projects in poetry on a workshop and conference basis. Readings in poetry. Discussion of poetic elements such as image, sound, internal structure, rhythm, tone, figurative language.

ENGL 411: Technology, Rhetoric, and Professional Communication
(3-0) Cr. 3.
Prereq: ENGL 310; ENGL 302, ENGL 309, ENGL 313, or ENGL 314; junior classification
Seminar course on the implication of technologies, especially computer technology, for the writing and reading of business, technical, and academic texts. Extensive reading, discussion, and writing on selected technology-related topics.

ENGL 415: Business and Technical Editing
(3-0) Cr. 3. S.
Prereq: ENGL 302, ENGL 309, or ENGL 314; junior classification
Editing concepts and processes for choosing the appropriate level of editing for the particular rhetorical situation. Covers using editorial tools such as copy-marking symbols, developing style sheets and guides, and managing document production. Emphasizes developing an editorial eye for verbal and visual details in order to achieve accuracy, consistency, correctness, and completeness.

ENGL 416: Visual Aspects of Business and Technical Communication
(3-0) Cr. 3. F.
Prereq: ENGL 302, ENGL 309, or ENGL 314; junior classification
Rhetorical strategies and perceptual principles for designing print and digital visual elements such as diagrams and graphs and integrating those visual elements into business and technical communications. Covers strategies for employing visual elements such as typeface, page and screen layout, and illustrations in order to make communications more usable.

ENGL 417: Student Teaching
Cr. arr. F.S.
Prereq: admission to teacher education, approval of coordinator the semester prior to student teaching
Full-time teaching in content licensure area: long term and unit planning, lesson planning, classroom teaching practice.

ENGL 417E: Student Teaching: English and Literature
(Cross-listed with C I). Cr. arr. F.S.
Prereq: ENGL 494, admission to teacher education, approval of coordinator the semester prior to student teaching
Full-time teaching in secondary English: long term and unit planning, lesson planning, classroom teaching practice in English language arts.

ENGL 418: Seminar in Argumentation
(3-0) Cr. 3. S.
Prereq: ENGL 310, junior classification
Advanced seminar in theory and analysis with extensive practice in various modes of argument.

ENGL 420: History of the English Language
(Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: ENGL 219 or LING 219, ENGL 220 or LING 220
Comparison of English to other languages by family background and by type. Analysis of representative Old, Middle, Early Modern and present-day English texts, including both literary works and non-literary documents.

ENGL 422: Women, Men, and the English Language
(Cross-listed with LING, W S). (3-0) Cr. 3. S.
Prereq: ENGL 219 or LING 219
The ways men and women differ in using language in varied settings and the ways in which language both creates and reflects gender divisions. Meets U.S. Diversity Requirement

ENGL 425: Second Language Learning and Teaching
(Cross-listed with LING). (3-0) Cr. 3. S.
Prereq: ENGL 219 or LING 219; junior classification
The process of second language learning and principles and techniques of teaching second languages. Learning and teaching in specific situations and for particular purposes. Current applications of technology in teaching and assessment.

ENGL 437: Grammatical Analysis
(Cross-listed with LING). (3-0) Cr. 3. F.
Prereq: ENGL 220 or LING 220; ENGL 219 or LING 219 or introductory course in linguistics; junior classification
Theories and methods for analysis of syntax and morphology.

ENGL 440: Seminar in British Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Completion of 9 credits of surveys; completion of or concurrent enrollment in ENGL 339; junior classification
Selected authors, movements, eras, or genres in British literature. Readings in criticism; required research paper.

ENGL 441: Seminar in American Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Completion of 9 credits of surveys; completion of or concurrent enrollment in ENGL 339; junior classification
Selected authors, movements, eras, or genres in American literature. Readings in criticism; required research paper.

ENGL 445: Seminar: Literature Crossing Boundaries
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Completion of 9 credits of surveys; completion of or concurrent enrollment in ENGL 339; junior classification
Intensive study of selected literature that bridges traditional genre, period, national, or disciplinary boundaries. Readings in criticism; required research paper.

ENGL 450: Seminar in Literary Genres
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Completion of 9 credits of surveys; completion of or concurrent enrollment in ENGL 339; junior classification
Intensive study of drama, film, fiction, poetry, or prose. Selected movements, eras, or national traditions. Readings in criticism; required research paper.

ENGL 460: Seminar in Gender and Ethnicity
(Cross-listed with W S). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Completion of 9 credits of surveys; completion of or concurrent enrollment in ENGL 339; junior classification
Selected readings of various authors, movements, eras, or genres. Readings in criticism; required research paper.

ENGL 477: Seminar in Technical Communication
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 302, ENGL 309, or ENGL 314
Intensive study of a selected topic that bridges theory and practice in technical communication. Required project that contributes to the understanding of an emerging issue in the profession.

ENGL 487: Internship in Business, Technical, and Professional Communication
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: 9 credits in ENGL 302, ENGL 309, ENGL 313, ENGL 314, ENGL 415 (preferred), ENGL 416, or ENGL 477; junior classification; and permission of coordinator
An opportunity to write, edit, and design business and technical documents in a professional setting. Projects might include reports, proposals, manuals, brochures, newsletters.

ENGL 490: Independent Study
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490A: Independent Study: Literature
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490B: Independent Study: Linguistics
(Cross-listed with LING). Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee or Linguistics Adviser
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490C: Independent Study: Rhetoric, Teaching of Composition
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490D: Independent Study: Criticism and Theory of Literature
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490E: Independent Study: Instructional Methods and Research
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490F: Independent Study: Creative Writing
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490G: Independent Study: Business/Technical Communication
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490H: Independent Study: Honors
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered or who desire to integrate a study of literature or language with special problems in major fields. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 492: Undergraduate Teaching Experience
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Teaching assistant experience.

ENGL 493: Advanced Creative Writing Workshop—Multi-Genre
Cr. 3. Repeatable, maximum of 6 credits. F.S.
Prereq: ENGL 304, ENGL 305, or ENGL 306 and junior standing
Advanced workshop of individual creative writing projects in short fiction, nonfiction, and poetry. Readings and discussion of published examples of short fiction, nonfiction, and poetry by authors of national and international note. Extensive discussion and written analysis of elements of craft across genres.

ENGL 494: Practice and Theory of Teaching Literature in the Secondary Schools
(Cross-listed with C I). (3-0) Cr. 3. F.S.
Prereq: ENGL 310, ENGL 397, 9 other credits in English beyond ENGL 250, PSYCH 333, admission to teacher education program
Portfolio review. Current theories and practices in the teaching of literature to secondary school students. Integrating literary study and writing. Preparation and selection of materials. Classroom presentation. Unit planning. (Taken concurrently with C I 280, Cr. 2, and Sp Ed 450).

ENGL 497: Capstone Assessment
Cr. 1. F.S.
Prereq: Junior status
Must be taken in conjunction with a 400-level English course.

Courses primarily for graduate students, open to qualified undergraduates:

ENGL 500: Teaching Multimodal Composition
(3-0) Cr. 3. F.
Prereq: Graduate classification; must be teaching Engl 150 or Engl 250 concurrently
Required of all new English Department teaching assistants teaching ISUComm Foundation Courses. Introduction to the teaching of ISUComm Foundation Courses. Foundational and relevant newer composition theory and pedagogical methods related to ISUComm Foundation Courses objectives and their classroom enactment, including development of assignments and supporting activities, and evaluation of student projects.

ENGL 501: Introduction to Research in Rhetoric, Composition, and Professional Communication
(3-0) Cr. 3.
Prereq: 6 graduate credits in English
Survey of the major rhetorical, qualitative, and quantitative methods used in research on communication and language in academic and nonacademic settings.

ENGL 503: Composition Theory
(3-0) Cr. 3.
Prereq: 6 graduate credits in English
In-depth consideration of the theory and practice of composition pedagogy. Opportunities for actual classroom application.

ENGL 504: Teaching Advanced Communication
(3-0) Cr. 3. F.
Prereq: Graduate classification
Teaching business and technical communication in university, community college, and industry settings. Emphasizes curriculum planning, materials development, assignment design, responding to student work, assessment of student work, and distance (online) teaching.

ENGL 505: User Experience Architecture and Testing for Advanced Communication
(3-0) Cr. 3.
Prereq: Graduate classification
Seminar course examining user experience (UX) interface design and development in technical communication. Focus is on the UX project cycle: creating userfaces, conducting user research, system testing, and implementing data-driven results.

ENGL 506: Professional Communication Theory
(3-0) Cr. 3.
Prereq: Admission to English Department graduate degree program
Introduction to professional communication as a discipline, with emphasis on theories of communication and discourse that inform professional communication research and on trends and developments in that research and the field.

ENGL 508: Writing for Academic Publication
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: 6 graduate credits
Hands-on practice in writing academic discourse for publication; rhetorical analyses of student-selected academic journals; discussion of current trends in academic writing; professional perspectives on the referee process and on journal editorial decision making. Focus on the writing of selected short pieces (opinion essays, standard reviews, conference-length papers) and of article-length manuscripts.

ENGL 510: Introduction to Computers in Applied Linguistics
(Cross-listed with LING). (3-0) Cr. 3. F.
Prereq: Graduate classification
Use of software and web applications for language teaching, linguistic analysis, and statistical analysis. Issues and problems in applied linguistics related to computer methods.

ENGL 511: Introduction to Linguistic Analysis
(Cross-listed with LING). (3-0) Cr. 3. F.
Prereq: Graduate classification
Principles and methods of linguistic analysis with emphasis on phonology, morphology, and syntax. Description of linguistic variation and current theoretical approaches to linguistics.

ENGL 512: Second Language Acquisition
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theory, methods, and results of second language acquisition research with emphasis on approaches relevant to second language teaching.

ENGL 513: Language Assessment Practicum
(Cross-listed with LING). (3-0) Cr. 3. F.S.SS.
Prereq: ENGL 519 or LING 519
Advanced practicum in language assessment.

ENGL 514: Sociolinguistics
(Cross-listed with LING). (3-0) Cr. 3. S.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theories and methods of examining language in its social setting. Analysis of individual characteristics (e.g., age, gender, ethnicity, social class, region), interactional factors (e.g., situation, topic, purpose) and national policies affecting language use.

ENGL 515: Statistical Natural Language Processing
(Cross-listed with HCI, LING). (3-0) Cr. 3.
Prereq: STAT 330 or equivalent, recommended ENGL 219 or LING 219, or ENGL 511 or LING 511
Introduction to computational techniques involving human language and speech in applications such as information retrieval and extraction, automatic text categorization, word prediction, intelligent Web searching, spelling and grammar checking, speech recognition and synthesis, statistical machine translation, n-grams, POS-tagging, word-sense disambiguation, on-line lexicons and thesauri, markup languages, corpus analysis, and Python programming language.

ENGL 516: Methods of Formal Linguistic Analysis
Cr. 3. Alt. S., offered even-numbered years.
Prereq: ENGL/LING 219 or equivalent.
Data and knowledge structures for formal representation of natural language and speech data. Designing and implementing algorithms for automating linguistic analysis tasks. Conceptual issues for natural language and speech processing programming.

ENGL 518: Teaching English as a Second Language Methods and Materials
(Cross-listed with LING). (3-0) Cr. 3. F.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Introduction to approaches, methods, techniques, materials, curricular design, and assessment for various levels of ESL instruction. Attention to issues related to the teaching of listening, speaking, reading, writing, vocabulary, pronunciation, and culture.

ENGL 519: Second Language Assessment
(Cross-listed with LING). (3-0) Cr. 3. S.
Prereq: ENGL 511 or LING 511
Principles of second language assessment including reliability, validity, authenticity and practicality. Constructing, scoring, interpreting, and evaluating second language tests for a variety of situations.

ENGL 520: Computational Analysis of English
(Cross-listed with HCI, LING). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 510 or LING 510, and ENGL 511 or LING 511
Concepts and practices for analysis of English by computer with emphasis on the applications of computational analysis to problems in applied linguistics such as corpus analysis and recognition of learner language in computer-assisted learning and language assessment.

ENGL 521: Teaching of Literature and the Literature Curriculum
(3-0) Cr. 3.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Examination of the roles of the literary work, reader, and teacher in literary study. Responses to literature. Place of literature in language arts. Study and development of curriculum materials for middle school, high school, and college levels of instruction.

ENGL 522: Literary Theory and Criticism
(3-0) Cr. 3.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Examination of the history, logic, and rhetoric of contemporary literary criticism and analysis.

ENGL 523: Introduction to Old English Language and Literature
(3-0) Cr. 3.
Prereq: Course in medieval literature or history or history of the English language recommended
Introductory study of Old English language and literature in prose and poetry, including extracts from Beowulf. Some attention to Anglo-Saxon culture.

ENGL 524: Literacy: Issues and Methods for Nonnative Speakers of English
(Cross-listed with LING). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theoretical and practical issues and techniques in the teaching of literacy in a variety of contexts, involving children and adults at basic skill levels and teens and adults in academic and vocational programs.

ENGL 525: Research and Teaching of Second Language Pronunciation
(Cross-listed with LING). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theoretical and practical issues and techniques in the teaching of second language pronunciation as it relates to other areas of language, especially listening and speaking skills. Topics will include segmental and suprasegmental features; intelligibility; pronunciation in language assessment; classroom, technology and individual instruction; and research issues. Topics will be relevant to those intending to teach or research in various contexts.

ENGL 526: Computer-Assisted Language Learning
(Cross-listed with LING). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ENGL 511 or LING 511 or equivalent
Theory, research, and practice in computer use for teaching nonnative speakers of English. Methods for planning and evaluating computer-based learning activities.

ENGL 527: Discourse Analysis
(Cross-listed with LING). (3-0) Cr. 3. S.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Methods and theoretical foundations for linguistic approaches to discourse analysis. Applications of discourse analysis to the study of texts in a variety of settings, including academic and research contexts.

ENGL 528: English for Specific Purposes
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Issues and techniques in analyzing, teaching, and assessing English for specific purposes. Topics include theories of specific purpose language use, analysis of learner needs in target language contexts, and corpus-informed syllabus and materials development for teaching and assessment.

ENGL 529: Content Management
(3-0) Cr. 3.
Prereq: ENGL 313
Strategies for developing and delivering multimodal content via digital media. Focus on the principles of database design, interface development, usability testing, and collaborative content management within professional communication settings.

ENGL 531: Topics in the Study of Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Intensive study of literary genres, periods, movements, or themes; e.g., Literature and Historicism, Narrating the Feminine, Allegory.

ENGL 532: American Literature to 1865
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Selected texts in American literature from Beginnings to the Civil War. Study may include Native American literature, the literature of European conquest, Colonial and Revolutionary periods, Early Republic, and Jacksonian Era, in critical and cultural contexts.

ENGL 533: British Literature to 1830
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Selected texts from the Medieval, Renaissance, Restoration, Eighteenth-Century, and/or Romantic periods, in critical and cultural contexts.

ENGL 534: American Literature 1865 to the Present
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Selected texts in American literature from the Civil War to the present. Study may include Realism, Naturalism, Modernism, and Postmodernism, with significant attention to race/ethnicity, gender, and identity, and to contemporary critical views. Range of authors and genres.

ENGL 535: British Literature 1830 to the Present
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Selected texts from the Victorian, Edwardian, Modernist, and/or Contemporary periods, in critical and cultural contexts.

ENGL 537: Corpus Approaches to Grammatical Analysis
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: ENGL 220 or LING 220; ENGL 219, LING 219, ENGL 511, LING 511, or introductory course in linguistics; graduate classification
Corpus-informed analysis of syntax in authentic writing and speech, with emphasis on approaches used in applied linguistics.

ENGL 538: Fiction
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Selected fiction writers in English; range of authors and genres. Emphasis on both male and female writers; attention to the relationships between fiction and cultural change.

ENGL 539: Poetry
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Selected poets writing in English, considered in representative groups.

ENGL 540: Drama
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Primary texts in dramatic genres from various literary periods, in critical and cultural contexts. Frequently concentrates on the English Renaissance and the Shakespearean stage.

ENGL 541: Autobiography, Biography, Memoir
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Study of lifewriting, e.g., autobiography, biography, memoir, cross-genre writing, autobiographical criticism. Readings may be arranged by period, nationality, or subgenre (e.g., autobiography of childhood experience, celebrity auto/biography).

ENGL 542: Document Design and Editing
(3-0) Cr. 3.
Prereq: Senior classification
Overview of the principles of desktop publishing as practiced in the field of technical communication. Focus on theories of print document design and project management, as well as digital prepress techniques employed to produce documents using external print services. Requires extensive use of current desktop publishing software.

ENGL 543: The Study of Environmental Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification
Intensive study of environmental literary genres, periods, figures, movements, or themes: e.g., Ecofeminism, Imagining Natural Disaster, Material Ecocriticism, Environmental Justice, Posthumanism.

ENGL 545: Women's Literature
(Cross-listed with W S). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Primary texts by women writers; historical, thematic, formal, or theoretical approaches; secondary readings; e.g., Nineteenth-Century Women Writers; American Women's Personal Narratives; Southern Women Writers of the U.S.

ENGL 546: Issues in the Study of Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Intensive study of current and emerging topics and problems concerning literature and its relationship to theory and to language study; e.g., Theory of Metaphor; Renegotiating the Canon; Feminist Theory.

ENGL 547: The History of Rhetorical Theory I: From Plato to Bacon
(Cross-listed with SP CM). (3-0) Cr. 3.
Prereq: 6 credits in English
Rhetorical theory from the classical period of ancient Greece and Rome through the Middle Ages to the early Renaissance; attention to its relation to the nature of knowledge, communication, practice, and pedagogy.

ENGL 548: The History of Rhetorical Theory II: From Bacon to the Present
(Cross-listed with SP CM). (3-0) Cr. 3.
Prereq: 6 credits in English
Rhetorical theory from the early modern period (Bacon, Descartes, and Locke) to the present; attention to its relation to the nature of knowledge, communication practice, and pedagogy.

ENGL 549: Multimedia and Interaction Design
(3-0) Cr. 3.
Prereq: Senior classification
Rhetorical principles of interactive multimedia design, such as those in DVDs, Blu-Ray videos, and streaming web multimedia. Practical understanding of computer applications used in interactive multimedia development. Focus on theoretical and practical elements of producing multimedia training in both education and industry. Work with interactive hypertext, digital audio, and nonlinear video editing.

ENGL 550: Creative Writing: Craft and Professional Practice
(3-0) Cr. 3. F.
Prereq: Admission into MFA Program in Creative Writing and Environment
A multigenre craft course required of all incoming students in the MFA Program in Creative Writing and Environment. Students develop an understanding of craft and environmental writing across genres (poetry, fiction, nonfiction) as well as learn about editing and publication practice through the lens of a working literary journal, "Flyway: A Journal of Writing and Environment." Other course activities include presentations on the production practices of leading literary journals, individual editing projects, pragmatic tips for finding publication outlets for polished creative work, and a field trip to publishing houses.

ENGL 551: Master Workshop
(3-0) Cr. 3. F.
Prereq: Fifth-semester or equivalent standing in the Creative Writing and Environment MFA program
An advanced multigenre creative writing workshop. Students work intensively on book-length manuscripts of fiction, creative nonfiction, scriptwriting, or poetry.

ENGL 554: Workshop: Fiction
(3-0) Cr. 3. Repeatable, maximum of 12 credits.
Prereq: ENGL 550 and graduate classification. Open to graduate students outside MFA in Creative Writing and Environment with permission of instructor
Individual projects in fiction on a workshop and conference basis. Readings in short fiction. Discussion of elements of narrative such as plot, point of view, characterization, theme, setting.

ENGL 555: Workshop: Nonfiction
Cr. arr. Repeatable, maximum of 12 credits.
Prereq: ENGL 550 and graduate classification. Open to graduate students outside MFA in Creative Writing and Environment with permission of instructor
Individual projects in memoir, immersion journalism, character studies, and/or the personal essay on a workshop and conference basis. Readings in creative nonfiction.

ENGL 556: Workshop: Poetry
(3-0) Cr. 3. Repeatable, maximum of 12 credits.
Prereq: ENGL 550 and graduate classification. Open to graduate students outside MFA in Creative Writing and Environment with permission of instructor
Individual projects in poetry on a workshop and conference basis. Readings in poetry. Discussion of poetic elements such as image, sound, internal structure, rhythm, tone, figurative language.

ENGL 557: Studies in Creative Writing
(3-0) Cr. 3. Repeatable, maximum of 12 credits.
Prereq: Graduate classification. Open to graduate students outside MFA in Creative Writing and Environment with permission of instructor.
Special topics course on ideas, issues, and techniques in creative writing. Subject matter may include specific genres, aspects of the creative writing process, or themes of particular interest. Significant readings and written work required; previous workshop experience helpful.

ENGL 558: Teaching Creative Writing
(3-0) Cr. 3.
Prereq: Graduate classification
Pedagogical approaches that are effective for grade-school through adult-education creative writing teaching. Writing exercises, workshops, text evaluation, and visits from creative writers.

ENGL 559: Creative Writing Teaching Internship
Cr. 1-3. Repeatable.
Prereq: Permission of participating instructors
Students assist in an introductory creative writing class. Some supervised teaching but mainly evaluation of submissions and individual conferences. Requirements and grades determined by participating instructors.

ENGL 560: Environmental Field Experience
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 550 and graduate classification. Open to graduate students outside MFA in Creative Writing and Environment with permission of instructor
Students spend a term on a project that requires fieldwork. Projects might include working for a federal, state, or private non-profit environmental organization or farm, or living and working in a specified natural area.

ENGL 561: Methods for Scholarship in Literature and the Humanities
Cr. 3.
Prereq: Graduate classification or permission from the instructor
Intensive study of research methods and perspectives concerning the study of literature and the humanities at the master's level. Introduction to resources and techniques of research, the structure of academic articles, and strategies for argument in academic communication.

ENGL 586: Visual Rhetoric in Professional Communication
(3-0) Cr. 3.
Prereq: A course in professional communication
Rhetorical theory and research in graphics, document design, and related principles of visual communication. Methods of designing texts, data displays, illustrations, and other visual elements in business and technical communication.

ENGL 587: Internship in Business, Technical, and Professional Communication
(3-0) Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: ENGL 507 plus 3 additional graduate credits in business and technical writing or composition and rhetoric, permission of instructor. Limited to master's and doctoral degree candidates in the field of rhetoric and professional communication
An opportunity to write, edit, and design business and technical documents in a professional setting.

ENGL 588: Supervised Practice Teaching in Teaching English as a Second Language
(Cross-listed with LING). (1-5) Cr. 3. F.S.SS.
Prereq: 9 credits toward the TESL/TEFL Certificate, 15 credits toward the TESL/AL master's degree, or 18 credits completed toward the ESL Endorsement option.
Intensive observation of ESL instruction and supervised practice in teaching learners of English in a context appropriate to the student teacher's goals. ENGL 588 cannot be used for teacher licensure and cannot be taken during student teaching.

ENGL 589: Supervised Practicum in Literary Editing
(3-0) Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: ENGL 550 and permission of instructor
An opportunity to edit literary texts and gain experience in a literary publishing setting.

ENGL 590: Special Topics
(Cross-listed with LING). Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 590A: Special Topics: Literature
Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 590B: Special Topics: Teaching English as a Second Language (TESL)/Applied Linguistics
(Cross-listed with LING). Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 590C: Special Topics: Composition and Rhetoric
Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 590E: Special Topics: Rhetoric and Professional Communication
Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 590F: Special Topics: Creative Writing
Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 590G: Special Topics: Applied Linguistics and Technology
(Cross-listed with LING). Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 591: Directed Readings
Cr. arr. Repeatable.

ENGL 591A: Directed Readings: Literature
Cr. arr. Repeatable.

ENGL 591B: Directed Readings: Teaching English as a Second Language (TESL)/Applied Linguistics
(Cross-listed with LING). Cr. arr. Repeatable.

ENGL 591C: Directed Readings: Composition and Rhetoric
Cr. arr. Repeatable.

ENGL 591E: Directed Readings: Rhetoric and Professional Communication
Cr. arr. Repeatable.

ENGL 591F: Directed Readings: Creative Writing
Cr. arr. Repeatable.

ENGL 591G: Directed Readings: Applied Linguistics and Technology
(Cross-listed with LING). Cr. arr. Repeatable.

ENGL 592: Core Studies in Rhetoric, Composition, and Professional Communication
(Cross-listed with SP CM). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

ENGL 592A: Core Studies: Rhetoric
(Cross-listed with SP CM). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

ENGL 592B: Core Studies: Composition
(Cross-listed with SP CM). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

ENGL 592C: Core Studies: Professional Communication
(Cross-listed with SP CM). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

ENGL 595: Graduate Study and Travel
Cr. arr.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.

ENGL 595A: Graduate Study and Travel: Literature
Cr. arr.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.

ENGL 595B: Graduate Study and Travel: Creative Writing
Cr. arr.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.

ENGL 595C: Graduate Study and Travel: Linguistics
Cr. arr.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.

ENGL 595D: Graduate Study and Travel: Rhetoric and Professional Communication
Cr. arr.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.

ENGL 595E: Graduate Study and Travel: Teacher Education
Cr. arr.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.

ENGL 599: Creative Component
Cr. 3. F.S.SS.
Prereq: Graduate classification, permission of major professor

Courses for graduate students:

ENGL 602: Research Methods in Rhetoric, Composition, and Professional Communication
(3-0) Cr. 3. S.
Prereq: ENGL 501
A workshop for advanced graduate students in rhetoric and professional communication. Focus on rhetorical analysis, qualitative methods, or quantitative methods.

ENGL 602A: Research Methods in Rhetoric, Composition, and Professional Communication: Qualitative Research
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ENGL 501
A workshop for advanced graduate students in rhetoric and professional communication.

ENGL 602B: Research Methods in Rhetoric, Composition, and Professional Communication: Quantitative Research
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: ENGL 501
A workshop for advanced graduate students in rhetoric and professional communication.

ENGL 602C: Research Methods in Rhetoric, Composition, and Professional Communication: Rhetorical Analysis
(3-0) Cr. 3.
Prereq: ENGL 501
Extended practice in close textual analysis of various kinds of rhetorical artifacts. Attention to important theoretical concepts used in rhetorical analysis and to historical controversies over the scope and function of rhetorical analysis.

ENGL 603: Seminar in Composition Theory
(3-0) Cr. 3.
Prereq: ENGL 503
Exploration of relationships between theory and practice in current pedagogy. Intensive examination of contemporary theories of poststructuralism, new media, feminism, postcolonialism, or cultural studies and their impact on current pedagogical practice. Participation in pedagogical research and theory building.

ENGL 611: Seminar in Rhetorical Theory
(3-0) Cr. 3. Repeatable.
Prereq: ENGL 547 or ENGL 548
Rhetorical theory, criticism, and/or practice in relation to an historical period or a particular theoretical issue.

ENGL 623: Research Methods in Applied Linguistics
(Cross-listed with LING). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 511 or LING 511, ENGL 517 or LING 517, ENGL 519 or LING 519
Survey of research traditions in applied linguistics. Focus on theoretical and practical aspects of quantitative and qualitative approaches to applied linguistic study, including experimental and quasiexperimental methods, classroom observation and research, introspective methods, elicitation techniques, case studies, interactional analysis, ethnography, and program evaluation. Computational tools and resources for linguistic research will be highlighted.

ENGL 626: Computer-Assisted Language Testing
(Cross-listed with LING). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ENGL 510 or LING 510, ENGL 511 or LING 511, ENGL 519 or LING 519
Principles and practice for the use and study of computers and the Internet in second language assessment.

ENGL 630: Seminar in Applied Linguistics
(Cross-listed with LING). (3-0) Cr. 3. Repeatable.
Prereq: ENGL 510 or LING 510, ENGL 511 or LING 511
Topic changes each semester. Topics include advanced methods in natural language processing, technology and literacy in a global context, feedback in CALL programs, technology and pronunciation, and advances in language assessment.

ENGL 631: Administration and Organization of Multimodal Writing Programs
(3-0) Cr. 3.
Prereq: ENGL 500, ENGL 503, ENGL 504, or ENGL 603
Survey of the major components of writing instruction in academic and nonacademic settings. History, theory, organization, and evaluation of writing programs. Guided observation of writing program functions at various institutions and businesses.

ENGL 688: Practicum in Technology and Applied Linguistics
(Cross-listed with LING). (1-5) Cr. 3. F.S.SS.
Prereq: ENGL 510 or LING 510, ENGL 626 or LING 626, or equivalent; at least 2nd year PhD student in Applied Linguistics and Technology
Focus on integrating theoretical knowledge with practical expertise. Assess client needs; develop, integrate, and evaluate solutions. Practical understanding of computer applications used in multimedia development. Create web-based or CD-ROM-based multimedia materials. Work with advanced authoring applications.

ENGL 699: Research
Cr. arr. Repeatable. F.S.SS.
Prereq: Graduate classification, permission of major professor
Research.

Entomology (ENT)

Courses primarily for undergraduates:

ENT 201: Introduction to Insects
(1-0) Cr. 1. F.S.SS.
5 weeks. Classroom section spring only. World Wide Web section of course offered summer and fall semesters. Biological and ecological aspects of insects.

ENT 211: Insects and Society
(2-0) Cr. 2. F.S.
Prereq: ENT 201
11 weeks. Classroom section spring only. World Wide Web section offered fall semester. The importance of insects in human well-being. Insect-human interactions. Primarily for nonscience and nonagriculture majors.

ENT 283: Pesticide Application Certification
(Cross-listed with AGRON, FOR, HORT). (2-0) Cr. 2. S.
Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized.

ENT 370: Insect Biology
(2-3) Cr. 3. F.
Prereq: BIOL 101 or BIOL 211
Structure, physiology, evolution, behavior, life histories, and recognition of insects. Collection required.

ENT 371I: Introduction to Insect Ecology
(Cross-listed with IA LL). (3-3) Cr. 4. Alt. SS., offered odd-numbered years.
Field and laboratory study of insects, their diversity, life history; emphasis on ecology and behavior.

ENT 372: Livestock Entomology
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Classroom and off-campus videotape sections. 12 weeks. Recognition, biology, behavior, economic importance, and management of insects and other arthropods affecting livestock and poultry production.

ENT 374: Insects and Our Health
(Cross-listed with MICRO). (3-0) Cr. 3. S.
Prereq: 3 credits in biological sciences
Identification, biology, and significance of insects and arthropods that affect the health of humans and animals, particularly those that are vectors of disease.
Meets International Perspectives Requirement.

ENT 374L: Insects and Our Health Laboratory
(Cross-listed with MICRO). (0-3) Cr. 1. Alt. S., offered even-numbered years.
Prereq: Credit or enrollment in ENT 374
Laboratory and field techniques for studying medical or public health entomology, including: collection, identification and maintenance of medically significant arthropods and experimental design and execution related to the biology of arthropods or arthropod-pathogen interactions.

ENT 375: Plant Protection Using Natural Enemies
(Dual-listed with ENT 575). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: ENT 370 or ENT 376
Overview of the biology, ecology, and classification of insect pathogens, predators, and parasitoids. Discussion of the use of these organisms in plant protection, including an emphasis on genetic alteration of natural enemies.

ENT 376: Fundamentals of Entomology and Pest Management
(2-3) Cr. 3. S.
Prereq: BIOL 101 or BIOL 211
Introduction to entomology and insect-pest management, including life processes, ecology, economics, tactics of population suppression, and ecological backlash.

ENT 410: Insect-Virus Interactions: a Molecular Perspective
(Dual-listed with ENT 510). (Cross-listed with MICRO). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: Permission of an instructor.
Overview of insect-virus interactions including insect immunity to viruses, genetic enhancement of viral insecticides, transgenic mosquitoes, disruption of virus transmission, and the role of insect and virus genomics in combating viral disease of both human and agricultural importance.

ENT 425: Aquatic Insects
(Dual-listed with ENT 525). (Cross-listed with A ECL). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312 or equivalent
Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

ENT 450: Pesticides in the Environment
(Dual-listed with ENT 550). (2-0) Cr. 2. S.
Prereq: 9 credits of biological sciences
Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere.

ENT 452: Integrated Management of Diseases and Insect Pests of Turfgrasses
(Dual-listed with ENT 552). (Cross-listed with HORT, PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HORT 351
Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

ENT 466: Ecosystem Service Management
(Dual-listed with ENT 566). (Cross-listed with ENSCI, NREM). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

ENT 471: Insect Ecology
(Dual-listed with ENT 571). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 9 credits biological sciences
The contribution of insects to ecosystem function is staggering. This course will focus on insect population ecology, predator-prey interaction and chemical ecology. The role of insects in nutrient cycling, pollination and pest management will be discussed with case studies used to highlight the applied nature of insect ecology and its relationship to agriculture.

ENT 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 15 credits in biological sciences, junior or senior classification
A maximum of 9 credits of all (university-wide) 490 credits may be applied toward graduation.

ENT 490E: Independent Study: Research or work experience.
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 15 credits in biological sciences, junior or senior classification
A maximum of 9 of all (university-wide) 490 credits may be used toward graduation.

ENT 490U: Independent Study: Laboratory teaching experience
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 15 credits in biological sciences, junior or senior classification. For students registering to be undergraduate laboratory assistants.
A maximum of 9 of all (university-wide) 490 credits may be used toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

ENT 510: Insect-Virus Interactions: a Molecular Perspective
(Dual-listed with ENT 410). (Cross-listed with MICRO). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: Permission of an instructor.
Overview of insect-virus interactions including insect immunity to viruses, genetic enhancement of viral insecticides, transgenic mosquitoes, disruption of virus transmission, and the role of insect and virus genomics in combating viral disease of both human and agricultural importance.

ENT 511: Integrated Management of Tropical Crops
(Cross-listed with HORT, PL P). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PL P 408 or PL P 416 or ENT 370 or ENT 376 or HORT 221
Applications of Integrated Crop Management principles (including plant pathology, entomology, and horticulture) to tropical cropping systems. Familiarization with a variety of tropical agroecosystems and Costa Rican culture is followed by 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects.
Meets International Perspectives Requirement.

ENT 525: Aquatic Insects
(Dual-listed with ENT 425). (Cross-listed with A ECL). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312 or equivalent
Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

ENT 530: Ecologically Based Pest Management Strategies
(Cross-listed with AGRON, PL P, SUSAG). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes.

ENT 550: Pesticides in the Environment
(Dual-listed with ENT 450). (Cross-listed with TOX). (2-0) Cr. 2. S.
Prereq: 9 credits of biological sciences
Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere.

ENT 552: Integrated Management of Diseases and Insect Pests of Turfgrasses
(Dual-listed with ENT 452). (Cross-listed with HORT, PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HORT 351
Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

ENT 555: Insect Physiology
(3-3) Cr. 4. Alt. S., offered even-numbered years.
Prereq: ENT 370
Life processes of the insects, including reviews of current problems in insect physiology.

ENT 566: Ecosystem Service Management
(Dual-listed with ENT 466). (Cross-listed with ENSCI, NREM). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

ENT 568: Advanced Systematics
(Cross-listed with EEOB). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Principles and practice of systematic biology; taxonomy, nomenclature and classification of plants and animals; sources and interpretation of systematic data; speciation; fundamentals of phylogenetic systematics.

ENT 570: Plant-Insect Interaction
(2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: 9 credits in biological sciences
Physiological, behavioral, ecological, and evolutionary factors that govern interactions between insects and plants, applications of this knowledge to agriculture, and important results from the study of natural systems. Additional topics covered during the semester include: tritrophic interactions, biological control of plants by insects, and pollination biology. Student-led discussions and draws on both the primary and secondary literature.

ENT 571: Insect Ecology
(Dual-listed with ENT 471). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 9 credits biological sciences
The contribution of insects to ecosystem function is staggering. This course will focus on insect population ecology, predator-prey interaction and chemical ecology. The role of insects in nutrient cycling, pollination and pest management will be discussed with case studies used to highlight the applied nature of insect ecology and its relationship to agriculture.

ENT 574: Medical Entomology
(3-3) Cr. 4. Alt. S., offered even-numbered years.
Prereq: 9 credits in biological sciences
Identification, biology, and significance of insects and other arthropods that attack people and animals, particularly those that are vectors of disease.

ENT 575: Plant Protection Using Natural Enemies
(Dual-listed with ENT 375). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: ENT 370 or ENT 376
Overview of the biology, ecology, and classification of insect pathogens, predators, and parasitoids. Discussion of the use of these organisms in plant protection, including an emphasis on genetic alteration of natural enemies.

ENT 576: Systematic Entomology
(3-6) Cr. 5. Alt. F., offered even-numbered years.
Prereq: ENT 370
Classification, distribution, and natural history of insects, including fundamentals of phylogenetic systematics, biogeography, taxonomic procedures, and insect collection and curation.

ENT 578: Global Protozoology - Molecular Biology of Protozoa
(Dual-listed with ENT 478). (Cross-listed with V PTH). (2-1) Cr. 3. F.
Prereq: Permission of instructor
Analysis of cellular systems, molecules, and organelles of pathogenic protozoan parasites. Emphasis is placed on processes and systems that are unique to protozoa, are important to understanding vector-parasite-host biology/ecology, or are targets of disease prevention/treatment programs for international disease control.

ENT 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: 15 credits in biological sciences.

ENT 590A: Special Topics: Biological Control and Pathology.
Cr. 1-3. Repeatable.

ENT 590B: Special Topics: Chemical Ecology and Behavior.
Cr. 1-3. Repeatable.

ENT 590C: Special Topics: Ecology and Pest Management.
Cr. 1-3. Repeatable.

ENT 590D: Special Topics: Evolution and Systematics.
Cr. 1-3. Repeatable.

ENT 590E: Special Topics: Special Research Topics.
Cr. 1-3. Repeatable.

ENT 590F: Special Topics: Medical and Veterinary Entomology.
Cr. 1-3. Repeatable.

ENT 590G: Special Topics: Molecular Entomology.
Cr. 1-3. Repeatable. Alt. F., offered even-numbered years.
Prereq: 15 credits in biological sciences.

ENT 590H: Special Topics: Physiology and Biochemistry.
Cr. 1-3. Repeatable.

ENT 590I: Special Topics: Toxicology
Cr. 1-3. Repeatable.

ENT 590K: Special Topics: Teaching Experience.
Cr. 1-3. Repeatable.

ENT 590L: Special Topics: Extension Internship.
Cr. 1-3. Repeatable.

ENT 590M: Special Topics: Immature Insects.
Cr. 1-3. Repeatable.

ENT 590N: Special Topics: Population Genetics.
Cr. 1-3. Repeatable.

Courses for graduate students:

ENT 600: Seminar
Cr. 1. F.S.SS.
Presentation of research results.

ENT 675: Insecticide Toxicology
(Cross-listed with TOX). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENT 555 or TOX 501
Principles of insecticide toxicology; classification, mode of action, metabolism, and environmental effects of insecticides.

ENT 699: Research
Cr. arr. Repeatable.

Entrepreneurship (ENTSP)

Courses primarily for undergraduates:

ENTSP 480: Applied Entrepreneurship: Executing New Ventures and Projects
(3-0) Cr. 3.
Prereq: MGMT 310, MGMT 313
Experiential learning through student-identified project. Students identify, propose and execute an experiential learning project that will be completed during the semester. The course provides application oriented learning of entrepreneurship. The course project must include a significant experiential learning activity, such as launching a venture or business, writing a business plan, or completing an internship in an entrepreneurial setting. Requires a field project.

ENTSP 485: Trends and Theories of Entrepreneurship
(3-0) Cr. 3. F.S.SS.
Prereq: MGMT 310, MGMT 313
A broad examination of historical, literary, and business perspectives on entrepreneurship. The entrepreneurial process is studied by examining the role of individuals, new ventures, and established organizations in the discovery, evaluation, and exploitation of economic opportunities. Emphasis is placed on tracing the evolution of entrepreneurship theories over time, as well as analyzing current trends related to the study of entrepreneurship.

Environmental Science (ENSCI)

Courses primarily for undergraduates:

ENSCI 110: Orientation to Environmental Science
(1-0) Cr. 1. F.
Prereq: Freshman classification in EnSci
Overview of Environmental Science curriculum and discussion of professional opportunities. Offered on a satisfactory-fail basis only.

ENSCI 201: Introduction to Environmental Issues
(Cross-listed with BIOL, ENV S). (2-0) Cr. 2. F.
Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change.

ENSCI 202: Exploration of Environmental and Sustainability Issues
(1-0) Cr. 1. F.
Prereq: Credit or enrollment in ENSCI 201
Exploration of specific environmental and sustainability issues; designed to complement ENSCI 201. Offered on a satisfactory-fail basis only.

ENSCI 203: Exploration of Environmental Science
(1-0) Cr. 1. S.
Prereq: ENSCI 202.
Continued exploration of specific environmental science issues developed in ENSCI 202. Topics may vary in different years. Offered on a satisfactory-fail basis only.

ENSCI 250: Environmental Geography
(Cross-listed with ENV S). (3-0) Cr. 3. F.
The distribution, origins and functions of the earth's physical systems and the spatial relationship between human activity and the natural world.

ENSCI 251: Biological Processes in the Environment
(Cross-listed with BIOL). (3-0) Cr. 3. S.
Plant and microbial processes in environmental systems including their interactions with human activities.

ENSCI 301: Natural Resource Ecology and Soils
(Cross-listed with NREM). (3-3) Cr. 4. F.
Prereq: BIOL 211, BIOL 211L; FOR 201 or a second course in biology
Effects of environmental factors on ecosystem structure and function using forest, prairie and agricultural ecosystems as models. Special emphasis is given to soil-forming factors and the role of soil in nutrient and water cycling and ecosystem dynamics. Additional emphasis is given to human influences on natural ecosystems and the role of perennial plant communities in agricultural landscapes.

ENSCI 312: Ecology
(Cross-listed with A ECL, BIOL). (3-3) Cr. 4. F.SS.
Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L
Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats.

ENSCI 312I: Ecology
(Cross-listed with A ECL, IA LL). Cr. 4. SS.
An introduction to the principles of ecology at the population, community and ecosystem level. Field studies of local lakes, wetlands and prairies are used to examine factors controlling distributions, interactions, and roles of plants and animals in native ecosystems.

ENSCI 324: Energy and the Environment
(Cross-listed with ENV S, GEOL, MTEOR). (3-0) Cr. 3. S.
Renewable and non-renewable energy resources. Origin, occurrence, and extraction of fossil fuels. Nuclear, wind, geothermal, biomass, hydroelectric, and solar energy. Biofuels. Energy efficiency. Environmental effects of energy production and use, including air pollution, acid precipitation, coal ash, mountaintop removal mining, oil drilling, hydraulic fracturing, groundwater contamination, nuclear waste disposal, and global climate change. Carbon sequestration and geoengineering solutions for reducing atmospheric CO2 concentrations.

ENSCI 345: Natural Resource Photogrammetry and Geographic Information Systems
(Cross-listed with NREM). (2-3) Cr. 3. S.
Prereq: Junior classification
Measurement and interpretation of aerial photos in resource management. Introduction to Geographic Information Systems (GIS) using ArcGIS including digitizing, development and query of attribute tables, georeferencing, and use of multiple GIS layers in simple spatial analyses.

ENSCI 360: Environmental Soil Science
(Cross-listed with AGRON). (2-2) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or ENSCI 250 or GEOL 201
Application of soil science to contemporary environmental problems; comparison of the impacts that different management strategies have on short- and long-term environmental quality and land development. Emphasis on participatory learning activities.

ENSCI 370: GIS for Ecology and Environmental Science
(Cross-listed with BIOL). Cr. 1-6. Repeatable. F.S.
Prereq: Six credits in biological and /or physical sciences, and permission of instructor.
Introduction to geographic information systems (GIS) with emphasis on ecological and environmental applications. No prior GIS experience required. Guided, individualized study of topics based on student background and interest. For students with prior experience, topics and activities are selected to build upon any previous experience and minimize duplication to previous GIS coursework. Potential topics include: basic concepts of GIS, data structures, database management, spatial analysis, modeling and visualization of ecological and environmental data. Case studies in ecological and environmental applications using ArcGIS. Offered on a satisfactory-fail basis only.

ENSCI 381: Environmental Systems I: Introduction to Environmental Systems
(Dual-listed with ENSCI 581). (Cross-listed with BIOL, ENV S, MICRO). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENSCI 382: Environmental Systems II: Analysis of Environmental Systems
(Dual-listed with ENSCI 582). (Cross-listed with BIOL). (2-2) Cr. 3. S.
Prereq: ENSCI 381
Continuation of EnSci 381. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENSCI 384: Introduction to Ecosystems
(3-0) Cr. 3. S.
Prereq: 12 credits of natural science including biology and chemistry
Biological and physical processes affecting material and energy flows in natural and managed ecosystems. Understanding and predicting climate and management impacts on ecosystem services and sustainability.

ENSCI 390: Internship in Environmental Science
Cr. arr. Repeatable. F.S.SS.
Prereq: Approval of the Environmental Science coordinator
Supervised off-campus work experience in the field of environmental science. Offered on a satisfactory-fail basis only.

ENSCI 391: Apprenticeship
Cr. arr. Repeatable. F.S.SS.
Prereq: Approval of the Environmental Science Coordinator
Practical experience in an approved setting such as a research laboratory, government office, or private office. Offered on a satisfactory-fail basis only.

ENSCI 402: Watershed Hydrology
(Dual-listed with ENSCI 502). (Cross-listed with GEOL, MTEOR, NREM). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

ENSCI 402I: Watershed Hydrology and Surficial Processes
(Cross-listed with AGRON, IA LL). Cr. 4. SS.
Prereq: Four courses in physical or biological sciences or engineering
Effects of geomorphology, soils, and land use on transport of water and materials (nutrients, contaminates) in watersheds. Fieldwork will emphasize investigations of the Iowa Great Lakes watershed.

ENSCI 404: Global Change
(Dual-listed with ENSCI 504). (Cross-listed with AGRON, ENV S, MTEOR). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

ENSCI 405: Environmental Biophysics
(Dual-listed with ENSCI 505). (Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)
Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

ENSCI 406: World Climates
(Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. S.
Prereq: AGRON 206/MTEOR 206
Distribution and causes of different climates around the world. Effects of climate and climate variations on human activities including society, economy and agriculture. Current issues such as climate change and international efforts to assess and mitigate the consequences of a changing climate. Semester project and in-class presentation required. Meets International Perspectives Requirement.

ENSCI 407: Watershed Management
(Dual-listed with ENSCI 507). (Cross-listed with ENV S, NREM). (3-3) Cr. 4. S.
Prereq: A course in general biology
Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers.

ENSCI 408: GIS and Natural Resources Management
(Dual-listed with ENSCI 508). (Cross-listed with A B E). (2-2) Cr. 3. F.
Prereq: Working knowledge of computers and Windows environment
Introduction to fundamental concepts and applications of GIS in natural resources management with specific focus on watersheds. Topics include: basic GIS technology, data structures, database management, spatial analysis, and modeling; visualization and display of natural resource data. Case studies in watershed and natural resource management using ArcView GIS.

ENSCI 408I: Aquatic Ecology
(Dual-listed with ENSCI 508I ENSCI 408I). (Cross-listed with IA LL). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

ENSCI 409: Field Methods in Hydrogeology
(Dual-listed with ENSCI 509). (Cross-listed with GEOL). (0-4) Cr. 3. Alt. SS., offered even-numbered years.
Prereq: GEOL/ENSCI 402 or GEOL/ENSCI 411 or C E 473
Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects.

ENSCI 411: Hydrogeology
(Dual-listed with ENSCI 511). (Cross-listed with GEOL). (3-2) Cr. 4. F.
Prereq: Four courses in biological or physical sciences
Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations.

ENSCI 414: Applied Groundwater Flow Modeling
(Dual-listed with ENSCI 514). (Cross-listed with GEOL). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: GEOL 411 or C E 473; MATH 165 or MATH 181
Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course.

ENSCI 415: Paleoclimatology
(Dual-listed with ENSCI 515). (Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in biological or physical science
Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods, utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~1 million years).

ENSCI 416: Hydrologic Modeling and Analysis
(Dual-listed with ENSCI 516). (Cross-listed with GEOL, MTEOR). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in Earth science, meteorology, or engineering; junior standing.
Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

ENSCI 418: Stream Ecology
(Dual-listed with ENSCI 518). (Cross-listed with A ECL). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A ECL 486
Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

ENSCI 419: Aqueous and Environmental Geochemistry
(Dual-listed with ENSCI 519). (Cross-listed with GEOL). (2-2) Cr. 3. S.
Prereq: CHEM 178, CHEM 178L; junior classification
Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling.

ENSCI 420: Environmental Engineering Chemistry
(Dual-listed with ENSCI 520). (Cross-listed with C E). (2-3) Cr. 3. F.
Prereq: C E 326, CHEM 178
Principles of chemical and physical phenomena applicable to the treatment of water and wastewater and natural waters; including chemical equilbria, reaction kinetics, acid-base equilibria, chemical precipitation, redox reactions, and mass transfer principles. Individual laboratory practicals and group projects required.

ENSCI 422I: Prairie Ecology
(Cross-listed with IA LL). Cr. 4. SS.
Prereq: Familiarity with basic principles in biological sciences and ecology
Basic patterns and underlying physical and biotic causes of both regional and local distributions of plants and animals of North American prairies; field and laboratory analyses and projects.

ENSCI 424: Air Pollution
(Dual-listed with ENSCI 524). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 424A: Air Polution: Air quality and effects of pollutants
(Dual-listed with ENSCI 524A). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 424B: Air Pollution: Climate change and causes
(Dual-listed with ENSCI 524B). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 424C: Air Pollution: Transportation Air Quality
(Dual-listed with ENSCI 524C). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

ENSCI 424D: Air Pollution: Off-gas treatment technology
(Dual-listed with ENSCI 524D). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

ENSCI 424E: Air Pollution: Agricultural sources of pollution
(Dual-listed with ENSCI 524E). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 426: Stable Isotopes in the Environment
(Dual-listed with ENSCI 526). (Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Four courses in biological or physical science
Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance.

ENSCI 437: Watershed Modeling and Policy
(Dual-listed with ENSCI 537). (Cross-listed with A B E). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CE 372 or equivalent
A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools.

ENSCI 446: Integrating GPS and GIS for Natural Resource Management
(Dual-listed with ENSCI 546). (Cross-listed with NREM). (2-3) Cr. 3. F.
Prereq: 12 credits in student's major at 300 level or above, NREM 345 or equivalent experience with ArcGIS
Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation.

ENSCI 451: Applied and Environmental Geophysics
(Dual-listed with ENSCI 551). (Cross-listed with GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar.

ENSCI 452: GIS for Geoscientists
(Dual-listed with ENSCI 552). (Cross-listed with AGRON, GEOL). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

ENSCI 459: Environmental Soil and Water Chemistry
(Dual-listed with ENSCI 559). (Cross-listed with AGRON). (3-3) Cr. 4. F.
Prereq: Two semesters of college-level chemistry, MATH 140, AGRON 182 (or equivalent) or AGRON 360; GEOL 100 and AGRON 354 recommended
An introduction to the chemical properties of soils, chemical reactions and transformations in soils and surface waters, and their impact on the environment. Topics include solution chemistry in soils and surface waters, solid-phase composition of soils, reactions at the solid-solution interface, and applications to contemporary environmental issues.

ENSCI 461I: Introduction to GIS
(Cross-listed with ENV S, IA LL, L A). Cr. 4. SS.
Descriptive and predictive GIS modeling techniques, spatial statistics, and map algebra. Application of GIS modeling techniques to environmental planning and resource management.

ENSCI 463: Soil Formation and Landscape Relationships
(Dual-listed with ENSCI 563). (Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. Credit for one of AGRON 463 or AGRON 463I may be applied for graduation.

ENSCI 463I: Soil Formation and Landscape Relationships
(Dual-listed with ENSCI 563I). (Cross-listed with AGRON, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

ENSCI 464: Wetland Ecology
(Dual-listed with ENSCI 564). (Cross-listed with BIOL). (3-0) Cr. 3. S.
Prereq: 15 credits in biological sciences.
Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands.

ENSCI 466: Ecosystem Service Management
(Dual-listed with ENSCI 566). (Cross-listed with ENT, NREM). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

ENSCI 477: Soil Physics
(Dual-listed with ENSCI 577). (Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 182 or equivalent and MATH 166 recommended
The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

ENSCI 479: Surficial Processes
(Dual-listed with ENSCI 579). (Cross-listed with GEOL). (2-3) Cr. 3. F.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips.

ENSCI 480: Engineering Analysis of Biological Systems
(Cross-listed with A B E). (2-2) Cr. 3. F.
Prereq: A B E 380 or permission of the instructor
Systems-level quantitative analysis of biological systems, including applications in foods, feeds, biofuels, bioenergy, and other biological systems. Introduction to economic analysis and life-cycle assessment of these systems at multiple production scales. Applying these tools to evaluate and improve cost and sustainability performance of these biological systems.

ENSCI 484: Ecosystem Ecology
(Cross-listed with BIOL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Combined 12 credits in biology, chemistry, and physics.
Introduction of the study of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations for ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues.

ENSCI 485: Soil and Environmental Microbiology
(Dual-listed with ENSCI 585). (Cross-listed with AGRON, MICRO). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

ENSCI 486: Aquatic Ecology
(Dual-listed with ENSCI 586). (Cross-listed with A ECL, BIOL). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

ENSCI 486L: Aquatic Ecology Laboratory
(Dual-listed with ENSCI 586L). (Cross-listed with A ECL, BIOL). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

ENSCI 487: Microbial Ecology
(Dual-listed with ENSCI 587). (Cross-listed with BIOL, MICRO). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

ENSCI 488: GIS for Geoscientists II
(Dual-listed with ENSCI 588). (Cross-listed with AGRON, GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

ENSCI 490: Independent Study
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval of the Environmental Science coordinator

ENSCI 490H: Independent Study: Honors
Cr. arr. Repeatable. F.S.SS.
Permission of instructor and approval of Environmental Science coordinator.

ENSCI 495: Current Topics and Case Studies in Environmental Science
Cr. 1-3.
Prereq: Junior classification in Environmental Science, permission of instructor
Current topics and case studies related to the analysis and management of environmental systems. Individual and/or group projects.

ENSCI 496: Travel Course
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings. A. International Tour B. Domestic Tour.

ENSCI 496A: Travel Course: International Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

ENSCI 496B: Travel Course: Domestic Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

ENSCI 498: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of Environmental Science Coordinator
Required of all cooperative education students. Students must register prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

ENSCI 502: Watershed Hydrology
(Dual-listed with ENSCI 402). (Cross-listed with GEOL, MTEOR, NREM). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

ENSCI 504: Global Change
(Dual-listed with ENSCI 404). (Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

ENSCI 505: Environmental Biophysics
(Dual-listed with ENSCI 405). (Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)
Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

ENSCI 507: Watershed Management
(Dual-listed with ENSCI 407). (Cross-listed with NREM). (3-3) Cr. 4. S.
Prereq: A course in general biology
Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers.

ENSCI 508: GIS and Natural Resources Management
(Dual-listed with ENSCI 408). (Cross-listed with A B E). (2-2) Cr. 3. F.
Prereq: Working knowledge of computers and Windows environment
Introduction to fundamental concepts and applications of GIS in natural resources management with specific focus on watersheds. Topics include: basic GIS technology, data structures, database management, spatial analysis, and modeling; visualization and display of natural resource data. Case studies in watershed and natural resource management using ArcView GIS.

ENSCI 508I: Aquatic Ecology
(Cross-listed with IA LL, NREM). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

ENSCI 509: Field Methods in Hydrogeology
(Dual-listed with ENSCI 409). (Cross-listed with GEOL). (0-4) Cr. 3. Alt. SS., offered even-numbered years.
Prereq: GEOL/ENSCI 402 or GEOL/ENSCI 411 or C E 473
Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects.

ENSCI 511: Hydrogeology
(Dual-listed with ENSCI 411). (Cross-listed with GEOL). (3-2) Cr. 4. F.
Prereq: Four courses in biological or physical sciences
Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations.

ENSCI 514: Applied Groundwater Flow Modeling
(Dual-listed with ENSCI 414). (Cross-listed with GEOL). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: GEOL 411 or C E 473; MATH 165 or MATH 181
Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course.

ENSCI 515: Paleoclimatology
(Dual-listed with ENSCI 415). (Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in biological or physical science
Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods; utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~ 1 million years).

ENSCI 516: Hydrologic Modeling and Analysis
(Dual-listed with ENSCI 416). (Cross-listed with GEOL, MTEOR). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in earth science, meteorology, or engineering; junior standing
Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

ENSCI 518: Stream Ecology
(Dual-listed with ENSCI 418). (Cross-listed with A ECL). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A ECL 486
Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

ENSCI 519: Aqueous and Environmental Geochemistry
(Dual-listed with ENSCI 419). (Cross-listed with GEOL). (2-2) Cr. 3. S.
Prereq: CHEM 178, CHEM 178L; junior classification
Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling.

ENSCI 520: Environmental Engineering Chemistry
(Dual-listed with ENSCI 420). (Cross-listed with C E). (2-3) Cr. 3. F.
Prereq: C E 326, CHEM 178
Principles of chemical and physical phenomena applicable to the treatment of water and wastewater and natural waters; including chemical equilbria, reaction kinetics, acid-base equilibria, chemical precipitation, redox reactions, and mass transfer principles. Individual laboratory practicals and group projects required.

ENSCI 521: Environmental Biotechnology
(Cross-listed with C E). (2-2) Cr. 3. F.
Prereq: C E 326
Fundamentals of biochemical and microbial processes applied to environmental engineering processes, role of microorganisms in wastewater treatment and bioremediation, bioenergetics and kinetics, metabolism of xenobiotic compounds, waterborne pathogens and parasites, and disinfection. Term paper and oral presentation.

ENSCI 522: Water Pollution Control Processes
(Cross-listed with C E). (2-2) Cr. 3.
Prereq: C E 521
Fundamentals of biochemical processes, aerobic growth in a single CSTR, multiple events in complex systems, and techniques for evaluating kinetic parameters; unit processes of activated sludge system, attached growth systems, stabilization and aerated lagoon systems, biosolids digestion and disposal, nutrient removal, and anaerobic treatment systems.

ENSCI 523: Physical-Chemical Treatment Process
(Cross-listed with C E). (2-2) Cr. 3.
Prereq: C E 520
Material and energy balances. Principles and design of physical-chemical unit processes; including screening, coagulation, flocculation, chemical precipitation, sedimentation, filtration, lime softening and stabilization, oxidation, adsorption, membrane processes, ion exchange and disinfection; recovery of resources from residuals and sludges; laboratory exercises and demonstrations; case studies in mineral processing and secondary industries.

ENSCI 524: Air Pollution
(Dual-listed with ENSCI 424). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 524A: Air Polution: Air quality and effects of pollutants
(Dual-listed with ENSCI 424A). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 524B: Air Pollution: Climate change and causes
(Dual-listed with ENSCI 424B). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 524C: Air Pollution: Transportation Air Quality
(Dual-listed with ENSCI 424C). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

ENSCI 524D: Air Pollution: Off-gas treatment technology
(Dual-listed with ENSCI 424D). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

ENSCI 524E: Air Pollution: Agricultural sources of pollution
(Dual-listed with ENSCI 424E). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 526: Stable Isotopes in the Environment
(Dual-listed with ENSCI 426). (Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Four courses in biological or physical science
Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance.

ENSCI 528: Solid and Hazardous Waste Management
(Cross-listed with C E). (3-0) Cr. 3.
Prereq: C E 326 or background courses in both environmental chemistry and microbiology; junior or higher standing
Evaluation, characterization, assessment, planning and design of solid and hazardous waste management systems, regulatory requirements, material characterization and collection, minimization and recycling, energy and materials recovery, composting, off-gas treatment, incineration, stabilization, and landfill design. Design of treatment and disposal systems, including physical, chemical, and biological treatment, solidification, incineration, secure landfill design, and final disposal site closure plus restoration.

ENSCI 531: Design and Evaluation of Soil and Water Conservation Systems
(Cross-listed with A B E). (2-3) Cr. 3. F.
Prereq: E M 378 or CH E 356
Hydrology and hydraulics in agricultural and urbanizing watersheds. Design and evaluation of systems for the conservation and quality preservation of soil and water resources. Use and analysis of hydrologic data in engineering design; relationship of topography, soils, crops, climate, and cultural practices in conservation and quality preservation of soil and water for agriculture. Small watershed hydrology, water movement and utilization in the soil-plant-atmosphere system, agricultural water management, best management practices, and agricultural water quality. Graduate students will prepare several research literature reviews on topics covered in the class in addition to the other assignments.

ENSCI 532: Nonpoint Source Pollution and Control
(Cross-listed with A B E). (3-0) Cr. 3.
Prereq: A B E 431 or C E 372 or instructor permission
Characteristics and courses of non-point source (NPS) pollution in agricultural and urban watersheds, computer modeling and NPS pollution for terrestrial and aquatic systems, strategies to control and manage NPS pollution of water bodies, total maximum daily loads (TMDLs) and integrated watershed management. Graduate students are required to review research papers and develop/deliver lecture models on assigned topics.

ENSCI 533: Erosion and Sediment Transport
(Cross-listed with A B E, NREM). (2-3) Cr. 3. F.
Prereq: C E 372 or GEOL/ENSCI/MTEOR 402, MATH 166 or equivalent
Soil erosion processes, soil loss equations and their application to conservation planning, sediment properties, initiation of sediment motion and over land flow, flow in alluvial channels and theory of sediment transport, channel stability, reservoir sedimentation, wind erosion, BMPs for controlling erosion.

ENSCI 534: Contaminant Hydrogeology
(Cross-listed with GEOL). (3-0) Cr. 3. S.
Prereq: GEOL 511 or equivalent
Theory and practical considerations of fate and transport of solutes through porous geologic materials. Organic and inorganic contaminants in industrial and agricultural settings. Subsurface microbiology and biodegradation of aromatic and chlorinated hydrocarbons. Investigation of coupled processes (diffusion, advection, dispersion, sorption, and biodegradation) using computer models. Soil and groundwater monitoring and remediation strategies.

ENSCI 535: Restoration Ecology
(Cross-listed with EEOB, NREM). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 366 or BIOL 474 or graduate standing
Theory and practice of restoring animal and plant diversity, structure and function of disturbed ecosystems. Restored freshwater wetlands, forests, prairies and reintroduced species populations will be used as case studies.

ENSCI 535I: Restoration Ecology
(Cross-listed with A ECL, EEOB, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: A course in ecology
Ecological principles for the restoration of native ecosystems; establishment (site preparation, selection of seed mixes, planting techniques) and management (fire, mowing, weed control) of native vegetation; evaluation of restorations. Emphasis on the restoration of prairie and wetland vegetation.

ENSCI 536: Design and Evaluation of Soil and Water Monitoring Systems
(Cross-listed with A B E). (2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 431/A B E 531
Development of monitoring systems that support effective planning, performance evaluation, modeling, or environmental impact assessment of soil-, water-, and waste-management systems. Typical soil and water pollutants and physical, chemical, and biological characteristics that affect sample location and timing. Sample collection, documentation, chain-of-custody, and quality assurance procedures. In addition to other assignments, graduate students will prepare several research literature reviews on topics covered in the class and develop monitoring plans.

ENSCI 537: Watershed Modeling and Policy
(Dual-listed with ENSCI 437). (Cross-listed with A B E). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CE 372 or equivalent
A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools.

ENSCI 546: Integrating GPS and GIS for Natural Resource Management
(Dual-listed with ENSCI 446). (Cross-listed with NREM). (2-3) Cr. 3. F.
Prereq: 12 credits in student's major at 300 level or above, NREM 345 or equivalent experience with ArcGIS
Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation.

ENSCI 551: Applied and Environmental Geophysics
(Dual-listed with ENSCI 451). (Cross-listed with GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar.

ENSCI 552: GIS for Geoscientists
(Dual-listed with ENSCI 452). (Cross-listed with AGRON, GEOL). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

ENSCI 553: Soil-Plant Relationships
(Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 354
Composition and properties of soils in relation to the nutrition and growth of plants.

ENSCI 558: Laboratory Methods in Soil Chemistry
(Cross-listed with AGRON). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: AGRON 354 and CHEM 211
Experimental and descriptive inorganic and organic analyses. Operational theory and principles of applicable instruments, including spectrophotometry, atomic and molecular absorption and emission spectroscopy, mass spectrometry, X-ray diffraction and fluorescence, gas and ion chromatography, and ion-selective electrodes.

ENSCI 559: Environmental Soil and Water Chemistry
(Dual-listed with ENSCI 459). (Cross-listed with AGRON). (3-3) Cr. 4. F.
Prereq: Two semesters of college-level chemistry, MATH 140, AGRON 182 (or equivalent) or AGRON 360; GEOL 100 and AGRON 354 recommended
An introduction to the chemical properties of soils, chemical reactions and transformations in soils and surface waters, and their impact on the environment. Topics include solution chemistry in soils and surface waters, solid-phase composition of soils, reactions at the solid-solution interface, and applications to contemporary environmental issues.

ENSCI 563: Soil Formation and Landscape Relationships
(Dual-listed with ENSCI 463). (Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. Credit for one of AGRON 463 or AGRON 463I may be applied for graduation.

ENSCI 563I: Soil Formation and Landscape Relationships
(Dual-listed with ENSCI 463I). (Cross-listed with AGRON, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

ENSCI 564: Wetland Ecology
(Dual-listed with ENSCI 464). (Cross-listed with EEOB). (3-0) Cr. 3. S.
Prereq: 15 credits in biological sciences.
Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands.

ENSCI 564I: Wetland Ecology
(Cross-listed with EEOB, IA LL). Cr. 4. SS.
Prereq: Ia LL 312I
Ecology, classification, creation, restoration, and management of wetlands. Field studies will examine the composition, structure and functions of local natural wetlands and restored prairie pothole wetlands. Individual or group projects.

ENSCI 566: Ecosystem Service Management
(Dual-listed with ENSCI 466). (Cross-listed with ENT, NREM). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

ENSCI 571: Surface Water Hydrology
(Cross-listed with C E). (3-0) Cr. 3. S.
Prereq: C E 372
Analysis of hydrologic data including precipitation, infiltration, evapotranspiration, direct runoff and streamflow; theory and use of frequency analysis; theory of streamflow and reservoir routing; use of deterministic and statistical hydrologic models. Fundamentals of surface water quality modeling, point and non-point sources of contamination. Design project.

ENSCI 572: Analysis and Modeling Aquatic Environments
(Cross-listed with C E). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: C E 372
Principles of surface water flows and mixing. Introduction to hydrologic transport and water quality simulation in natural water systems. Advection, diffusion and dispersion, chemical and biologic kinetics, and water quality dynamics. Applications to temperature, dissolved oxygen, primary productivity, and other water quality problems in rivers, lakes and reservoirs. Deterministic vs. stochastic models.

ENSCI 573: Groundwater Hydrology
(3-0) Cr. 3. F.
Prereq: C E 372
Principles of groundwater flow, hydraulics of wells, superposition, slug and pumping tests, streamlines and flownets, and regional groundwater flow. Contaminant transport. Computer modeling. Design project. Extra assignments required for graduate students.

ENSCI 575: Soil Formation and Transformation
(Cross-listed with AGRON). (3-0) Cr. 3. F.
Prereq: AGRON 463 or equivalent
Advanced study of soil formation, emphasizing relationships among soils, landscapes, environment, humans, and land use.

ENSCI 577: Soil Physics
(Dual-listed with ENSCI 477). (Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 182 or equivalent and MATH 166 recommended
The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

ENSCI 578: Laboratory Methods in Soil Physics
(Cross-listed with AGRON). (0-3) Cr. 1. S.
Prereq: concurrent enrollment in AGRON 477 or AGRON 577
Methods of measuring soil physical properties such as texture, density, and water content, and transport of heat, water, and gases.

ENSCI 579: Surficial Processes
(Dual-listed with ENSCI 479). (Cross-listed with GEOL). (2-3) Cr. 3. F.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips.

ENSCI 581: Environmental Systems I: Introduction to Environmental Systems
(Dual-listed with ENSCI 381). (Cross-listed with EEOB). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENSCI 582: Environmental Systems II: Analysis of Environmental Systems
(Dual-listed with ENSCI 382). (Cross-listed with EEOB). (2-2) Cr. 3. S.
Prereq: ENSCI 381
Continuation of EnSci 381. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENSCI 584: Advanced Ecosystem Ecology
(Cross-listed with EEOB). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Combined 12 credits in biology, chemistry, and physics.
Advanced studies of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations and modern approaches to ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues.

ENSCI 585: Soil and Environmental Microbiology
(Dual-listed with ENSCI 485). (Cross-listed with AGRON, MICRO). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

ENSCI 586: Aquatic Ecology
(Dual-listed with ENSCI 486). (Cross-listed with A ECL, EEOB). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

ENSCI 586L: Aquatic Ecology Laboratory
(Dual-listed with ENSCI 486L). (Cross-listed with A ECL, EEOB). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

ENSCI 587: Microbial Ecology
(Dual-listed with ENSCI 487). (Cross-listed with EEOB, MICRO). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

ENSCI 588: GIS for Geoscientists II
(Dual-listed with ENSCI 488). (Cross-listed with AGRON, GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

ENSCI 590: Special Topics
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of major professor in Environmental Science faculty
Literature reviews and conference in accordance with needs and interest of the student.

ENSCI 599: Creative Component
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of major professor in Environmental Science faculty
Creative component for nonthesis master of science degree.

Courses for graduate students:

ENSCI 685: Advanced Soil Biochemistry
(Cross-listed with AGRON, MICRO). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: AGRON 585
Chemistry of soil organic matter and biochemical transformations brought about by microorganisms and enzymes in soils.

ENSCI 698: Seminar in Environmental Science
Cr. 1. Repeatable. S.
Reports and discussion of recent research and literature.

ENSCI 699: Research
Cr. arr. Repeatable. F.S.SS.

Environmental Studies (ENV S)

Courses primarily for undergraduates:

ENV S 101: Environmental Geology: Earth in Crisis
(Cross-listed with GEOL). (3-0) Cr. 3. F.S.
An introduction to geologic processes and the consequences of human activity from local to global scales. Discussion of human population growth, resource depletion, pollution and waste disposal, global warming and ozone depletion, desertification, and geologic hazards such as earthquakes, landslides, flooding, and volcanism.

ENV S 108: Introduction to Oceanography
(Cross-listed with GEOL). (3-0) Cr. 3. F.
Introduction to study of the oceans. Ocean exploration. Waves and currents. Shape, structure, and origin of the ocean basins. Sedimentary record of oceanic life. Composition of seawater and its significance for life. Ocean circulation and its influence on climate. Life of the oceans, including coral reefs. Use and misuse of ocean resources. Anthropogenic impacts on the oceanic environment.

ENV S 111: Geological Disasters
(Cross-listed with GEOL). (1-0) Cr. 1. F.S.SS.
Introduction to the catastrophic geologic processes that disrupt ecosystems and human activity. Includes a discussion on the role of plate tectonics, the hydrologic cycle, and humans as the driving forces behind selected case studies on volcanic eruptions, earthquakes, tsunamis, landslides, and floods. Summer - online only.

ENV S 120: Introduction to Renewable Resources
(Cross-listed with AGRON, NREM). (3-0) Cr. 3. F.S.
Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management.

ENV S 130: Natural Resources and Agriculture
(Cross-listed with NREM). (3-0) Cr. 3. S.
Survey of the ecology and management of fish, forest, and wildlife resources in areas of intensive agriculture, with emphasis on Iowa. Conservation and management practices for private agricultural lands. Designed for nonmajors.

ENV S 160: Water Resources of the World
(Cross-listed with AGRON, GEOL, MTEOR). (3-0) Cr. 3. S.
Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement.

ENV S 173: Environmental Biology
(Cross-listed with BIOL). (3-0) Cr. 3. F.S.
An introduction to the structure and function of natural systems at scales from the individual to the biosphere and the complex interactions between humans and their environment. Discussions of human population growth, biodiversity, sustainability, resource use, and pollution. Does not satisfy biology major requirements.

ENV S 201: Introduction to Environmental Issues
(Cross-listed with BIOL, ENSCI). (2-0) Cr. 2. F.
Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change.

ENV S 204: Biodiversity
(Cross-listed with BIOL). (4-0) Cr. 2. S.
Prereq: One course in life sciences
Survey of the major groups of organisms and biological systems. Definition, measurements, and patterns of distribution of organisms. Sources of information about biodiversity. Does not satisfy biology major requirements. Half semester course.

ENV S 220: Globalization and Sustainability
(Cross-listed with ANTHR, GLOBE, M E, MAT E, SOC, T SC). (3-0) Cr. 3. F.S.
An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.
Meets International Perspectives Requirement.

ENV S 250: Environmental Geography
(Cross-listed with ENSCI). (3-0) Cr. 3. F.
The distribution, origins and functions of the earth's physical systems and the spatial relationship between human activity and the natural world.

ENV S 270: Foundations in Natural Resource Policy and History
(Cross-listed with L A, NREM). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
The development of natural resource conservation philosophy and policy from the Colonial Era to the present. North American wildlife, forestry, and environmental policy; national parks and other protected lands; federal and state agencies. Relationship to cultural contexts, including urban reform and American planning movement. Discussion of common pool resources, public and private lands.

ENV S 293: Environmental Planning
(Cross-listed with C R P). (3-0) Cr. 3. F.S.
Comprehensive overview of the field of environmental relationships and the efforts being made to organize, control, and coordinate environmental, aesthetic, and cultural characteristics of land, air, and water.

ENV S 320: Ecofeminism
(Cross-listed with W S). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: W S 201 or 3 credits in Women's Studies at the 300 level or above
Women's relationships with the earth, non-human nature, and other humans. The course explores the connections between society's treatment of women and nature; origins of ecofeminism and how it relates to the science of ecology, conventional and sustainable agriculture as well as how ecofeminism relates to other branches of feminist philosophy. Evaluation and critique of modern science, technology, political systems and SOLUTIONS will be included.

ENV S 324: Energy and the Environment
(Cross-listed with ENSCI, GEOL, MTEOR). (3-0) Cr. 3. S.
Renewable and non-renewable energy resources. Origin, occurrence, and extraction of fossil fuels. Nuclear, wind, geothermal, biomass, hydroelectric, and solar energy. Biofuels. Energy efficiency. Environmental effects of energy production and use, including air pollution, acid precipitation, coal ash, mountaintop removal mining, oil drilling, hydraulic fracturing, groundwater contamination, nuclear waste disposal, and global climate change. Carbon sequestration and geoengineering solutions for reducing atmospheric CO2 concentrations.

ENV S 334: Environmental Ethics
(Cross-listed with PHIL). (3-0) Cr. 3. F.
Prereq: Three credits in philosophy or junior classification
Thorough study of some of the central moral issues arising in connection with human impact on the environment, e.g., human overpopulation, species extinction, forest and wilderness management, pollution. Several world views of the proper relationship between human beings and nature will be explored.

ENV S 342: World Food Issues: Past and Present
(Cross-listed with AGRON, FS HN, T SC). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

ENV S 342H: World Food Issues: Past and Present, Honors
(Cross-listed with AGRON, T SC). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

ENV S 345: Population and Society
(Cross-listed with SOC). (3-0) Cr. 3. F.
Prereq: SOC 134
Human population growth and structure; impact on food, environment, and resources; gender issues; trends of births, deaths, and migration; projecting future population; population policies and laws; comparison of the United States with other societies throughout the world.
Meets International Perspectives Requirement.

ENV S 355: Literature and the Environment
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 250
Study of literary texts that address the following topics, among others: the relationship between people and natural/urban environments, ecocriticism, and the importance of place in the literary imagination.

ENV S 380: Energy, Environmental and Resource Economics
(Cross-listed with ECON). (3-0) Cr. 3.
Prereq: ECON 101
Natural resource availability, use, conservation, and government policy, with emphasis on energy issues. Environmental quality and pollution control policies.

ENV S 381: Environmental Systems I: Introduction to Environmental Systems
(Cross-listed with BIOL, ENSCI, MICRO). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENV S 382: Environmental Sociology
(Cross-listed with SOC). (3-0) Cr. 3. F.S.
Prereq: Soc 134 or 3 credits of ENV S
Environment-society relations; social construction of nature and the environment; social and environmental impacts of resource extraction, production, and consumption; environmental inequality; environmental mobilization and movements; U.S. and international examples.

ENV S 383: Environmental Politics and Policies
(Cross-listed with POL S). (3-0) Cr. 3. F.
Prereq: sophomore classification
Major ideologies relation to conservation and ecology. Processes, participants, and institutions involved in state, national, and global environmental policymaking. Case studies of environmental controversies and proposals for policy reform.

ENV S 384: Religion and Ecology
(Cross-listed with RELIG). (3-0) Cr. 3.
Introduction to concepts of religion and ecology as they appear in different religious traditions, from both a historical and contemporary perspective. Special attention to religious response to contemporary environmental issues.
Meets International Perspectives Requirement.

ENV S 390: Internship in Environmental Studies
Cr. arr. Repeatable. F.S.SS.
Prereq: Approval of the Environmental Studies Coordinator
Practical experience with nature centers, government agencies, schools, private conservation groups, and other organizations. Offered on a satisfactory-fail basis only.

ENV S 404: Global Change
(Cross-listed with AGRON, ENSCI, MTEOR). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

ENV S 407: Watershed Management
(Cross-listed with ENSCI, NREM). (3-3) Cr. 4. S.
Prereq: A course in general biology
Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers.

ENV S 417: Urban and Peri-urban Watershed Assessment
(Cross-listed with L A). (2-3) Cr. 3. F.
Prereq: Junior classification and 6 credits of natural science
Assessment and reduction of impacts in urban and peri-urban watershed areas. Course prepares students to work with various analysis methods for vegetation, topography, stormwater and stream condition as well as work with data from other disciplines. Emphasis on communicating with the public. Introductory GIS and GPS technologies are utilized. Learning is largely field-based.

ENV S 424: Sustainable and Environmental Horticulture Systems
(Cross-listed with HORT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Inquiry into ethical issues and environmental consequences of horticultural cropping systems, production practices and managed landscapes. Emphasis on systems that are resource efficient, environmentally sound, socially acceptable, and profitable.

ENV S 442: The Policy and Politics of Coastal Areas
(Cross-listed with POL S). (3-0) Cr. 3. SS.
Exploration of political implications of coastal policy. Issues include: "Carrying capacity," zoning, regulation of human development activities, trade-offs between conservation and jobs, the quality of coastal lifestyle, ways in which citizens participate in policy for coastal areas.

ENV S 450: Issues in Sustainable Agriculture
(Cross-listed with AGRON). (3-0) Cr. 3. F.
Agricultural science as a human activity; contemporary agricultural issues from agroecological perspective. Comparative analysis of intended and actual consequences of development of industrial agricultural practices.

ENV S 460: Controversies in Natural Resource Management
(Cross-listed with NREM). (3-0) Cr. 3. F.S.
Prereq: NREM 120, and A ECL 312 or NREM 301, and Junior classification
Analysis of controversial natural resource issues using a case approach that considers uncertainty and adequacy of information and scientific understanding. Ecological, social, political, economic, and ethical implications of issues will be analyzed.

ENV S 461I: Introduction to GIS
(Cross-listed with ENSCI, IA LL, L A). Cr. 4. SS.
Descriptive and predictive GIS modeling techniques, spatial statistics, and map algebra. Application of GIS modeling techniques to environmental planning and resource management.

ENV S 471: Global Environmental History
(Cross-listed with HIST). (3-0) Cr. 3. F.
Prereq: Either one of HIST 201, 202, or 207; or 3 credits of Environmental Studies; and sophomore classification.
Survey of the interactions of human communities with their environments from the beginnings of human history to the present. Topics include the domestication of animals, the agricultural revolution, industrialization, urbanization, deforestation, hydraulic management, fossil fuel consumption, and climate change.

ENV S 472: U. S. Environmental History
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
Survey of the interactions of human communities with the North American environment. Focus on the period from presettlement to the present, with a particular concentration on natural resources, disease, settlement patterns, land use, and conservation policies.

ENV S 484: Sustainable Communities
(Cross-listed with C R P). (3-0) Cr. 3. S.
Prereq: Junior classification
The history and theory of sustainable community planning. Procedural and substantive dimensions. Case studies of communities engaged in sustainability planning. Use and development of indicators.

ENV S 490: Independent Study
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor and approval of Environmental Studies coordinator

ENV S 490H: Independent Study: Honors
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor and approval of Environmental Studies coordinator.

ENV S 491: Environmental Law and Planning
(Cross-listed with C R P, L A). (3-0) Cr. 3. S.
Prereq: 6 credits in natural sciences
Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs.

ENV S 496: Travel Course
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

ENV S 496A: International Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

ENV S 496B: Domestic Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

Event Management (EVENT)

Courses primarily for undergraduates:

EVENT 271: Introduction to Event Management
(3-0) Cr. 3. F.S.
Overview of the event management industries. Techniques and procedures required for producing successful and sustainable events.

EVENT 289: Contemporary Club Management
(Cross-listed with HSP M). (3-0) Cr. 3. F.S.
Prereq: HSP M 101
Organization and management of private clubs including city, country, and other recreational and social clubs. Field trip may be required.

EVENT 290: Independent Study
Cr. 1-2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Freshman or Sophomore Classification. Permission of instructor, adviser, and department chair.
Independent study on topics of special interest to the student, facilitated by approved faculty member. No more than 9 credits of EVENT 290 and EVENT 490 may be applied towards graduation requirements.

EVENT 320: Attractions and Amusement Park Administration
(Cross-listed with HSP M). (3-0) Cr. 3. S.
Prereq: HSP M 101 or permission of instructor
Examination of current issues in the attractions and amusement park industry. Emphasis will be placed on development and design along with the functional departments of modern amusement parks and themed attractions.

EVENT 333: Entertainment Venue Management
(3-0) Cr. 3. F.S.
Prereq: EVENT 271 or equivalent
Organization and management of various types of entertainment venues including clubs, theaters, auditoriums, and arenas.

EVENT 371: Conference and Meeting Planning
(3-0) Cr. 3. F.S.
Prereq: EVENT 271 and junior standing
Application of event management principles to conference and meeting planning. Providing a comprehensive introduction to the key elements of the global conference, convention and meetings focus on destination marketing and professional development.

EVENT 373: Wedding Planning and Management
(3-0) Cr. 3. F.S.
Prereq: EVENT 371 and Event Management major
Overview of wedding event industry. Focus on wedding planning processes and implementation, design, and business planning and development.

EVENT 393: Event Management Workshop
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: EVENT Junior or Senior Classification and Permission of Instructor
Intensive 2 to 8 week workshop exploration. Topics vary each time offered. Maximum of 6 Event 393 credits can be applied to graduation.

EVENT 471: Special Events Coordination
(3-0) Cr. 3. F.S.
Prereq: EVENT 371 and junior standing; permission of instructor.
Advanced application event management. Provide leadership and communicate direction for production of an event including developing event strategy, financial management, wayfinding, volunteer management, and marketing.

EVENT 490: Independent Study
Cr. arr. Repeatable.
Prereq: Sections B-D: Program approval; Section H: Full membership in Honors Program
Independent study.

EVENT 490B: Independent Study: Conferences
Cr. arr. Repeatable.
Prereq: Program approval
Independent study.

EVENT 490C: Independent Study: Special Events
Cr. arr. Repeatable.
Prereq: Program approval.
Independent study.

EVENT 490D: Independent Study: Event Management
Cr. arr. Repeatable.
Prereq: Sections B-D: Program approval; Section H: Full membership in Honors Program
Independent study.

Family Financial Planning (FFP)

Courses primarily for graduate students, open to qualified undergraduates:

FFP 520: Financial Theory and Research I
(3-0) Cr. 3. F.S.SS.
Theories of family functioning, macroeconomic theory related to family resource allocation decisions, the family as an economic unit, and the interaction of the economy and families. (on-line course offering via Distance Education).

FFP 525: Financial Theory and Research II
(3-0) Cr. 3. F.S.SS.
Microeconomic theory as it relates to family resource allocation decisions, theories of household behavior, the lifecycle hypothesis, behavioral economics, behavioral finance, theories of behavioral change, and psychological theories of family well-being. Focus on empirical research investigating household financial decision-making. (on-line course offering via Distance Education).

FFP 530: Fundamentals of Family Financial Planning
(3-0) Cr. 3. F.S.SS.
The nature and functioning of financial systems, including currencies, markets, monetary and fiscal policy, and supply/demand for land, labor, and capital. Focus is on the impact of global financial interdependence on individuals and families in the U.S. Current and emerging issues, as well as current research and theory relative to financial systems. (on-line course offering via Distance Education).

FFP 535: Financial Counseling

(3-0) Cr. 3. F.S.SS.

Theory and research regarding the interactive process between the client and the practitioner, including communication techniques, motivation and esteem building, the counseling environment, ethics, and methods of data intake, verification, and analysis. Other topics include legal issues, compensation, uses of technology to identify resources, information management, and current or emerging issues. (on-line course offering via Distance Education).

FFP 540: Estate Planning for Families

(3-0) Cr. 3. F.S.SS.

Fundamentals of the estate planning process, including estate settlement, estate and gift taxes, property ownership and transfer, and powers of appointment. Tools and techniques used in implementing an effective estate plan, ethical considerations used in providing estate planning services, and new and emerging issues in the field. Case studies provide experience in developing estate plans suitable for varied family forms. (on-line course offering via Distance Education).

FFP 541: Housing and Real Estate in Family Financial Planning

(Cross-listed with HD FS). (3-0) Cr. 3. Alt. SS., offered even-numbered years.

The role of housing and real estate in the family financial planning process, including taxation, mortgages, financial calculations, legal concerns, and ethical issues related to home ownership and real estate investments. Emphasis on emerging issues in the context of housing and real estate. (on-line course offering via Distance Education).

FFP 545: Retirement Planning, Employee Benefits, and the Family

(3-0) Cr. 3. F.S.SS.

Study of micro and macro considerations for retirement planning. Survey of various types of retirement plans, ethical considerations in providing retirement planning services, assessing and forecasting financial needs in retirement, and integration of retirement plans with government benefits.(on-line course offering via Distance Education).

FFP 550: Military Personal Financial Readiness

(3-0) Cr. 3. F.SS.

Overview of the topics relevant to the financial planning process that address the unique needs of military service members and their families. (on-line course offering via Distance Education).

FFP 555: Insurance Planning for Families

(3-0) Cr. 3. F.S.SS.

In-depth study of risk management concepts, tools, and strategies for individuals and families, including life insurance; property and casualty insurance; liability insurance; accident, disability, health, and long-term care insurance; and government-subsidized programs. Current and emerging issues and ethical considerations relative to risk management. Case studies provide experience in selecting insurance products suitable for individuals and family, study of investment options for clients including common stocks, fixed income securities, convertible securities, and related choices. Relationships between investment options and employee/employer benefit plan choices. Current and emerging issues and ethics are included. (on-line course offering via Distance Education).

FFP 565: Personal Income Taxation

(3-0) Cr. 3. F.S.SS.

In-depth information on income tax practices and procedures including tax regulations, tax return preparation, the tax audit processes, the appeals process, preparation for an administrative or judicial forum, and ethical considerations of taxation. New and emerging issues related to taxation. Family/individual case studies provide practice in applying and analyzing tax information and recommending appropriate tax strategies. (on-line course offering via Distance Education).

FFP 570: Professional Practices in Financial Planning

(3-0) Cr. 3. F.S.SS.

Challenges of managing financial planning practices including, but not limited to: business valuation, personnel, marketing, client services, ethics and technological applications. Relying both on a theoretical as well as an applied approach, students analyze case studies that provide relevant, practical exposure to practice management issues, with a strong emphasis on current research findings. (on-line course offering via Distance Education).

FFP 583: Investing for the Family's Future

(Cross-listed with HD FS). (3-0) Cr. 3. F.

Prereq: HD FS 483

Evaluation of investment markets for the household. Analysis of how families choose where to put their savings. Emphasis is on using the family's overall financial and economic goals to help inform investment choices. (on-line course offering via Distance Education).

FFP 591: Practicum

Cr. 3-6. F.S.SS.

Supervised experience in family financial planning.

FFP 595: Financial Planning - Case Studies
(3-0) Cr. 3. F.S.SS.
Prereq: FFP 530, FFP 540, FFP 545, FFP 555, FFP 565, FFP 583
Professional issues in financial planning, including ethical considerations, regulation and certification requirements, communication skills, and professional responsibility. Students are expected to utilize skills obtained in other courses and work experiences in the completion of personal finance case studies, the development of a targeted investment policy, and other related financial planning assignments. (on-line course offering via Distance Education).

Family and Consumer SciencesEducation and Studies (FCEDS)

Courses primarily for undergraduates:

FCEDS 206: Professional Roles in Family and Consumer Sciences
(1-1) Cr. 2. F.
Prereq: HD FS 103 or concurrent enrollment in HD FS 103
Influencing factors that have contributed to the development and mission of Family and Consumer Sciences. Program goals, objectives and professional ethics. Introduction to various roles in professional settings, e.g., community agencies, secondary schools, business and industry, and Cooperative Extension. Includes 12 hours of a practicum experience outside of the regular class schedule.

FCEDS 306: Educational Principles for Family and Consumer Sciences and Family Life Education
(3-2) Cr. 4. F.
Prereq: 15 credits in family and consumer sciences subject matter
Principles of teaching and learning applied to family and consumer sciences content, including incorporating reading and STEM strategies. Instructional methods appropriate for formal and non-formal educational settings. Specific strategies for diverse audiences. Includes 12 hour arranged practicum. May be used for family life certification.

FCEDS 413: Planning and Assessment for Family and Consumer Sciences and Family Life Education
(3-2) Cr. 4. S.
Prereq: FCEDS 306
Development of curriculum and assessment tools for family and consumer sciences programs for school settings. Accommodating exceptional learners. Includes 12 hours of Career and Technical Student Organization Competitive Event Assessment. May be used for family life certification.

FCEDS 417: Supervised Teaching in Family and Consumer Sciences
Cr. 3-8. Repeatable. F.S.
Prereq: FCEDS 413; 24 credits in family and consumer sciences subject matter; cumulative grade point of 2.50; full admission to teacher education
Supervised teaching experience in secondary schools. Examination of ways to implement actions that reflect a professional philosophy of family and consumer sciences for teaching middle and high school level students. Reservation required.

FCEDS 417A: Supervised Teaching in Family and Consumer Sciences: Vocational family and consumer sciences.
Cr. 3-8. Repeatable. F.S.
Prereq: FCEDS 413, 24 credits in family and consumer sciences subject matter, cumulative grade point of 2.50, full admission to teacher education
Supervised teaching experience in secondary schools. Examination of ways to implement actions that reflect a professional philosophy of family and consumer sciences for teaching middle and high school level students. Reservation required.

FCEDS 417B: Supervised Teaching in Family and Consumer Sciences: Family and consumer sciences.
Cr. 3-8. Repeatable. F.S.
Prereq: FCEDS 413, 24 credits in family and consumer sciences subject matter, cumulative grade point of 2.50, full admission to teacher education
Supervised teaching experience in secondary schools. Examination of ways to implement actions that reflect a professional philosophy of family and consumer sciences for teaching middle and high school level students. Reservation required.

FCEDS 418: Foundations of Career and Technical Education in Family and Consumer Sciences
(Dual-listed with FCEDS 518). (3-0) Cr. 3. S.
Prereq: 400 hours employment in a family and consumer sciences related field.
Philosophy of career and technical education. Historical development of family and consumer sciences. Planning and implementing programs in family and consumer sciences including FCCLA. Impact of selected legislation on family and consumer sciences programs. Techniques for cooperative education, school-to-work, and work-based education programs. May be used toward Multioccupations Endorsement.

FCEDS 480: Pre-Student Teaching Experience in Family and Consumer Sciences Education
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Admission to teacher education.
Laboratory experience in foods, textiles and human development in family and consumer sciences secondary programs. At least 2 hour blocks of time needed for field experience. Observation of family and consumer sciences laboratories in diverse classrooms. Planning, implementing, managing and assessing laboratory lessons in family and consumer sciences. Offered on a satisfactory-fail basis only.

FCEDS 480A: Pre-Student Teaching Experience in FCS Education: Practicum in FCS Labs (24 hours)
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Admission to teacher education
Laboratory experience in foods, textiles and human development in family and consumer sciences secondary programs. At least 2 hour blocks of time needed for field experience. Observation of family and consumer sciences laboratories in diverse classrooms. Planning, implementing, managing and assessing laboratory lessons in family and consumer sciences. Offered on a satisfactory-fail basis only.

FCEDS 480B: Pre-Student Teaching Experience in FCS Education: Practicum in Diverse Settings (24 hours)
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Admission to teacher education.
Laboratory experience in foods, textiles and human development in family and consumer sciences secondary programs. At least 2 hour blocks of time needed for field experience. Observation of family and consumer sciences laboratories in diverse classrooms. Planning, implementing, managing and assessing laboratory lessons in family and consumer sciences. Offered on a satisfactory-fail basis only.

FCEDS 490: Independent Study
Cr. arr. F.S.SS.

FCEDS 490G: Independent Study: General
Cr. arr. F.S.SS.

FCEDS 490H: Independent Study: Honors
Cr. arr. F.S.SS.

FCEDS 491: Supervised Experiences in a Professional Setting
Cr. 3-8. Repeatable. F.S.SS.
Prereq: HD FS 418B; 24 credits in family and consumer sciences; reservation required
Supervised professional experience in an approved setting such as Cooperative Extension, business, community, human service, or government agency. Offered on a satisfactory-fail basis only.

FCEDS 491A: Supervised Experiences in a Professional Setting: Communications
Cr. 3-8. Repeatable, maximum of 8 credits. F.S.SS.
Prereq: HD FS 418B; 24 credits in family and consumer sciences; reservation required
Supervised professional experience in an approved setting such as Cooperative Extension, business, community, human service, or government agency. Offered on a satisfactory-fail basis only.

FCEDS 491B: Supervised Experiences in a Professional Setting: Professional Studies
Cr. 3-8. Repeatable, maximum of 8 credits. F.S.SS.
Prereq: HD FS 418B; 24 credits in family and consumer sciences; reservation required
Supervised professional experience in an approved setting such as Cooperative Extension, business, community, human service, or government agency. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

FCEDS 500: Short Course: Current Family and Consumer Sciences Offerings
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 credits in family and consumer sciences or education

FCEDS 500F: Short Course: Career and Technical Education
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 credits in family and consumer sciences or education

FCEDS 500G: Short Course: General
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 credits in family and consumer sciences or education

FCEDS 500K: Short Course: Textile Selection and Apparel Construction Methods
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 credits in family and consumer sciences or education

FCEDS 507: Program Development and Assessment in Family and Consumer Sciences
(3-0) Cr. 3. S.
Prereq: Professional experience in family and consumer sciences or related area
Application of principles of program development and assessment to formal and non-formal educational settings, e.g., secondary school family and consumer sciences programs, training positions in business, Cooperative Extension, human services agencies. Planning and constructing test items and other assessments of school and non-school learning.

FCEDS 508: Models for Teaching Family and Consumer Sciences
(3-0) Cr. 3. F.Alt. SS., offered odd-numbered years.
Prereq: 6 credits in family and consumer sciences
Selecting and applying teaching strategies and instructional materials based on theories of learning and human development that reflect a professional philosophy of family and consumer sciences. Application to formal and non-formal educational settings with diverse audiences.

FCEDS 515: Assessment in Family and Consumer Sciences
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Introductory statistical and program development skills
Role of assessment in family and consumer sciences education programs. Planning and constructing test items and other assessments of school and nonschool learning.

FCEDS 518: Foundations of Career and Technical Education in Family and Consumer Sciences
(Dual-listed with FCEDS 418). (3-0) Cr. 3. S.
Prereq: 400 hours employment in a family and consumer sciences related field.
Philosophy of career and technical education. Historical development of family and consumer sciences. Planning and implementing programs in family and consumer sciences including FCCLA. Impact of selected legislation on family and consumer sciences programs. Techniques for cooperative education, school-to-work, and work-based education programs. May be used toward Multioccupations Endorsement.

Finance (FIN)

Courses primarily for undergraduates:

FIN 301: Principles of Finance
(3-0) Cr. 3. F.S.SS.
Prereq: ACCT 284, ECON 101, STAT 226
Introduction to financial management with emphasis on corporate financing and investment decision making, time value of money, asset valuation, capital budgeting decision methods, cash budgeting, and financial markets.

FIN 310: Corporate Finance
(3-0) Cr. 3. F.S.SS.
Prereq: FIN 301
Theory used in a firm's investment and financing decisions. Analysis of environment in which financial decisions are made; applications of analytical techniques to financial management problems.

FIN 320: Investments
(3-0) Cr. 3. F.S.SS.
Prereq: FIN 301
Introduction to securities and markets from the viewpoint of the individual investor. Emphasis on mechanics of trading, measurement of return and risk, behavior of security prices, valuation of stocks and bonds, mutual funds, portfolio selection techniques, and performance evaluation.

FIN 327: Fixed Income Securities
(3-0) Cr. 3.
Prereq: FIN 301
Valuation of fixed income securities, including pricing conventions, term structure of interest rates, default, duration, and hedging of interest rate risk with derivatives. Analysis of bond market sectors, including treasury, agency, corporate, sovereign, municipal, and residential mortgage bonds.

FIN 330: Financial Markets and Institutions
(3-0) Cr. 3. F.S.
Prereq: FIN 301
Introduction to the structure and operations of the United States financial system and its markets and institutions. Emphasis on developing an integrated understanding of markets and financial service providers including global linkages.

FIN 361: Personal Risk Management and Insurance
(3-0) Cr. 3. F.S.
Prereq: ECON 101
Risk concepts and the use of insurance by individuals and families. Emphasis on the insurance mechanism and methods of dealing with income, property, and liability risks.

FIN 371: Real Estate Principles
(3-0) Cr. 3. SS.
Prereq: ECON 101
Legal, economic, social and financial aspects of real estate, including property rights, contracts, mortgage instruments, tax factors, brokerage, valuation, risk and return analysis, financing techniques, and investments.

FIN 415: Business Financing Decisions
(3-0) Cr. 3.
Prereq: FIN 301
In depth study of the firm's external financing decision. Emphasis on the development of cash flow statements, projected financing needs and the selection of the appropriate financing instrument. Focus on case studies and application of developed techniques on actual field project.

FIN 424: Financial Futures and Options
(3-0) Cr. 3.
Prereq: FIN 320 and STAT 326
Advanced study of pricing and using derivatives - instruments deriving value from fundamental items such as commodities, currency exchange rates, market indices, equities and bonds. Addresses basic building blocks of derivatives (i.e., forwards, futures, options and swaps) and relevant current topics and issues.

FIN 425: Security Analysis and Portfolio Management
(3-0) Cr. 3. F.S.
Prereq: FIN 320, STAT 326 and permission of instructor
Advanced study of security analysis, security selection techniques and portfolio management. Emphasis on the applications of methods learned via the selection and evaluation of a portfolio of actual securities purchased in securities markets in the U.S. or abroad. Tracking and periodic reporting of the portfolio's performance relative to standard benchmarks is also required.

FIN 428: Advanced Fixed Income Analysis and Portfolio Management
(Dual-listed with FIN 528). (3-0) Cr. 3.
Prereq: FIN 327, FIN 320, STAT 326
Advanced analysis of fixed income markets and securities, including valuation and trading of treasury securities, corporate bonds, mortgage backed securities. Analysis of structured financial securities, including CDO, CMBS, and ABS. Analysis of active and passive investment strategies for managing fixed income portfolios. Students are required to manage a fixed income portfolio for an institutional investor. A top-down approach to portfolio management is assumed, with active bets taken on market direction, duration, yield curve, and credit spreads.

FIN 435: Venture Capital, Private Equity, and Mergers and Acquisitions
(3-0) Cr. 3. S.
Prereq: FIN 310, FIN 320, STAT 326
An advanced investments class that focuses on alternative investments. Topics include techniques for valuing public and private firms, venture capital finance, investment banking, private equity finance, leveraged buyouts, hedge funds, the structure and financing of mergers and acquisitions, and divestitures.

FIN 445: Bank Management Decisions
(3-0) Cr. 3. F.S.
Prereq: STAT 326; and FIN 330 or ECON 353
Analysis of operations of depository financial institutions from management viewpoint. Emphasis on evaluating performance, policy formation, asset and liability management, the role of capital, and the operating environment.

FIN 462: Corporate Risk Management and Insurance
(3-0) Cr. 3. F.
Prereq: FIN 301 and STAT 326
Analysis of an organization's approaches to the management of price, credit, and pure risk. Emphasis on the consideration and selection of risk control and financing treatments and the decision making framework underlying the alternatives selected. Covers commercial insurance, self-insurance, and alternative financing arrangements.

FIN 472: Real Estate Finance
(3-0) Cr. 3.
Prereq: FIN 301 and STAT 326
Introduction to the techniques of assessing the value of real estate and real estate financing instruments.

FIN 474: Real Estate Investment
(3-0) Cr. 3. F.S.
Prereq: FIN 301, FIN 371
Introduction to theories and methods of investment analysis applied to real estate. Studies cash flow analysis, alternative measures of investment performance, the impact of the financing decision on real estate investment risks and return, and various real estate financing techniques. Covers cases involving more complex financing and capital markets tools used in real estate.

FIN 480: International Finance
(3-0) Cr. 3. F.S.
Prereq: FIN 310, FIN 320 or FIN 330
Advanced study of currency market equilibrium, use and analysis of currency derivatives, hedging currency risk, and additional topics, which could include multinational capital budgeting, taxation, raising capital internationally, international portfolio diversification, international capital market equilibrium, political and country risk, financing international trade, multinational corporate treasury management, and current issues.

FIN 490: Independent Study
Cr. 1-3. Repeatable.
Prereq: FIN 301, STAT 326 and permission of instructor

FIN 499: Finance Internship
(3-0) Cr. 1-3. F.S.SS.
Prereq: GPA 2.5; permission of internship coordinator; STAT 326; FIN 499A: FIN 330; FIN 499B: FIN 361; FIN 499C: FIN 301 plus 3 additional credits in finance; FIN 499D: FIN 320; FIN 499E: FIN 310
Supervised experience in a private sector banking, insurance, real estate, investments or corporate organization or in a governmental agency that regulates such organizations. Offered on a satisfactory-fail basis only.

FIN 499A: Finance Internship:Banking
(3-0) Cr. 1-3. F.S.SS.
Prereq: GPA 2.5; permission of internship coordinator; STAT 326.
Supervised experience in a private sector banking, insurance, real estate, investments or corporate organization or in a governmental agency that regulates such organizations. Offered on a satisfactory-fail basis only.

FIN 499B: Insurance
(3-0) Cr. 1-3. F.S.SS.
Prereq: GPA 2.5; permission of internship coordinator; FIN 361 and STAT 326
Supervised experience in a private sector insurance organization or in a governmental agency that regulates such organizations. Offered on a satisfactory-fail basis only.

FIN 499C: Real Estate
(3-0) Cr. 1-3. F.S.SS.
Prereq: GPA 2.5; permission of internship coordinator; FIN 301 plus 3 additional credits in finance and STAT 326;
Supervised experience in a private sector real estate organization or in a governmental agency that regulates such organizations. Offered on a satisfactory-fail basis only.

FIN 499D: Investments
(3-0) Cr. 1-3. F.S.SS.
Prereq: GPA 2.5; permission of internship coordinator; FIN 320 and STAT 326
Supervised experience in a private sector investment organization or in a governmental agency that regulates such organizations. Offered on a satisfactory-fail basis only.

FIN 499E: Corporate
(3-0) Cr. 1-3. F.S.SS.
Prereq: GPA 2.5; permission of internship coordinator; FIN 310 and STAT 326
Supervised experience in a private sector corporate organization or in a governmental agency that regulates such organizations. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

FIN 501: Financial Valuation and Corporate Financial Decisions
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission.
Shareholder wealth maximization as the goal of the firm within a social responsibility context, financial Math, valuation of securities, the global financial market place as the test of value, estimation of cost of capital, global capital investment decisions, capital structure policy, working capital management.

FIN 510: Advanced Corporate Finance
(3-0) Cr. 3.
Prereq: FIN 501
Examines corporate financial decisions, including theory and associated empirical evidence. Topics include agency conflicts, corporate governance, executive compensation, becoming publicly traded, raising capital through public and private offerings, capital structure, financial distress and bankruptcy, leasing, dividend policy, corporate control, restructuring, and risk management.

FIN 515: Case Studies in Financial Decision Making
(3-0) Cr. 3.
Prereq: FIN 501
This course focuses on case studies to develop an integrated set of financial decisions. Topic areas include fixed asset, working capital, capital structure, dividend and merger/acquisition decisions. The objective of the course is to examine different firm settings and establish a framework within which to apply financial tools.

FIN 520: Investments
(3-0) Cr. 3.
Prereq: FIN 501
Analysis of risk and return for individual securities and portfolios of securities. Topics include the market environment, mechanics of trading, measurement of return and risk, valuation of stocks and bonds, mutual funds, optimal asset allocation, market efficiency, portfolio performance evaluation, and risk management.

FIN 528: Advanced Fixed Income Analysis and Portfolio Management
(Dual-listed with FIN 428). (3-0) Cr. 3.
Prereq: FIN 327, FIN 320, STAT 326
Advanced analysis of fixed income markets and securities, including valuation and trading of treasury securities, corporate bonds, mortgage backed securities. Analysis of structured financial securities, including CDO, CMBS, and ABS. Analysis of active and passive investment strategies for managing fixed income portfolios. Students are required to manage a fixed income portfolio for an institutional investor. A top-down approach to portfolio management is assumed, with active bets taken on market direction, duration, yield curve, and credit spreads.

FIN 530: Financial Analysis and Valuation
(3-0) Cr. 3.
Prereq: FIN 501
Valuation of public and private firms through analysis of financial statements and other information. Study of drivers of value creation, industry analysis, patterns of growth, models for forecasting and analyzing firm cash flows, estimating and adjusting cost of capital, alternative methods of cash flow valuation, the calculation and use of valuation multiples, and valuing mergers and acquisitions.

FIN 534: Financial Derivatives
(3-0) Cr. 3. F.
Prereq: Graduate classification
An applied course in derivative markets. Topics covered include futures and options markets, option pricing, swaps, use and rating of insurance products, and alternative forms of reinsurance. Emphasis will be placed on agricultural commodity markets, but energy, interest, currency and stock index contracts will also be covered.

FIN 535: Venture Capital, Private Equity, and Mergers and Acquisitions
(3-0) Cr. 3.
Prereq: FIN 501
Advanced investments class focusing on alternative investments. Topics include the nature and scope of investment banking, techniques for valuing public and private firms, venture capital finance, private equity finance, leveraged buyouts, hedge funds, the structure and financing of mergers and acquisitions, and divestitures.

FIN 550: Financial Econometrics
(3-0) Cr. 3.
Prereq: FIN 501, ECON 571
Analysis, modeling, and forecasting of time series data, volatility modeling and forecasting, maximum likelihood estimation, robust standard error computation, specification testing, estimation under alternative distributional assumptions, and Monte Carlo simulation. Applications include tests of asset pricing models, analysis of asset volatility, corporate event studies, and value at risk analysis.

FIN 564: Advanced Derivatives and Risk Management
(3-0) Cr. 3.
Prereq: FIN 501, FIN 534
Risk management tools and how they are applied within financial institutions and the corporate enterprise. Focus on measuring exposure to stock market risk, interest rate risk, currency risk, and credit risk and how these exposures may be managed. Topics include bank risk management regulations, volatility modeling, value at risk analysis, extreme value theory, credit default swaps, and portfolio simulation.

FIN 572: Real Estate Finance
(3-0) Cr. 3.
Prereq: MBA Core
Survey of techniques for assessing the value of real estate assets. Introduction to real estate financing instruments, their use and appropriateness.

FIN 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
For students wishing to do individual research in a particular area of finance.

Food Science and Human Nutrition (FS HN)

Courses primarily for undergraduates:

FS HN 101: Food and the Consumer
(3-0) Cr. 3. F.S.
Prereq: High school biology and chemistry or 3 credits each of biology and chemistry
The food system from point of harvest to the consumption of the food by the consumer. Properties of food constituents. Protection of food against deterioration and microbial contamination. Introduction of foods into the marketplace. Processes for making various foods. Government regulations. Use of food additives. Current and controversial topics. Electronic communication from web emphasized for class reports, notes and assignments.

FS HN 102: Nutrition for Sport Performance
(1-0) Cr. 1. F.S.
Analysis of how the body uses nutrients for energy and how to select a balanced diet to meet specific athletic performance needs. Lecture and activities specific to students' interest.

FS HN 104: Introduction to Professional Skills in Culinary Science
(0-6) Cr. 1. S.
Introduction to culinary science. Students will develop fundamental culinary skills by arranged on-campus work experience (100 hours). Sessions with instructor arranged.

FS HN 110: Professional and Educational Preparation
(1-0) Cr. 1. F.S.
Introduction to professional and educational development within the food science and human nutrition disciplines. Focus is on university and career acclimation as well as enhancement of communication skills. Offered on a satisfactory-fail basis only.

FS HN 111: Fundamentals of Food Preparation
(2-0) Cr. 2. F.S.
Prereq: FS HN 101 or FS HN 167; high school chemistry or CHEM 160; concurrent enrollment in FSHN 115.
Principles involved in preparation of food products of standard quality. Influence of composition and techniques on properties of food products.

FS HN 115: Food Preparation Laboratory
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in FS HN 111 or FS HN 214
Practice standard methods of food preparation with emphasis on quality, nutrient retention, and safety.

FS HN 120: The Biochemistry of Beer
(Cross-listed with BBMB). (2-0) Cr. 2. F.
An introduction to the major classes of biomolecules, basic biochemical concepts, enzymology, metabolism and genetic engineering as they apply to the production and flavor of beer. All aspects of the biochemistry of beer will be covered, including the malting of barley, starch conversion, yeast fermentation and the chemical changes that occur during the aging of beer. Intended for non-majors. Natural science majors are limited to elective credit only.

FS HN 167: Introduction to Human Nutrition
(3-0) Cr. 3. F.S.SS.
Prereq: High school biology or 3 credits of biology
Understanding and implementing present day knowledge of nutrition. The role of nutrition in the health and well being of the individual and family.

FS HN 203: Contemporary Issues in Food Science and Human Nutrition
(1-0) Cr. 1. F.S.
Introduction to published research and discussion of current issues in food science and human nutrition. Emphasis on sources of credible information, ethics, and communication.

FS HN 214: Scientific Study of Food
(3-0) Cr. 3. F.S.
Prereq: FS HN 167 or FS HN 265; CHEM 231 or CHEM 331; plus concurrent enrollment in FS HN 115 or 215
Composition and structure of foods. Principles of preparation of standard quality food products. Behavior and interactions of food constituents.

FS HN 215: Advanced Food Preparation Laboratory
(0-6) Cr. 2. F.S.
Prereq: Credit or enrollment in FS HN 214
Practice standard methods of food preparation with emphasis on quality, nutrient retention, and safety. Development of culinary skills and advanced food preparation.

FS HN 242: The US Food System
(3-0) Cr. 3. S.
Exploration of the components of our food system including food production, food processing, and food access and the social, political and ethical influences on these components. Controversial topics related to how food is produced, processed, marketed and consumed will be discussed.

FS HN 264: Fundamentals of Nutritional Biochemistry and Metabolism
(3-0) Cr. 3. F.
Prereq: FS HN 167; CHEM 163, CHEM 163L; BIOL 211
Digestion, absorption, metabolism, and biochemical functions of nutrients. Biochemical aspects of nutrient deficiencies.

FS HN 265: Nutrition for Active and Healthy Lifestyles
(3-0) Cr. 3. S.
Prereq: FS HN 167, plus credit or enrollment in BBMB 301 or credit in FS HN 264
Fundamentals of nutrient metabolism and nutrient requirements. Role of macronutrient metabolism in physical performance and disease prevention. Effect of manipulation of macronutrient metabolism on physical performance and disease prevention. Applications of nutrient metabolism principles to dietary recommendations and planning.

FS HN 276: Understanding Grape and Wine Science
(Cross-listed with HORT). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: High school biology and chemistry.
A scientific introduction to viticulture (grape-growing) and enology (wine-making). Topics include grape species and varieties, viticulture practices, fruit quality, geography, history, principles of fermentation and aging, wine classification, appreciation, evaluation, storage and service, regulations, wine as food. No wine tasting.

FS HN 308: Dairy Products: Current Issues and Controversies
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Course will address milk chemistry, microbiology, handling, processing, regulations, organic production, and nutrition; dispel myths about dairy foods; improve critical thinking and communication skills. Students will participate in structured controversies and debate.

FS HN 311: Food Chemistry
(3-0) Cr. 3. F.
Prereq: CHEM 231 and CHEM 231L or CHEM 331 and CHEM 331L; credit or enrollment in BBMB 301
The structure, properties, and chemistry of food constituents and animal and plant commodities.

FS HN 311L: Food Chemistry Laboratory
(0-3) Cr. 1. F.
Prereq: Credit or concurrent enrollment in FSHN 311.
The laboratory practices of structure, properties, and chemistry of food constituents.

FS HN 314: Foundations of Culinary Science
(1-0) Cr. 1. S.
Prereq: FSHN 104 or concurrent enrollment in FSHN 104.
Introduction to the roles culinary scientists hold within industry including product development, research, and quality assurance. Discussions focused on professional and educational development, enhancement of communication skills, ethics and emerging issues and trends in culinary science.

FS HN 340: Foundations of Dietetic Practice
(1-0) Cr. 1. F.
Prereq: DIET or PDEX classification
Introduction to the profession of dietetics and responsibilities associated with dietetic professional practice. Emphasis on exploring career options in dietetics and preparation for a dietetic internship. Leadership and professional career development for the dietitian is addressed through self reflection, creation of materials for post-baccalaureate programs and job shadowing experience. Professional issues related to dietetic practice include Code of Ethics, legal credentialing and standards of professional practice, leadership and future trends in the profession. Offered on a satisfactory-fail basis only.

FS HN 342: World Food Issues: Past and Present
(Cross-listed with AGRON, ENV S, T SC). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

FS HN 351: Introduction to Food Engineering Concepts
(3-0) Cr. 3. S.
Prereq: A course in calculus and physics (PHYS 111 or PHYS 115)
Methodology for solving problems in food processing and introduction to food engineering concepts including food properties, material and energy balances, sources of energy, thermodynamics, fluid flow, heat transfer, and mass transfer.

FS HN 360: Advanced Human Nutrition and Metabolism
(3-0) Cr. 3. F.
Prereq: FS HN 265, 3 credits in biochemistry; 3 credits in physiology recommended
Physiological and biochemical basis for nutrient needs; assessment of nutrient deficiency and toxicity; examination of nutrient functions and regulation of metabolism; nutrient-gene interactions.

FS HN 361: Nutrition and Health Assessment
(1-3) Cr. 2. S.
Prereq: FS HN 265; 3 credits in statistics; 3 credits in physiology recommended
The assessment of nutritional status in healthy individuals. Laboratory experiences in food composition and assessment of dietary intake, body composition, and biochemical indices of nutritional status.

FS HN 362: Nutrition in Growth and Development
(3-0) Cr. 3. S.
Prereq: FS HN 360; credit or enrollment in a course in physiology
Nutrient needs throughout the life cycle. Interrelationships of genes, gene expression and nutrients with physiological outcomes during human development and aging.

FS HN 364: Nutrition and Prevention of Chronic Disease
(3-0) Cr. 3. F.
Prereq: BIOL 256, BIOL 256L or BIOL 306
Overview of nutrients, their functions, metabolism, food sources and optimal choices for the promotion of health and wellness. Nutrition strategies for the prevention of chronic disease, including cancer, diabetes and obesity, as they apply to individuals or the wider population will be discussed.

FS HN 365: Obesity and Weight Management
(3-0) Cr. 3. S.
Prereq: BIOL 256 and BIOL 256L, or BIOL 306
Multifactorial aspects of obesity, maintenance of healthy weight, and the relationship of weight status and chronic disease prevention. Traditional and novel nutrition and exercise theories as well as current popular diet and exercise trends will be discussed.

FS HN 366: Communicating Nutrition Messages
(3-0) Cr. 3. S.
Prereq: FS HN 264 or FS HN 265
Theory and application of adult learning and behavior change as it relates to the role of nutrition in health promotion and disease prevention. Discussion of nutrition education and interventions relative to various models. Factors to consider in developing the nutrition education/intervention practicum experience. Focus on communication strategies for providing nutrition messages to diverse community audiences using various forms of media and outreach (print, radio, TV, newspaper, consumer publications, websites, community venues). Development of nutrition messages using various forms of media for a target population.

FS HN 367: Medical Terminology for Health Professionals
(1-0) Cr. 1. F.S.SS.
An independent course focused on medical terminology, abbreviations, and simple clinical mathematical calculations. (offered online only).

FS HN 403: Food Laws and Regulations
(2-0) Cr. 2. S.SS.
Prereq: 3 credits in food science coursework at 200 level or above
History of food law in the US and the world. Relationship between policy, legislation and regulation. Introduction to primary US regulatory agencies and enforcement principles. Discussion of key laws related to food safety and nutrition. Overview of federal and independent research tools and sources of food law.

FS HN 405: Food Quality Assurance
(Dual-listed with FS HN 505). (2-3) Cr. 3.
Prereq: FS HN 214 or FS HN 311; STAT 101 or STAT 104
Basis of food quality control/assurance programs and establishment of decision-making processes using official (government and industry) instrumental, chemical, and sensory procedures. Statistical process and quality control procedures and their applications to various food systems. Development of hazard analysis procedures, specifications, grades, standards, and the procedures and processes which can affect the overall microbiological safety of the food. Successful completion of the course will result in certification in Preventive Controls for Human Food (FSMA).

FS HN 406: Sensory Evaluation of Food
(Dual-listed with FS HN 506). (2-3) Cr. 3. F.
Prereq: FS HN 214 or FS HN 311 or AN S 360; 3 credits in statistics
Sensory evaluation techniques used to evaluate the appearance, aroma, flavor, texture and acceptability of foods. Relationships between sensory and instrumental measurements of color and texture. Work independently and cooperatively (in a team) to identify sensory evaluation objectives, write hypotheses, design and conduct experiments, and analyze and interpret data.

FS HN 407: Microbiological Safety of Foods of Animal Origins
(Dual-listed with FS HN 507). (Cross-listed with MICRO). (3-0) Cr. 3. S.
Prereq: MICRO 420
Examination of the various factors in the production of foods of animal origin, from animal production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. The two modules of this course will be 1) the procedures and processes which can affect the overall microbiological safety of the food, and 2) the Hazard Analysis Critical Control Point (HACCP) system.

FS HN 408: Dairy Products Evaluation
(0-3) Cr. 1. S.
Prereq: Permission of instructor
Gain experience in identifying quality defects in dairy products including milk, cottage cheese, cheddar cheese, strawberry yogurt, butter, and vanilla ice cream. Intensive training for the National Collegiate Dairy Products Evaluation competition and for dairy product evaluation in the food industry.

FS HN 410: Food Analysis
(2-3) Cr. 3. F.
Prereq: FS HN 214 or FS HN 311 or CHEM 211
An introduction to the theory and application of chemical and instrumental methods for determining the constituents of food. Use of standard procedures for food analysis and food composition data bases.

FS HN 411: Food Ingredient Interactions and Formulations
(1-3) Cr. 2. F.S.
Prereq: FSHN 214 or FS HN 311 and FS HN 115, FS HN 215 or FS HN 311L.
Application of food science principles to ingredient substitutions in food products. Laboratory procedures for standard formulations and instrumental evaluation, with emphasis on problem-solving and critical thinking.

FS HN 412: Food Product Development
(Dual-listed with FS HN 512). (1-6) Cr. 3. F.S.
Prereq: FS HN 311 or FS HN 411
Principles of developing consumer packaged food products. Application of skills gained in food chemistry, formulation, microbiology, and processing. Some pilot plant experiences. Electronic communication from web emphasized for class reports, notes and assignments.

FS HN 419: Foodborne Hazards
(Cross-listed with MICRO, TOX). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MICRO 201 or MICRO 302, a course in biochemistry
Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

FS HN 420: Food Microbiology
(Cross-listed with MICRO, TOX). (3-0) Cr. 3.
Prereq: MICRO 201 or MICRO 302
Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications.

FS HN 421: Food Microbiology Laboratory
(Cross-listed with MICRO). (0-6) Cr. 3.
Prereq: MICRO 201 or MICRO 302; MICRO 201L or MICRO 302L. Credit or enrollment in FS HN/MICRO 420
Standard techniques used for the microbiological examination of foods. Independent and group projects on student-generated questions in food microbiology. Emphasis on oral and written communication and group interaction.

FS HN 440: Bioprocessing and Bioproducts

(Dual-listed with FS HN 540). (Cross-listed with C E). (3-0) Cr. 3. F.

Prereq: C E 326 or equivalent, MATH 160 or MATH 165, CHEM 167 or higher, BIOL 173 or BIOL 211 or higher, senior or graduate classification

Sustainability, cleaner production. Taxonomy, kinetics, metabolism, microbial cultivation, aerobic and anaerobic fermentation. Antibiotics, food supplements, fermented foods, vitamin production. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis.

FS HN 442: Issues in Food and Society

(2-0) Cr. 2. F.

Prereq: FS HN 242, FS HN 342

In-depth discussion, synthesis, and analysis of domestic and international food issues including: food systems from farm to fork, poverty and world hunger, overnutrition, population, agriculture and the environment, ethics, biotechnology, and policy.

FS HN 460: Global Nutrition

(Dual-listed with NUTRS 560 FS HN 560). (3-0) Cr. 3.

Prereq: FS HN 361 or equivalent; senior or graduate standing

An overview of global nutrition issues, including the sociocultural, biological, economic, and environmental context of nutrition related topics. The etiology, epidemiology, and program/policy responses to issues will be presented. Areas to be covered include childhood malnutrition, growth stunting, micronutrient deficiencies, parasites and nutrition, sanitation, and obesity and chronic disease incidence in developing countries. Participatory course, students will engage in a series of class activities, discussions, and presentations.

FS HN 461: Medical Nutrition and Disease I

(4-0) Cr. 4. F.

Prereq: FS HN 360, FS HN 361, FS HN 367; plus BIOL 256 and 256L or BIOL 306 or BIOL 335

(Dual-listed with NutrS 561) Pathophysiology of selected chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state.

FS HN 463: Community Nutrition

(3-0) Cr. 3. F.

Prereq: FS HN 265 or FS HN 360; FS HN 366 recommended

Dual-listed with NutrS 563. Survey of current public health nutrition problems among nutritionally vulnerable individuals and groups. Discussion of the multidimensional nature of those problems and of community programs addressing them. Grant writing as a means for funding community nutrition program development. Significant emphasis on written and oral communication at the lay and professional level. Field trip.

Meets U.S. Diversity Requirement

FS HN 464: Medical Nutrition and Disease II

(3-0) Cr. 3. S.

Prereq: FS HN 360, FS HN 461; plus BIOL 256 and BIOL 256L or BIOL 306 or BIOL 335

(Dual-listed with NutrS 564) Pathophysiology of selected acute and chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state.

FS HN 466: Nutrition Counseling and Education Methods

(Dual-listed with FS HN 566). (2-2) Cr. 3. F.

Prereq: FS HN 361 and FS HN 362

Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories.

FS HN 467: Molecular Basis of Nutrition in Disease Prevention

(3-0) Cr. 3. S.

Prereq: FS HN 360 or equivalent

Understanding the molecular basis for the role of diet in the development and prevention of common diseases such as diabetes, cancer, and vascular diseases. Translating this understanding into practical approaches for improving the health of individuals and populations.

FS HN 471: Food Processing I

(2-3) Cr. 3. F.

Prereq: FS HN 351 or A E 451 or CH E 357; MICRO 201 or 302; CHEM 163 or 177.

Principles and applications of food processing by application of heat (blanching, pasteurization, canning, extrusion, evaporation and distillation, extrusion and dehydration) and by removal of heat (refrigeration and freezing). Emphasis on solving problems in laboratory and recitation sessions.

FS HN 472: Food Processing II
(2-3) Cr. 3. S.
Prereq: FS HN 351 or A E 451 or CH E 357.
Principles and applications of food processing by biological 9fermentation, enzymes) and nontraditional (high pressure, irradiation, pulsed electric field) preservation methods. Includes packaging, waste water treatment, and sanitation. Emphasis on solving problems in laboratory and recitation sessions.

FS HN 480: Professional Communication in Food Science and Human Nutrition
(1-0) Cr. 1. F.S.
Prereq: FS HN 203, senior classification in the department
Presentation of current topics using written and oral communication to a lay audience. Emphasis on communication skills for the profession.

FS HN 489: Issues in Food Safety
(Cross-listed with AN S, HSP M, VDPAM). (1-0) Cr. 1. S.
Prereq: Credit or enrollment in FS HN 101 or FS HN 272 or HSP M 233; FS HN 419 or FS HN 420; FS HN 403
Capstone seminar for the food safety minor. Case discussions and independent projects about safety issues in the food system from a multidisciplinary perspective.

FS HN 490: Independent Study
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490A: Independent Study: Dietetics
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490B: Independent Study: Food Science
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490C: Independent Study: Nutrition
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490D: Independent Study: International Experience
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490E: Independent Study: Entrepreneurship
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490H: Independent Study: Honors
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 491: Supervised Work Experience
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 491A: Supervised Work Experience: Dietetics
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 491B: Supervised Work Experience: Food Science
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 491C: Supervised Work Experience: Nutrition
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 491D: Supervised Work Experience: Culinary Science
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 492: Research Concepts in Human Nutrition
(1-3) Cr. 2. F.
Prereq: senior classification or permission of instructor; FS HN 360
Students will develop and implement research projects with faculty supervision, based on knowledge gained from nutrition, biology and chemistry courses. Students will prepare a research proposal, conduct research and report results. Students will gain appreciation for independent research and experience creative and innovative aspects of nutrition research.

FS HN 493: Food Preparation Workshop
(1-3) Cr. 1-3.
Selected topics in food preparation including scientific principles, culture and culinary techniques. Variable format may include laboratory, recitation, and lecture. Offered on a satisfactory-fail basis only.

FS HN 495: Practicum
(1-3) Cr. 2. F.S.
Prereq: Senior classification in Nutritional Science-Nutrition and Wellness option or permission of instructor; FS HN 366; credit or enrollment in FS HN 463.
Students will develop, implement and assess a community-based project that engages groups in learning and practicing concepts related to nutrition and wellness. Assessed service learning component.

FS HN 496: Food Science and Human Nutrition Travel Course
(Dual-listed with FS HN 596). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled and 1 credit for pre-departure class, if offered.) Limited enrollment. Tour and study of food industry, culinary science, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

FS HN 496A: Food Science and Human Nutrition Travel Course: International travel
(Dual-listed with FS HN 596A). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.
Meets International Perspectives Requirement.

FS HN 496B: Food Science and Human Nutrition Travel Course: Domestic travel
(Dual-listed with FS HN 596B). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

FS HN 498: Cooperative Education
Cr. R. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Permission of department chair.
Required for students completing professional work periods in a cooperative education program. Students must register prior to commencing each work period. Offered on a satisfactory-fail basis only.

FS HN 499: Undergraduate Research
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of staff member with whom student proposes to work
Research under staff guidance. A maximum of 6 credits of FS HN 499 may be used toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

FS HN 505: Food Quality Assurance
(Dual-listed with FS HN 405). (2-3) Cr. 3.
Prereq: FS HN 214 or FS HN 311; STAT 101 or STAT 104
Basis of food quality control/assurance programs and establishment of decision-making processes using official (government and industry) instrumental, chemical, and sensory procedures. Statistical process and quality control procedures and their applications to various food systems. Development of hazard analysis procedures, specifications, grades, standards, and the procedures and processes which can affect the overall microbiological safety of the food. Successful completion of the course will result in certification in Preventive Controls for Human Food (FSMA).

FS HN 506: Sensory Evaluation of Food
(Dual-listed with FS HN 406). (2-3) Cr. 3. F.
Prereq: FS HN 214 or FS HN 311 or AN S 360; 3 credits in statistics
Sensory evaluation techniques used to evaluate the appearance, aroma, flavor, texture and acceptability of foods. Relationships between sensory and instrumental measurements of color and texture. Work independently and cooperatively (in a team) to identify sensory evaluation objectives, write hypotheses, design and conduct experiments, and analyze and interpret data.

FS HN 507: Microbiological Safety of Foods of Animal Origins
(Dual-listed with FS HN 407). (Cross-listed with MICRO). (3-0) Cr. 3. S.
Prereq: MICRO 420
Examination of the various factors in the production of foods of animal origin, from animal production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. The two modules of this course will be 1) the procedures and processes which can affect the overall microbiological safety of the food, and 2) the Hazard Analysis Critical Control Point (HACCP) system.

FS HN 511: Integrated Food Science
(3-0) Cr. 3. F.
Prereq: 3 credits in each of organic chemistry, physics, mathematics, and microbiology.
Critical review of the key principles of food science and applications in the chemistry, microbiology, and processing of food. Understanding of the impact of processing on the quality of foods with respect to composition, quality and safety.

FS HN 512: Food Product Development
(Dual-listed with FS HN 412). (1-6) Cr. 3. F.S.
Prereq: FS HN 311 or FS HN 411
Principles of developing consumer packaged food products. Application of skills gained in food chemistry, formulation, microbiology, and processing. Some pilot plant experiences. Electronic communication from web emphasized for class reports, notes and assignments.

FS HN 519: Food Toxicology
(Cross-listed with NUTRS, TOX). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A course in biochemistry
Basic principles of toxicology. Toxicants in the food supply: modes of action, toxicant defense systems, toxicant and nutrient interactions, risk assessment. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

FS HN 521: Microbiology of Food
(2-0) Cr. 2. S.SS.
Prereq: A course in microbiology with laboratory; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
This course deals with the identification, enumeration, and characterization of bacteria, yeasts, and mold associated with foods and food processing. Effects of physical and chemical agents on micro-organisms will be studied. Microbiological problems in food spoilage, food preservation, food fermentation, and food-borne disease will be discussed. Offered online only.

FS HN 522: Advanced Food Microbiology and Biotechnology
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Food microbiology, a course in biochemistry; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
This course will cover basic principles in biotechnology and applied food microbiology, including current topics of interest in food biotechnology. Students will be introduced to recombinant DNA techniques and how they are applied to genetically modify microorganisms, the use of nucleic acids as tools of rapid detection of microorganisms in foods, basic enzyme immobilization and down-stream processing techniques, and regulatory aspects of food biotechnology. Offered online only.

FS HN 523: A Multidisciplinary Overview of Food Safety and Security
(2-0) Cr. 2. F.SS.
Prereq: A course in biology or chemistry; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Multidisciplinary food safety and security perspectives provided by numerous subject matter experts. Topics include food safety policy, ag bioterrorism, border security, animal ID, food defense and site security, risk analysis, crisis communication, epidemiology, HACCP, and more. Offered online only.

FS HN 524: Food Microbiology
(3-0) Cr. 3. F.
Prereq: A course in microbiology with laboratory; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Food Microbiology looks at the nature, physiology, and interactions of microorganisms in foods. The course is an introduction to food-borne diseases, the effect of food processing systems on the microflora of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. Additionally, the course looks at food plant sanitation and criteria for establishing microbial standards for food products. Offered online only.

FS HN 525: Principles of HACCP
(2-0) Cr. 2. F.
Prereq: Undergraduate biology and chemistry courses;enrollment in GP-IDEA Food Safety and Defense Certificate or permission of instructor.
A comprehensive study of the Hazard Analysis and Critical Control Point System and its application in the food industry. Offered online only.

FS HN 526: Ethnic Foods: Food Safety, Food Protection and Defense
(2-0) Cr. 2. SS.
Prereq: Graduate standing; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Understanding of the various factors that impact safety of ethnic and imported ethnic foods; knowledge about the handling, preparation, processing and storage of ethnic and imported foods and food products; science-based characterization of representative ethnic foods. Offered online only.

FS HN 527: Microbiology of Fermented Foods
(2-0) Cr. 2. SS.
Prereq: Food microbiology; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Microbiology of fermented foods covers the physiology, biochemistry, and genetics of microorganisms important in food fermentations. The course looks at how microorganisms are used in fermentations and the effects of processing and manufacturing conditions on production of fermented foods. Offered online only.

FS HN 528: Food Protection and Defense-Essential Concepts
(2-0) Cr. 2. S.
Prereq: Enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
This course will provide students with an understanding of the principles required in a food defense program for a food manufacturing, warehousing or distribution center. The topics covered include: defining threats and aggressors; the Bioterrorism Act; food defense teams; vulnerability assessments; security programs; recall and traceability basics; security inspections; crisis management; emergency preparedness; and workplace violence. Offered online only.

FS HN 529: Foodborne Toxicants
(Cross-listed with TOX). (2-0) Cr. 2. F.
Prereq: A course in biochemistry; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Mechanisms of action, metabolism, sources, remediation/detoxification, risk assessment of major foodborne toxicants of current interest, design of HAACP plans for use in food industries targeting foodborne toxicants, discussion of toxicants from a food defense perspective. Offered online only.

FS HN 540: Bioprocessing and Bioproducts
(Dual-listed with FS HN 440). (Cross-listed with BRT, C E). (3-0) Cr. 3. F.
Prereq: C E 326 or equivalent, MATH 160 or MATH 165, CHEM 167 or higher, BIOL 173 or BIOL 211 or higher, senior or graduate classification
Sustainability, cleaner production. Taxonomy, kinetics, metabolism, microbial cultivation, aerobic and anaerobic fermentation. Antibiotics, food supplements, fermented foods, vitamin production. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis.

FS HN 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

FS HN 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

FS HN 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

FS HN 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

FS HN 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

FS HN 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

FS HN 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

FS HN 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

FS HN 554: Dietetic Internship I
(0-22) Cr. 5. S.SS.
For students enrolled in the Dietetic Internship program only. Supervised practice experience in operational management, medical nutrition therapy and community nutrition. Capstone research project: Technology in Health Promotion. Experiences and activities designed to meet accreditation standards.

FS HN 555: Dietetic Internship II
(0-18) Cr. 4. F.S.
Prereq: Concurrent enrollment or successful completion of FS HN 554
For students enrolled in the Dietetic Internship program only. Supervised practice experience in operational management, medical nutrition therapy and community nutrition. Capstone research project: Leadership Challenge. Experiences and activities designed to meet accreditation standards.

FS HN 556: Dietetic Internship III
(0-22) Cr. 5. F.SS.
Prereq: Concurrent enrollment or successful completion of FS HN 554 and FS HN 555
For students enrolled in the Dietetic Internship program only. Supervised practice experience in operational management, medical nutrition therapy and community nutrition. Capstone research project: Evidenced Analysis Based Clinical Presentation. Experiences and activities designed to meet accreditation standards.

FS HN 560: Global Nutrition
(Dual-listed with FS HN 460). (Cross-listed with NUTRS). (3-0) Cr. 3.
Prereq: FS HN 361 or equivalent; senior or graduate standing
An overview of global nutrition issues, including the sociocultural, biological, economic, and environmental context of nutrition related topics. The etiology, epidemiology, and program/policy responses to issues will be presented. Areas to be covered include childhood malnutrition, growth stunting, micronutrient deficiencies, parasites and nutrition, sanitation, and obesity and chronic disease incidence in developing countries. Participatory course, students will engage in a series of class activities, discussions, and presentations.

FS HN 566: Nutrition Counseling and Education Methods
(Dual-listed with FS HN 466). (Cross-listed with DIET). (2-2) Cr. 3. F.
Prereq: FS HN 361 and FS HN 362
Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories.

FS HN 575: Processed Foods
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: FS HN 214 or FS HN 311; a course in nutrition
This course will examine effect of industrial and domestic food processing on the nutrient content of food and risk of developing chronic disease.

FS HN 580: Orientation to Food Science and Nutrition Research
(1-0) Cr. 1. F.
Orientation to and discussion of research interests in food science and nutrition. Discussion of policy and ethical issues in the conduct of research. Intended for entering students in FS HN. Offered on a satisfactory-fail basis only.

FS HN 581: Seminar
(1-0) Cr. 1. S.
Discussion and practice of oral presentation of scientific data in a professional setting. Discussion of issues related to data presentation. Intended for graduate students in their first or second semester in FS HN.

FS HN 590: Special Topics
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

FS HN 590A: Special Topics: Nutrition
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

FS HN 590B: Special Topics: Food Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

FS HN 590C: Special Topics: Teaching
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

FS HN 596A: Food Science and Human Nutrition Travel Course: International travel
(Dual-listed with FS HN 496A). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.
Meets International Perspectives Requirement.

FS HN 596B: Food Science and Human Nutrition Travel Course: Domestic travel
(Dual-listed with FS HN 496B). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

FS HN 597: Nutritional Aspects of Oncology
(Cross-listed with DIET, NUTRS). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: B.S. in nutrition, dietetics, biology, or related discipline.
Understanding of basic cancer biology and methodology used to study nutrition and cancer relationships. Using current research as a basis, the role of nutrition in specific cancers will be explored. Students will learn about sources of information for cancer prevention programs, and how to apply this information to clinical patient management.

FS HN 599: Creative Component
Cr. arr.
Nonthesis option only.

Courses for graduate students:

FS HN 606: Advanced Food Analysis and Instrumentation
(3-3) Cr. 4. Alt. S., offered odd-numbered years.
Prereq: FS HN 311, or FS HN 410, or FS HN 511 or equivalent.
Instrumental methods for measuring chemical and physical properties of foods, food quality and functionality. Techniques for methods development, sample preparation, optimization of operating conditions, and data analysis needed to obtain accurate, reproducible results by means of instrumentation.

FS HN 611: Advanced Food Processing
(Cross-listed with BRT). (3-0) Cr. 3. F.
Prereq: FS HN 311, or FS HN 471/472 or equivalent, or FS HN 511.
Recent advances in the science and technology of food processing and preservation; examples include both thermal and non-thermal processes, including cold plasma, nanotechnology, food packaging, and extrusion. Advances in extraction and separation technologies, waste management, by-product utilization, biorenewables and sustainability in food processing industry will also be discussed. Students to research on select topics and present.

FS HN 612: Advanced Food Chemistry
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: FS HN 311, or FS HN 411, or FS HN 511, or BBMB 404, or equivalent.
Structure, chemical and physical properties of lipids, proteins and carbohydrates, and their food and industrial applications. Changes in functionalities during processing and storage.

FS HN 626: Advanced Food Microbiology
(Cross-listed with MICRO, TOX). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials.

FS HN 627: Rapid Methods in Food Microbiology
(Cross-listed with MICRO, TOX). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Provides an overview of rapid microbial detection methods for use in foods. Topics include historical aspects of rapid microbial detection, basic categories of rapid tests (phenotypic, genotypic, whole cell, etc.), existing commercial test formats and kits, automation in testing, sample preparation and "next generation" testing formats now in development.

FS HN 681: Seminar
(1-0) Cr. 1. F.S.SS.
Presentation of thesis or dissertation research. May be taken once for M.S. program and twice for the Ph.D. program.

FS HN 682: Seminar Reflection
Cr. R. Repeatable. F.S.
Active listening and critical thinking activities related to research seminars in food science and human nutrition. Required each semester for all FSHN graduate students. Electronic documentation.

FS HN 690: Special Problems
Cr. arr. Repeatable. F.S.SS.
Prereq: FS HN 502 or FS HN 503 or FS HN 504 or FS HN 553 or FS HN 554

FS HN 695: Grant Proposal Writing
(Cross-listed with NUTRS). (1-0) Cr. 1. F.
Prereq: 3 credits of graduate course work in food science and/or nutrition
Grant proposal preparation experiences including writing and critiquing of proposals and budget planning. Formation of grant writing teams in food science and/or nutrition. Offered on a satisfactory-fail basis only.

FS HN 699: Research in Food Science and Technology
Cr. arr. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

Forestry (FOR)

Courses primarily for undergraduates:

FOR 201: Forest Biology
(2-0) Cr. 2. F.
Prereq: Concurrent enrollment in FOR 202, FOR 203, FOR 204, FOR 205, and FOR 206
Discussion of ecological concepts, individual tree structure and growth, variation and diversity in tree populations. Physical environment of trees and forests, ecological processes in forest communities, and introduction to different regional forest communities.

FOR 202: Sustainable Materials: Wood Utilization
(2-0) Cr. 2. F.
Prereq: Concurrent enrollment in FOR 201, FOR 203, FOR 204, FOR 205, and FOR 206
Basis for use of wood as an industrial raw material for lumber, composites, pulp and paper, energy and chemicals. Implications of use of alternative renewable and non-renewable materials for societal infrastructure and consumer goods.

FOR 203: Resource Measurements/Evaluation
(2-0) Cr. 2. F.
Prereq: Concurrent enrollment in FOR 201, FOR 202, FOR 204, FOR 205, and FOR 206; MATH 140
Survey techniques involved in quantification, valuation, and evaluation of tree and stand growth and other variables in the forest environment (e.g., recreational use, wildlife habitat value, biomass, and solid wood).

FOR 204: Forest Ecosystem Decision-Making
(2-0) Cr. 2. F.
Prereq: Concurrent enrollment in FOR 201, FOR 202, FOR 203, FOR 205, and FOR 206
Methods of decision-making related to forest ecosystems including communications, teams and conflict resolution. Current issues relating to public, private, and urban forests; quantification of processes, services, and goods produced by the forest and expected by the public such as wildlife, water, range, recreation, wilderness, biodiversity, as well as wood and fiber products.

FOR 205: Integrated Forestry Laboratory
(0-8) Cr. 3. F.
Prereq: Concurrent enrollment in FOR 201, FOR 202, FOR 203, FOR 204, and FOR 206
Field and laboratory exercises integrating the evaluation and management of forest goods, services, and the processing of wood products.

FOR 206: Fall Forestry Camp
Cr. 4. F.
Prereq: Concurrent enrollment in FOR 201, FOR 202, FOR 203, FOR 204, and FOR 205
Three-week field camp to address topics and issues covered in 201, 202, 203, 204, and 205.

FOR 280: Wood Properties and Identification
(3-3) Cr. 4. S.
Properties of wood and how they relate to its successful use. Comparative anatomical characteristics, scientific nomenclature, and hand lens identification of commercially important North American woods.

FOR 283: Pesticide Application Certification
(Cross-listed with AGRON, ENT, HORT). (2-0) Cr. 2. S.
Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized.

FOR 290: Special Problems
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290A: Special Problems: Leadership in Forestry Teams (LIFT) Learning Community
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290B: Special Problems: Forest Ecosystem Management
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290C: Special Problems: Natural Resource Conservation
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290D: Special Problems: Urban and Community Forestry
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290E: Special Problems: Wood Science and Technology
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 302: Silviculture
(2-3) Cr. 3. S.
Prereq: FOR 201
Manipulation of forest vegetation based on ecological principles for the production of goods and services.

FOR 356: Dendrology
(Cross-listed with BIOL). (2-4) Cr. 4. F.
Prereq: BIOL 211
Identification and ecology of North American woody plant species. Importance of woody plants in timber production and wildlife habitat. Natural disturbances, human impacts, management and restoration concerns for major North American forest regions will be addressed.

FOR 358: Forest Herbaceous Layer: Ecology and Identification.
(Cross-listed with NREM). (0.5-1) Cr. 1. S.
Prereq: BIOL 212
Survey of the major plant families, general, and representative species of the forest herbaceous layer. Functional ecology and restoration.

FOR 416: Forest Insects and Diseases
(Cross-listed with PL P). (3-0) Cr. 3. F.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent.
Nature of insects and pathogens of forest and shade trees; their role in the dynamics of natural and managed forest ecosystems; and the management of indigenous and exotic pests.

FOR 416L: Forest Insects and Diseases Laboratory
(Cross-listed with PL P). (0-3) Cr. 1. F.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent. Credit or enrollment in Pl P 416.
Laboratory experience working with insect and fungal pests of trees.

FOR 442: Dynamics of Forest Stands
(2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: NREM 301, FOR 302, STAT 101 or their equivalents
Change in forest species composition and structure at the stand and landscape scales resulting from site quality, tree growth, competition, succession, and disturbance. Methods for assessing tree growth and reconstructing past stand development. Applications to forest and savanna management.

FOR 451: Forest Resource Economics and Quantitative Methods
(3-3) Cr. 4. S.
Prereq: FOR 203, MATH 150
Application of economic principles to forest resource management considering both market and non-market goods and services. Methods of identifying and specifying problems in the management and use of forest resources. Application of mathematical and statistical models to the solution of managerial problems.

FOR 452: Ecosystem Management
(Dual-listed with FOR 552). (Cross-listed with NREM). (2-3) Cr. 3. S.
Prereq: Senior classification, and NREM 120 or its equivalent
Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints.

FOR 454: Forestry Practicum
(1-4) Cr. 3. S.
Prereq: 20 credits in student's major at 300 level or above
Integrated decision-making related to the conservation, management, and preservation of private and public forests, wildlands, urban/community forests, and/or the production and utilization of wood products. Student teams work with a client and develop management plans that incorporate ecological, social, economic, ethical, and institutional/political factors. Effective teamwork, written/oral/visual communication, and problem-solving stressed. Multiple trips to project site and client.

FOR 475: Urban Forestry
(Cross-listed with HORT). (2-3) Cr. 3. F.
Prereq: Junior or senior classification, 3 credits in biology
Discussion of establishment and management of woody perennials in community-owned urban greenspaces, consideration of urban site and soil characteristics, plant physiology, plant culture, urban forest valuation, inventory methods, species selection, and urban forest maintenance (health care and pest management).

FOR 480: Wood Anatomy and Fiber Analysis
(2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: FOR 280 or permission of instructor
Microscopic anatomy and ultrastructure of wood and other industrial lignocellulosic materials. Microscopy techniques for fiber analysis. Comparison of fiber properties.

FOR 481: Conversion of Lignocellulosic Materials
(2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: FOR 280 or equivalent
Chemical properties of lignocellulosic materials. Wood chemistry. Various conversion processes. Pulp and paper technology. Biobased products. Other fiber products. Cellulose derivatives. Term paper and/or student project required for graduate level.

FOR 485: Wood and Natural Fiber Composites
(2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: FOR 280 or TSM 240
Consolidation behavior of wood and other lignocellulosic materials. Principles of adhesion. Manufacturing processes for wood and lignocellulose composites such as plywood, oriented strand products, laminated lumber, particleboard, medium density fiberboard, and bast fiber products. Extrusion processing of natural fiber/plastic composites.

FOR 486: Drying Processes for Wood and Other Lignocellulosic Materials
(2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: FOR 280 or TSM 240
Principles of moisture relations in hygroscopic materials; adsorption, desorption, equilibrium moisture content. Transport processes in natural materials such as wood. Drying processes for wood and other lignocellulosic materials. Influence of moisture on dimensional stability and durability of wood and lignocelluosic composites.

FOR 487: Physical Properties of Wood
(3-3) Cr. 4. Alt. S., offered even-numbered years.
Prereq: FOR 280
Mechanical, thermal, electrical, and acoustical properties of wood. Lumber grading and stress rating, nondestructive evaluation of wood and wood composite products.

Courses primarily for graduate students, open to qualified undergraduates:

FOR 552: Ecosystem Management
(Dual-listed with FOR 452). (Cross-listed with NREM). (2-3) Cr. 3. S.
Prereq: Senior classification, and NREM 120 or its equivalent
Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints.

FOR 599: Creative Component
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599A: Creative Component: Forest Biology
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599B: Creative Component: Forest Biometry
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599C: Creative Component: Forest and Recreation Economics
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599D: Creative Component: Forest Management and Administration
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599E: Creative Component: Wood Science
Cr. 1-12. Repeatable, maximum of 12 credits.

Courses for graduate students:

FOR 696: Research Seminar
(Cross-listed with AGRON, BBMB, GDCB, HORT, PLBIO). Cr. 1. Repeatable. Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

FOR 699: Research
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699A: Research: Forest Biology - Wood Science
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699B: Research: Forest Biometry
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699C: Research: Forest Economics
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699D: Research: Forest Management and Administration
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699E: Research: Wood Science
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699F: Research: Plant Physiology
Cr. 1-12. Repeatable, maximum of 12 credits.

French (FRNCH)

Courses primarily for undergraduates:

FRNCH 101: Elementary French I
(4-0) Cr. 4. F.SS.
Beginning level development of reading, writing, listening comprehension, and speaking in French, within the context of French culture.

FRNCH 102: Elementary French II
(4-0) Cr. 4. S.SS.
Prereq: FRNCH 101
Beginning level development of reading, writing, listening comprehension, and speaking in French, within the context of French culture.
Meets International Perspectives Requirement.

FRNCH 201: Intermediate French I
(4-0) Cr. 4. F.
Prereq: FRNCH 102
Intermediate level development of reading, writing, listening comprehension, and speaking in French within the context of French culture.
Meets International Perspectives Requirement.

FRNCH 202: Intermediate French II
(4-0) Cr. 4. S.
Prereq: FRNCH 201
Intermediate level development of reading, writing, listening comprehension, and speaking in French within the context of French culture.
Meets International Perspectives Requirement.

FRNCH 301: French Writing and Grammar
(3-0) Cr. 3. F.
Prereq: FRNCH 202
Emphasis on developing functional language skills in reading and writing. Selective review of grammar within the context of cultural and literary prose.
Meets International Perspectives Requirement.

FRNCH 302: Reading and Writing French
(3-0) Cr. 3. S.
Prereq: FRNCH 301
Readings in French prose, theater and poetry. Introduction to close reading and analysis. Development of reading and writing skills for upper-level courses.
Meets International Perspectives Requirement.

FRNCH 304: French for Global Professionals
(3-0) Cr. 3.
Prereq: FRNCH 301
Communication in business and professional contexts in French-speaking countries. Development of effective communication strategies and project management in the workplace. Cultural contexts of business and professional practice. Emphasis on working across French-American cultures. Preparation for internships.
Meets International Perspectives Requirement.

FRNCH 305: French Conversation
(3-0) Cr. 3.
Prereq: FRNCH 202
Intensive conversational and listening practice emphasizing contemporary France and the Francophone world. Native or near-native speakers are not eligible to enroll.
Meets International Perspectives Requirement.

FRNCH 320: France Today
(3-0) Cr. 3.
Prereq: FRNCH 202
Selected topics dealing with contemporary French society and culture.
Meets International Perspectives Requirement.

FRNCH 326: Studies in French or Francophone Film
(3-0) Cr. 3. Repeatable.
Prereq: FRNCH 302 or concurrent enrollment in FRNCH 302
In-depth study of a selected filmmaker, genre, or movement. Emphasis on analytical interpretation and relationship between film and French or Francophone culture, history, and society.
Meets International Perspectives Requirement.

FRNCH 340: Studies in French or Francophone Literature
(3-0) Cr. 3. Repeatable.
Prereq: FRNCH 302 or concurrent enrollment in FRNCH 302
In-depth study of a selected topic, genre, movement or writer in French or Francophone literature, civilization or culture. Emphasis on close readings and discussion.
Meets International Perspectives Requirement.

FRNCH 370: French Studies in English
(3-0) Cr. 3. Repeatable.
Author, genre, or period study in French or Francophone history, literature, or culture. Readings, discussions, and papers in English.
Meets International Perspectives Requirement.

FRNCH 370F: Studies in English Translation: French Topics on Women and Gender Studies
(Cross-listed with W S). (3-0) Cr. 3. Repeatable.
Topics vary according to faculty interest. Readings, discussions, and papers in English.
Meets International Perspectives Requirement.

FRNCH 378: French Film Studies in English
(2-2) Cr. 3. Repeatable.
Analysis and interpretation of film in French society. Topics vary according to faculty interest. Film directors, genres, movements (e.g. The New Wave), historical survey, aesthetics, and cinematography. Readings, discussions and papers in English.
Meets International Perspectives Requirement.

FRNCH 476: French Civilization Seminar in English
(3-0) Cr. 3. S.
Advanced seminar in French civilization. Topics vary according to faculty interest. Readings, discussions, and paper in English.
Meets International Perspectives Requirement.

FRNCH 490: Independent Study
Cr. 1-6. Repeatable, maximum of 9 credits.
Prereq: Permission of French staff and department chair
Designed to meet the needs of students who wish to focus on areas other than those in which courses are offered. No more than 9 credits in Frnch 490 may be counted toward graduation.

FRNCH 499: Internship in French
Cr. 1-3. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: 9 credits of French at the 300 level; permission of advisor and WLC Internship Coordinator. Work experience using French language skills in the public or private sector, combined with academic work under faculty supervision
Credits may be applied only to LCP major. Offered on a satisfactory-fail basis only. No more than 3 credits of Frnch 499 may be applied to the major.

Courses primarily for graduate students, open to qualified undergraduates:

FRNCH 590: Special Topics in French
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credtis of 400 level French

FRNCH 590A: Special Topics in French: Literature or Literary Criticism
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credtis of 400 level French

FRNCH 590B: Special Topics in French: Linguistics
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credtis of 400 level French

FRNCH 590C: Special Topics in French: Language Pedagogy
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credtis of 400 level French

FRNCH 590D: Special Topics in French: Civilization
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credtis of 400 level French

Genetics (GEN)

Courses primarily for undergraduates:

GEN 110: Genetics Orientation
(1-0) Cr. 1. F.
This course is intended for first year students and others new to the genetics major. Discussion of university policies and resources, requirements of the major, career opportunities, and other topics related to the first year experience.

GEN 112: Genetics Orientation for Transfer Students
(0.5-0) Cr. 0.5. S.
Eight-week course for external transfer students and internal change of major students. Discussion of university policies and resources, requirements of the major, and career opportunities. Only one of GEN 110 or 112 may count toward graduation.

GEN 298: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department cooperative education coordinator; sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

GEN 313: Principles of Genetics
(Cross-listed with BIOL). (3-0) Cr. 3. F.S.SS.
Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L
Introduction to the principles of transmission and molecular genetics of plants, animals, and bacteria. Recombination, structure and replication of DNA, gene expression, cloning, quantitative genetics, and population genetics. Students may receive graduation credit for no more than one of the following: Gen 260, Gen 313 and 313L, Gen 320, Biol 313 and 313L, and Agron 320.

GEN 313L: Genetics Laboratory
(Cross-listed with BIOL). (0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in BIOL 313
Laboratory to accompany 313. Students may receive graduation credit for no more than one of the following: Biol 313 and 313L, Gen 260, Gen 313, Gen 320, and Agron 320.

GEN 320: Genetics, Agriculture and Biotechnology
(Cross-listed with AGRON). (3-0) Cr. 3. F.S.
Prereq: BIOL 212
Transmission genetics with an emphasis on applications in agriculture, the structure and expression of the gene, how genes behave in populations and how recombinant DNA technology can be used to improve agriculture. Credit for graduation will not be allowed for more than one of the following: Gen 260, 313, 320 and Biol 313 and 313L.

GEN 322: Introduction to Bioinformatics and Computational Biology
(Cross-listed with BCBIO, BIOL). (3-0) Cr. 3. F.
Prereq: BIOL 212
Genome sequencing, assembly, structural and functional annotation, and comparative genomics. Investigating these topics will develop skills in programming and scripting (Perl and/or Python), the use of biological databases, sequence alignment, similarity search, identification of sequence patterns, construction of phylogenetic trees, and comparative genomics.

GEN 340: Human Genetics
(3-0) Cr. 3. F.S.SS.
Prereq: BIOL 313 or GEN 313
Fundamental concepts and current issues of human genetics. Human chromosome analysis, pedigree analysis, gene mapping, the human genome project, sex determination, genetics of the immune system, genetics of cancer, gene therapy, the genetic basis of human diversity, eugenics.

GEN 349: The Genome Perspective in Biology
(Cross-listed with BIOL). (2-2) Cr. 3. S.
Prereq: GEN 313 or GEN 320
Analysis of genome, RNA, and protein data using computer technology to answer biological questions on topics ranging from microbial diversity to human health. An introduction for students in the life sciences to the fields of genomics, bioinformatics and systems.

GEN 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

GEN 402: Microbial Genetics and Genomics
(Cross-listed with MICRO). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MICRO 302, Biol 313
The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics.

GEN 409: Molecular Genetics
(3-0) Cr. 3. F.S.
Prereq: BIOL 313
The principles of molecular genetics. Gene structure and function; molecular mechanisms of DNA replication, recombination and repair, transcription and translation, regulation of gene expression.

GEN 410: Analytical Genetics
(3-0) Cr. 3. F.S.
The principles and practice of genetic analysis. Mendelian genetic analysis, mutational, transgenic, and genomic analysis of gene function, linkage and gene mapping, chromosomal aberrations, aneuploidy and polyploidy, extrachromosomal inheritance, analysis of genetic pathways.

GEN 444: Bioinformatic Analysis
(Cross-listed with BCB, BCBIO, BIOL, COM S, CPR E). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

GEN 462: Evolutionary Genetics
(Cross-listed with BIOL). (3-0) Cr. 3. F.
Prereq: BIOL 315
The genetic basis of evolutionary processes in higher organisms. The role of genetic variation in adaptation, natural selection, adaptive processes, and the influence of random processes on evolutionary change.

GEN 490: Independent Study
Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: GEN 313, junior or senior classification, permission of instructor
Independent study in any area of genetics. Students may use no more than 9 credits of university-wide 490 credits (including Gen 490) toward the total of 120 credits required for graduation.

GEN 491: Undergraduate Seminar
(1-0) Cr. 1. F.S.
Prereq: GEN 409
Communication within the discipline based on comprehension, discussion, presentation, and critical evaluation of original research literature; survey of career paths within the genetics disciplines and approaches to obtaining positions; exposure to research publication and grantsmanship processes; ethical issues in genetics research; outcomes assessment activities.

GEN 492: Laboratory Teaching Experience
Cr. 1-2. Repeatable, maximum of 9 credits. F.S.
Prereq: GEN 313, junior or senior classification, permission of instructor
For students registering to be undergraduate laboratory assistants. Offered on a satisfactory-fail basis only. No more than 2 credits of GEN 490U or GEN 492 may be applied toward the Genetics advanced course requirement.

GEN 495: Special Topics in Genetics
(1-0) Cr. 1-3. Repeatable, maximum of 3 credits. F.S.
Prereq: GEN 313; permission of instructor
Content varies from year to year. Genetics students may use no more than 9 credits of university-wide 490-499 credits toward the total of 120 credits required for graduation.

GEN 496: Attendance and Critique of Genetics Seminars
Cr. 1. Repeatable, maximum of 3 credits. F.S.
Prereq: GEN 313, junior or senior classification, permission of instructor
Attendance and critique of departmental seminars in BBMB, GDCB, or EEOB. Offered on a satisfactory-fail basis only. Genetics students may use no more than 9 credits of university-wide 490 - 499 credits toward the total of 120 credits required for graduation.

GEN 498: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

GEN 499: Genetics Research
Cr. 1-5. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: GEN 313, junior or senior classification, permission of instructor
Independent research in any area of genetics. Genetics students may use no more than 9 credits of university-wide 490-499 credits toward the total of 120 credits required for graduation.

GEN 499H: Genetics Research for Honors
Cr. 1-5. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: GEN 313, junior or senior classification, permission of instructor
Independent research in any area of genetics; for Honors students only. Genetics students may use no more than 9 credits of university-wide 490-499 credits toward the total of 120 credits required for graduation.

Genetics (GENET)

Courses primarily for graduate students, open to qualified undergraduates:

GENET 539: Ethics and Biological Sciences
(2-0) Cr. 2. S.
Introduction to Bioethics through case study discussion and recent news events. Students will read and discuss contemporary issues in science ethics, including some of the following topics: ethics and responsible research practice, animal ethics and the use of animals in teaching and research, cloning, human reproductive and stem cell research, regulation of genetically modified crops and foods, plant biotechnology, gene patents. Students will be divided into groups to develop their own case study, to be presented in class at the end of the term. Offered on a satisfactory-fail basis only.

GENET 590: Special Topics
Cr. arr. Repeatable. F.S.SS.
Contact individual faculty for special projects or topics. Graded.

GENET 591: Workshop in Genetics
(1-0) Cr. 1. Repeatable. F.
Prereq: Permission of instructor
Current topics in genetics research. Lectures by off-campus experts. Students read background literature, attend preparatory seminars, attend all lectures, meet with lecturers.

Courses for graduate students:

GENET 690: Graduate Student Seminar in Genetics
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor
Research presentations by students to improve their ability to: orally present scientific work in a clear and meaningful way, critically evaluate oral presentations, and give and receive constructive criticism. Students may enroll in one seminar per school year.

GENET 691: Faculty Seminar in Genetics
(1-0) Cr. 1. Repeatable. F.
Prereq: Permission of instructor
Faculty research seminars that introduce students to the variety of genetics research projects on campus and provide an opportunity for students to become engaged in the scientific presentation to the point where they can think critically and ask meaningful questions.

GENET 692: Conceptual Foundations of Genetics
(1-0) Cr. 1. F.
Prereq: Permission of instructor
Landmark papers in the development of genetics concepts. Papers are presented and discussions led by students, guided and mentored by the instructors. Instructors provide a broad overview and history of the development of fundamental concepts in genetics.

GENET 697: Graduate Research Rotation
Cr. arr. Repeatable. F.S.SS.
Graduate research projects performed under the supervision of selected faculty members in the graduate Genetics major.

GENET 699: Research
Cr. arr. Repeatable. F.S.SS.
Research.

Genetics, Development and Cell Biology (GDCB)

Courses primarily for graduate students, open to qualified undergraduates:

GDCB 505: Entrepreneurship in Science and Technology
(3-0) Cr. 3. Alt. F., offered even-numbered years.
High level success at modern science requires entrepreneurship both in and outside the laboratory. Scientists are in a unique position to not only think, but to thrive, "outside of the box" and take unorthodox approaches to research that lead to positive paradigm shifts in our lives. Exploration of many facets of science, technology, industry and commerce, with frequent guest lectures from entrepreneurs.

GDCB 510: Transmission Genetics
(3-0) Cr. 3. F.
Prereq: GEN 410 or graduate standing
In-depth investigations of modern research practices of transmission genetics. Designed for students interested in genetic research. Topics include: Mendelian genetic analysis, analysis of genetic pathways, mutational analysis of gene function, chromosomal mechanics, genetic mapping, epigenetic inheritance, human genetic analysis.

GDCB 511: Advanced Molecular Genetics
(Cross-listed with MCDB). (3-0) Cr. 3. S.
Prereq: BIOL 313 and BBMB 405
Mechanisms of molecular genetic processes in eukaryotes and prokaryotes, including DNA replication and repair, transcription, translation and regulation of gene expression. Critical evaluation and discussion of current primary literature, methodologies and experimental data.

GDCB 513: Plant Metabolism
(Cross-listed with PLBIO). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BIOL 330, PHYS 111, CHEM 331; one semester of biochemistry recommended
Photosynthesis, respiration, and other aspects of plant metabolism.

GDCB 528: Advances in Molecular Cell Biology
(Cross-listed with MCDB). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Courses in general cell biology and biochemistry
Cell biological processes including cell signaling, cell division, intracellular trafficking, biogenesis of organelles, cell adhesion and motility.

GDCB 533: Advances in Developmental Biology
(Cross-listed with MCDB). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 314 or Biol 423
Fundamental principles in multicellular development. Emphasis on cellular and molecular regulation of developmental processes, and experimental approaches as illustrated in the current literature.

GDCB 536: Statistical Genetics
(Cross-listed with STAT). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 401, STAT 447; GEN 320 or BIOL 313
Statistical models and methods for genetics covering models of population processes: selection, mutation, migration, population structure, and linkage disequilibrium, and inference techniques: genetic mapping, linkage analysis, and quantitative trait analysis. Applications include genetic map construction, gene mapping, genome-wide association studies (GWAS), inference about population structure, phylogenetic tree construction, and forensic and paternity identification.

GDCB 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

GDCB 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

GDCB 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

GDCB 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

GDCB 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

GDCB 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

GDCB 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

GDCB 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

GDCB 544: Fundamentals of Bioinformatics
(Cross-listed with BCB, COM S, CPR E). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent
A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies.

GDCB 545: Plant Molecular, Cell and Developmental Biology
(Cross-listed with MCDB, PLBIO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: Biol 313, BIOL 314, BIOL 330 or BBMB 405
Plant nuclear and organelle genomes; regulation of gene expression; hormone signaling; organization, function, and development of plant cells and subcellular structures; regulation of plant growth and development.

GDCB 556: Cellular, Molecular and Developmental Neuroscience
(Cross-listed with B M S, NEURO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 335 or BIOL 436; physics recommended
Fundamental principles of neuroscience including cellular and molecular neuroscience, nervous system development, sensory, motor and regulatory systems.

GDCB 557: Advanced Neuroscience Techniques
(Cross-listed with NEURO). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Neuro 556 or equivalent course
Research methods and techniques; lectures, laboratory exercises and/or demonstrations representing individual faculty specialties.

GDCB 568: Bioinformatics II (Statistical Bioinformatics)
(Cross-listed with BCB, COM S, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or (BIOL 315 and STAT 430), credit or enrollment in GEN 409
Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models.

GDCB 569: Bioinformatics III (Structural Bioinformatics)
(Cross-listed with BBMB, BCB, COM S, CPR E). (3-0) Cr. 3. F.
Prereq: BCB 567, BBMB 316, GEN 409, STAT 430
Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution.

GDCB 570: Bioinformatics IV (Systems Biology)
(Cross-listed with BCB, COM S, CPR E, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or COM S 311, COM S 228, GEN 409, STAT 430
Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration.

GDCB 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor

Courses for graduate students:

GDCB 661: Current Topics in Neuroscience
(Cross-listed with BBMB, NEURO). (2-0) Cr. 2-3. Repeatable. Alt. S., offered even-numbered years.
Prereq: NEURO 556 (or comparable course) or permission of instructor
Topics may include molecular and cellular neuroscience, neurodevelopment, neuroplasticity, neurodegenerative diseases, cognitive neuroscience, sensory biology, neural integration, membrane biophysics, neuroethology, techniques in neurobiology and behavior.

GDCB 690: Seminar in GDCB
Cr. 1. Repeatable.
Research seminars by faculty, invited speakers, and graduate students. Offered on a satisfactory-fail basis only.

GDCB 691: Faculty Seminar
Cr. 1. Repeatable.
Faculty research series.

GDCB 696: Research Seminar
(Cross-listed with AGRON, BBMB, FOR, HORT, PLBIO). Cr. 1. Repeatable.
Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

GDCB 698: Seminar in Molecular, Cellular, and Developmental Biology
(Cross-listed with BBMB, MCDB, MICRO, V MPM). (2-0) Cr. 1-2. Repeatable. F.S.
Student and faculty presentations.

GDCB 699: Research
Cr. arr. Repeatable.
Research for thesis or dissertation. Offered on a satisfactory-fail basis only.

GDCB 699I: Research
(Cross-listed with A ECL, ANTHR, EEOB, IA LL). Cr. 1-4. Repeatable.

Geology (GEOL)

Courses primarily for undergraduates:

GEOL 100: The Earth
(3-0) Cr. 3. F.S.SS.
How does the earth work, what is it made of, and how does it change through time? Plate tectonics, Earth materials, landforms, structures, climate, and natural resources. Emphasis on the observations and hypotheses used to interpret earth system processes. Students may also enroll in Geol 100L.

GEOL 100L: The Earth: Laboratory
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in GEOL 100
Students will gain understanding of how Earth processes affect their lives and how they affect the Earth, and of the complex nature of the Earth and its processes. They will gain a deep knowledge of the methods used to understand the time scales and rates of Earth processes also through an applied research experience on groundwater and surface water.

GEOL 101: Environmental Geology: Earth in Crisis
(Cross-listed with ENV S). (3-0) Cr. 3. F.S.
An introduction to geologic processes and the consequences of human activity from local to global scales. Discussion of human population growth, resource depletion, pollution and waste disposal, global warming and ozone depletion, desertification, and geologic hazards such as earthquakes, landslides, flooding, and volcanism.

GEOL 102: History of the Earth
(3-0) Cr. 3. S.
Prereq: GEOL 100 or GEOL 201
The Earth's physical and biological evolution; concepts of global tectonics. Methods used to decipher earth history. Students majoring in geology must also enroll in Geol 102L.

GEOL 102L: History of the Earth: Laboratory
(0-2) Cr. 1. S.
Prereq: Credit or enrollment in GEOL 102
Introduction to the use of sedimentary rocks and fossils in reconstructing the Earth's history.

GEOL 105: Gems and Gemstones
(2-0) Cr. 1. F.
Offered in second half of the semester. Introduction to gems and gemstones, physical and optical properties of gems and gemstones, explanation of where gems come from and how they are found, how to distinguish between synthetic and naturally occurring gems, how the value of gems are determined, and the history of famous gems.

GEOL 106: Earth and Space Science for Elementary Education Majors
(Cross-listed with ASTRO). (2-0) Cr. 2. F.S.
Prereq: Major in elementary or early childhood education.
Fundamental concepts of Earth and Space Science, including the solar system, weather and climate, water and soils, plate tectonics, and geologic hazards. Online course format.

GEOL 106L: Earth and Space Science for Elementary Education Majors: Laboratory
(Cross-listed with ASTRO). (0-2) Cr. 1. F.S.
Prereq: Restricted to elementary and early childhood education majors; to be taken concurrently with GEOL 106/ASTRO 106
Inquiry-based lab exploring fundamental concepts of Earth and Space Science, including the solar system, weather and climate, water and soils, plate tectonics, and geologic hazards. Must be taken concurrently with GEOL/ASTRO 106.

GEOL 108: Introduction to Oceanography
(Cross-listed with ENV S). (3-0) Cr. 3. F.
Introduction to study of the oceans. Ocean exploration. Waves and currents. Shape, structure, and origin of the ocean basins. Sedimentary record of oceanic life. Composition of seawater and its significance for life. Ocean circulation and its influence on climate. Life of the oceans, including coral reefs. Use and misuse of ocean resources. Anthropogenic impacts on the oceanic environment.

GEOL 111: Geological Disasters
(Cross-listed with ENV S). (1-0) Cr. 1. F.S.SS.
Introduction to the catastrophic geologic processes that disrupt ecosystems and human activity. Includes a discussion on the role of plate tectonics, the hydrologic cycle, and humans as the driving forces behind selected case studies on volcanic eruptions, earthquakes, tsunamis, landslides, and floods. Summer - online only.

GEOL 112: Geoscience Orientation
(Cross-listed with MTEOR). (1-0) Cr. 1. F.
Orientation course for students enrolled in the Earth, Wind and Fire Learning Community. Provides an introduction to Iowa State University and meteorology, geology, and Earth science programs for students enrolled in the department's learning community. Activities include academic and social activities, talks and presentations on academic success, resume writing, and study abroad, as well as research talks by faculty members.

GEOL 113: Spring Geoscience Orientation for Earth, Wind and Fire Learning Community
(Cross-listed with MTEOR). (0.5-0) Cr. 0.5. S.
Spring orientation course for students enrolled in the Earth, Wind and Fire Learning Community. Students are introduced to interview strategies, the importance of creating a professional image on social media, and the basics of financial literacy. Focused on professionalism and resilience, in this course students use their individual strengths to work in teams on a research project that applies their quantitative, data analysis, management, and communication skills. Activities include academic and social events, and two field trips.

GEOL 160: Water Resources of the World
(Cross-listed with AGRON, ENV S, MTEOR). (3-0) Cr. 3. S.
Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement.

GEOL 201: Geology for Engineers and Environmental Scientists
(2-2) Cr. 3. F.
Introduction to Earth materials and processes with emphasis on engineering and environmental applications.

GEOL 290: Independent Study
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Independent study for freshman and sophomore students.

GEOL 298: Cooperative Education
Cr. R. F.S.SS.
Prereq: GEOL 100 or GEOL 201, GEOL 100L, GEOL 102, GEOL 102L, and permission of the department cooperative education coordinator; sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing the work period.

GEOL 302: Summer Field Studies
Cr. 6. SS.
Prereq: GEOL 102, GEOL 356, GEOL 368
Geologic mapping; structural, stratigraphic, sedimentologic, metamorphic, geomorphic, and environmental analyses. Study areas in the Bighorn Basin and Wind River Range and excursions to Yellowstone and Grand Teton National Parks. A 6-week summer field course required of all geology majors.

GEOL 306: Geology Field Course
Cr. 1-2. Repeatable, maximum of 2 times. F.S.
Prereq: GEOL 100 or GEOL 201
Weekly seminar introduces students to a selected geological region or theme that is visited on a required ten-day field excursion. Introduction to field-safety leadership.

GEOL 315: Mineralogy and Earth Materials
(3-0) Cr. 3. F.
Prereq: GEOL 100 or GEOL 201, CHEM 177
Introduction to mineral classification, elementary crystal chemistry, crystal growth and morphology, mineral stability, and mineral associations.

GEOL 315L: Laboratory in Mineralogy and Earth Materials
(0-3) Cr. 1. F.
Prereq: GEOL 100 or GEOL 201
Mineral identification methods, especially hand-specimen identification.

GEOL 316: Optical Mineralogy
(1-2) Cr. 2. F.
Prereq: GEOL 100 or GEOL 201, CHEM 177, credit or enrollment in GEOL 315
Laboratory problems in mineral-identification methods utilizing optical microscopic techniques.

GEOL 324: Energy and the Environment
(Cross-listed with ENSCI, ENV S, MTEOR). (3-0) Cr. 3. S.
Renewable and non-renewable energy resources. Origin, occurrence, and extraction of fossil fuels. Nuclear, wind, geothermal, biomass, hydroelectric, and solar energy. Biofuels. Energy efficiency. Environmental effects of energy production and use, including air pollution, acid precipitation, coal ash, mountaintop removal mining, oil drilling, hydraulic fracturing, groundwater contamination, nuclear waste disposal, and global climate change. Carbon sequestration and geoengineering solutions for reducing atmospheric CO2 concentrations.

GEOL 356: Structural Geology
(3-3) Cr. 4. S.
Prereq: GEOL 100 or GEOL 201; PHYS 111
Principles of stress, strain, and rheology. Brittle and ductile behavior of rocks. Mechanics of formation, description, and classification of fractures, faults, folds, foliation, and lineation. From micro-structures to tectonic processes. Laboratory includes application of geometrical techniques to solve structural problems; emphasizes 3D thinking, map interpretation, and use of stereonet.

GEOL 365: Igneous and Metamorphic Petrology
(2-3) Cr. 3. S.
Prereq: GEOL 315, GEOL 315L, GEOL 316
Nature and origin of igneous and metamorphic rocks. Emphasis on important rock-forming environments and processes and their influence on rock characteristics. Laboratory includes thin section study of rock textures and mineralogy and the interpretation of these features.

GEOL 368: Sedimentary Geology
(3-3) Cr. 4. F.
Prereq: GEOL 102
Exploration of the interplay between weathering, sedimentation, sea-level change, tectonics, and life through time that creates sedimentary rocks and stratigraphic packages. Understanding of the historical development of sedimentary geology through the development of petrography, paleontology, deep earth sampling, geophysical technologies, and geochemistry. Field and laboratory problem sets illuminate lecture material.

GEOL 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: GEOL 100 or GEOL 201, GEOL 100L, GEOL 102, GEOL 102L, and permission of the department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

GEOL 402: Watershed Hydrology
(Dual-listed with GEOL 502). (Cross-listed with ENSCI, MTEOR, NREM).
(2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

GEOL 409: Field Methods in Hydrogeology
(Dual-listed with GEOL 509). (Cross-listed with ENSCI). (0-4) Cr. 3. Alt. SS., offered even-numbered years.
Prereq: GEOL/ENSCI 402 or GEOL/ENSCI 411 or C E 473
Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects.

GEOL 411: Hydrogeology
(Dual-listed with GEOL 511). (Cross-listed with ENSCI). (3-2) Cr. 4. F.
Prereq: Four courses in biological or physical sciences
Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations.

GEOL 414: Applied Groundwater Flow Modeling
(Dual-listed with GEOL 514). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: GEOL 411 or C E 473; MATH 165 or MATH 181
Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course.

GEOL 415: Paleoclimatology
(Dual-listed with GEOL 515). (Cross-listed with ENSCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in biological or physical science
Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods; utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~1 million years).

GEOL 416: Hydrologic Modeling and Analysis
(Dual-listed with GEOL 516). (Cross-listed with ENSCI, MTEOR). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in Earth science, meteorology, or engineering; junior standing
Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

GEOL 419: Aqueous and Environmental Geochemistry
(Dual-listed with GEOL 519). (Cross-listed with ENSCI). (2-2) Cr. 3. S.
Prereq: CHEM 178, CHEM 178L; junior classification
Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling.

GEOL 420: Mineral Resources
(Dual-listed with GEOL 520). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: GEOL 365
Geology and geochemistry of non-metallic and metallic ore deposits. Major processes that concentrate metals in the Earth. Geochemical conditions of ore formation using stable-isotope and fluid-inclusion studies. Laboratory emphasizes the study of metallic ores.

GEOL 426: Stable Isotopes in the Environment
(Dual-listed with GEOL 526). (Cross-listed with ENSCI). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Four courses in biological or physical science
Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance.

GEOL 444: Petroleum Geoscience and Engineering
(Dual-listed with GEOL 544). (2-2) Cr. 3. Alt. S., offered even-numbered years.
The geoscience and engineering aspects of exploration, development, and production of hydrocarbon resources around the world, as well as the historical and legal frameworks through which the industry has developed. Broader discussions of safety, risk, uncertainty, cost, and integrity as relevant to the petroleum industry.

GEOL 451: Applied and Environmental Geophysics
(Dual-listed with GEOL 551). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar.

GEOL 452: GIS for Geoscientists
(Dual-listed with GEOL 552). (Cross-listed with AGRON, ENSCI). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

GEOL 457: Seismic Methods in Geology, Engineering, and Petroleum Exploration
(Dual-listed with GEOL 557). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Physics of elastic-wave propagation. Seismic surveys in environmental imaging, engineering, and petroleum exploration. Reflection and refraction techniques. Data collection, processing, and geological interpretation. Field work with state-of-the-art equipment.

GEOL 474: Glacial and Quaternary Geology
(Dual-listed with GEOL 574). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of glaciers and glacial processes. Discussion of glaciology, glacial sediment transport, glacial landforms, and Quaternary history. Laboratory emphasizes topographic map interpretation and the Quaternary landscapes of Iowa.

GEOL 479: Surficial Processes
(Dual-listed with GEOL 579). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips.

GEOL 488: GIS for Geoscientists II
(Dual-listed with GEOL 588). (Cross-listed with AGRON, ENSCI). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

GEOL 489: Survey of Remote Sensing Technologies
(Dual-listed with GEOL 589). (Cross-listed with E E, MTEOR, NREM). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

GEOL 489L: Satellite Remote Sensing Laboratory
(Cross-listed with E E, MTEOR, NREM). (0-3) Cr. 1. S.
Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589
Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

GEOL 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in geology and permission of instructor
Independent study for senior students. No more than 9 credits of Geol 490 may be counted toward graduation.

GEOL 495: Undergraduate Seminar
Cr. 1. F.S.
Prereq: Junior or senior classification
Weekly seminar on topics of current research interest.

GEOL 498: Cooperative Education
Cr. R. F.S.SS.
Prereq: Geol 100 or GEOL 201, GEOL 100L, GEOL 102, GEOL 102L, and permission of the department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

GEOL 502: Watershed Hydrology
(Dual-listed with GEOL 402). (Cross-listed with ENSCI, MTEOR, NREM). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

GEOL 506: Geology Field Course
Cr. 1-2. Repeatable, maximum of 2 times. F.S.
Prereq: Graduate classification
Weekly seminar introduces students to a selected geological region or theme that is visited on a required ten-day field excursion. Graduate students are expected to assist in field teaching and safety leadership.

GEOL 507: Midwestern Geology Field Trip
Cr. 1. Repeatable, maximum of 4 times. F.
Prereq: GEOL 365
On-site inspection of various ore deposits, mining operations, and terrains dominated by igneous or metamorphic rocks. Offered on a satisfactory-fail basis only.

GEOL 509: Field Methods in Hydrogeology
(Dual-listed with GEOL 409). (Cross-listed with ENSCI). (0-4) Cr. 3. Alt. SS., offered even-numbered years.
Prereq: GEOL/ENSCI 402 or GEOL/ENSCI 411 or C E 473
Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects.

GEOL 511: Hydrogeology
(Dual-listed with GEOL 411). (Cross-listed with ENSCI). (3-2) Cr. 4. F.
Prereq: Four courses in biological or physical sciences
Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations.

GEOL 514: Applied Groundwater Flow Modeling
(Dual-listed with GEOL 414). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: GEOL 411 or C E 473; MATH 165 or MATH 181
Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course.

GEOL 515: Paleoclimatology
(Dual-listed with GEOL 415). (Cross-listed with ENSCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in biological or physical science
Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods; utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~ 1 million years).

GEOL 516: Hydrologic Modeling and Analysis
(Dual-listed with GEOL 416). (Cross-listed with ENSCI, MTEOR). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in earth science, meteorology, or engineering; junior standing
Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

GEOL 519: Aqueous and Environmental Geochemistry
(Dual-listed with GEOL 419). (Cross-listed with ENSCI). (2-2) Cr. 3. S.
Prereq: CHEM 178, CHEM 178L; junior classification
Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling.

GEOL 520: Mineral Resources
(Dual-listed with GEOL 420). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: GEOL 365
Geology and geochemistry of non-metallic and metallic ore deposits. Major processes that concentrate metals in the Earth. Geochemical conditions of ore formation using stable-isotope and fluid-inclusion studies. Laboratory emphasizes the study of metallic ores.

GEOL 526: Stable Isotopes in the Environment
(Dual-listed with GEOL 426). (Cross-listed with ENSCI). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Four courses in biological or physical science
Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance.

GEOL 544: Petroleum Geoscience and Engineering
(Dual-listed with GEOL 444). (2-2) Cr. 3. Alt. S., offered even-numbered years.
The geoscience and engineering aspects of exploration, development, and production of hydrocarbon resources around the world, as well as the historical and legal frameworks through which the industry has developed. Broader discussions of safety, risk, uncertainty, cost, and integrity as relevant to the petroleum industry.

GEOL 551: Applied and Environmental Geophysics
(Dual-listed with GEOL 451). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar.

GEOL 552: GIS for Geoscientists
(Dual-listed with GEOL 452). (Cross-listed with AGRON, ENSCI). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

GEOL 555: Environmental Soil Mineralogy
(Cross-listed with AGRON). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: AGRON 473, CHEM 178. Recommend: GEOL 311
Structure and behavior of clay minerals, humic substances and biochar in soil environments, with emphasis on reactions and environmental implications.

GEOL 557: Seismic Methods in Geology, Engineering, and Petroleum Exploration
(Dual-listed with GEOL 457). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Physics of elastic-wave propagation. Seismic surveys in environmental imaging, engineering, and petroleum exploration. Reflection and refraction techniques. Data collection, processing, and geological interpretation. Field work with state-of-the-art equipment.

GEOL 558: Introduction to the 3D Visualization of Scientific Data
(Cross-listed with COM S, HCI). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Graduate-student standing in the mathematical or natural sciences or engineering; basic programming knowledge
Introduction to visualizing scientific information with 3D computer graphics and their foundation in human perception. Overview of different visualization techniques and examples of 3D visualization projects from different disciplines (natural sciences, medicine, and engineering). Class project in interactive 3D visualization using the ParaView, Mayavi, TVTK, VTK or a similar system.

GEOL 574: Glacial and Quaternary Geology
(Dual-listed with GEOL 474). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of glaciers and glacial processes. Discussion of glaciology, glacial sediment transport, glacial landforms, and Quaternary history. Laboratory emphasizes topographic map interpretation and the Quaternary landscapes of Iowa.

GEOL 579: Surficial Processes
(Dual-listed with GEOL 479). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips.

GEOL 588: GIS for Geoscientists II
(Dual-listed with GEOL 488). (Cross-listed with AGRON, ENSCI). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

GEOL 589: Survey of Remote Sensing Technologies
(Dual-listed with GEOL 489). (Cross-listed with E E, MTEOR, NREM). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

GEOL 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590A: Special Topics: Surficial Processes
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590B: Special Topics: Stratigraphy
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590C: Special Topics: Sedimentation
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590D: Special Topics: Paleontology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590E: Special Topics: Petrology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590F: Special Topics: Structural Geology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590G: Special Topics: Geochemistry
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590H: Special Topics: Hydrogeology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590I: Special Topics: Earth Science
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590J: Special Topics: Mineral Resources
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590K: Special Topics: Geophysics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590L: Special Topics: Mineralogy
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590M: Special Topics: Tectonics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590N: Special Topics: Paleoecology and Paleoclimatology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590O: Special Topics: Isotope Geochemistry
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590P: Special Topics: Computational Methods and GIS
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590R: Special Topics: Surface Hydrology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590S: Special Topics: Oceanography
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 595: Graduate Seminar
(Cross-listed with MTEOR). Cr. 1. Repeatable. F.S.
Prereq: Senior or graduate classification
Weekly seminar on topics of current research interest. All students seeking a graduate degree in geology must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

GEOL 595A: Graduate Seminar: Presentation Required
(Cross-listed with MTEOR). (1-0) Cr. 1. Repeatable. F.S.
Prereq: Senior or graduate classification
Weekly seminar on topics of current research interest. All students seeking a graduate degree in geology must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

GEOL 595B: Graduate Seminar: Attendance Only
(Cross-listed with MTEOR). Cr. R. Repeatable. F.S.
Prereq: Senior or graduate classification
Attendance only. Weekly seminar on topics of current research interest. All students seeking a graduate degree in geology must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

GEOL 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

GEOL 610: Advanced Seminar
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610A: Advanced Seminar: Earth Materials
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610B: Advanced Seminar: Economic Geology
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610C: Advanced Seminar: Environmental Geochemistry
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610D: Advanced Seminar: Geophysics
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610E: Advanced Seminar: Geotectonics
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610F: Advanced Seminar: Hydrogeology
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610G: Advanced Seminar: Surficial Processes
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610H: Advanced Seminar: Sedimentation and Stratigraphy
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610I: Advanced Seminar: Paleoecology and Paleoclimatology
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610J: Advanced Seminar: Isotope Geochemistry
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610K: Advanced Seminar: Computational Methods and GIS
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 699: Research
Cr. arr. Repeatable.

GEOL 699A: Research: Surficial Processes
Cr. arr. Repeatable.

GEOL 699B: Research: Stratigraphy
Cr. arr. Repeatable.

GEOL 699C: Research: Sedimentation
Cr. arr. Repeatable.

GEOL 699D: Research: Paleontology
Cr. arr. Repeatable.

GEOL 699E: Research: Petrology
Cr. arr. Repeatable.

GEOL 699F: Research: Structural Geology
Cr. arr. Repeatable.

GEOL 699G: Research: Geochemistry
Cr. arr. Repeatable.

GEOL 699H: Research: Hydrogeology
Cr. arr. Repeatable.

GEOL 699I: Research: Earth Science
Cr. arr. Repeatable.

GEOL 699J: Research: Mineral Resources
Cr. arr. Repeatable.

GEOL 699K: Research: Geophysics
Cr. arr. Repeatable.

GEOL 699L: Research: Mineralogy
Cr. arr. Repeatable.

GEOL 699M: Research: Tectonics
Cr. arr. Repeatable.

GEOL 699N: Research: Paleoecology and Paleoclimatology
Cr. arr. Repeatable.

GEOL 699O: Research: Isotope Geochemistry
Cr. arr. Repeatable.

GEOL 699P: Research: Computational Methods and GIS
Cr. arr. Repeatable.

GEOL 699R: Research: Surface Hydrology
Cr. arr. Repeatable.

GEOL 699S: Research: Geoscience Education
Cr. arr. Repeatable.

German (GER)

Courses primarily for undergraduates:

GER 101: Elementary German I
(4-0) Cr. 4. F.SS.
Beginning level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. For beginning-level learners who have little or no prior exposure to German.

GER 102: Elementary German II
(4-0) Cr. 4. S.SS.
Prereq: GER 101
Beginning level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. For beginning level learners with only one semester of German (or exposure equivalent to two years or less in high school.).
Meets International Perspectives Requirement.

GER 201: Intermediate German I
(4-0) Cr. 4. F.
Prereq: GER 102
Intermediate level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. Intensive review of basic grammar covered in the first-year German class (or equivalent high school courses) while exploring cultural topics and themes.
Meets International Perspectives Requirement.

GER 202: Intermediate German II
(4-0) Cr. 4. S.
Prereq: GER 201
Intermediate level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. Emphasis on intermediate level grammar and communication about topics and themes beyond the personal realm.
Meets International Perspectives Requirement.

GER 301: Reading: Problems of the Early Twentieth Century
(3-0) Cr. 3. F.
Prereq: GER 202
Emphasis on the development of reading skills through a variety of text types with a focus on German Culture from circa 1900 to 1933.
Meets International Perspectives Requirement.

GER 302: Composition
(3-0) Cr. 3. S.
Prereq: GER 202
Emphasis on writing skills, with further development of grammar and reading skills using a variety of current and historical materials.
Meets International Perspectives Requirement.

GER 304: German for Global Professionals
(3-0) Cr. 3. F.
Prereq: GER 202
Communication in business and professional contexts in German-speaking countries. Development of effective communication strategies and project management in the workplace. Cultural contexts of business and professional practice. Preparation for internships.
Meets International Perspectives Requirement.

GER 305: Conversation: The City in Contemporary Europe
(3-0) Cr. 3. S.
Prereq: GER 202 minimum, GER 301 recommended
Intensive conversational and listening practice in German with an emphasis on a major German-speaking city.
Meets International Perspectives Requirement.

GER 320: Germany Today
(3-0) Cr. 3. S.
Prereq: GER 301 or GER 304
Selected topics dealing with contemporary German society and culture. Introduction to materials, resources, and forms of communication available on the Internet, and in other electronic and print media.
Meets International Perspectives Requirement.

GER 330: German Literature and Culture
(3-0) Cr. 3. Repeatable. F.
Prereq: GER 301 or permission of instructor
Selected readings in German literature from Classicism to present. Emphasis on techniques of reading and analysis of literary texts. No more than six credits of Ger 330 may be counted toward the major.
Meets International Perspectives Requirement.

GER 370: German Studies in English
(3-0) Cr. 3-4. Repeatable, maximum of 6 credits.
Prereq: Sophomore classification. For fourth credit, 6 credits in German at the 300 level
Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Three credits: English, open to all students. Four credits: Required for German concentration credit, supplementary readings and compositions in German.
Meets International Perspectives Requirement.

GER 370G: Studies in English Translation: German Topics on Women or Feminism

(Cross-listed with W S). (3-0) Cr. 3-4. Repeatable, maximum of 6 credits.

Prereq: Sophomore classification. For fourth credit, 6 credits in German at the 300 level

Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Three credits: English, open to all students. Four credits: Required for German concentration credit, supplementary readings and compositions in German.

Meets International Perspectives Requirement.

GER 371: The Holocaust in Text, Image, and Memory

(3-0) Cr. 3-4.

Prereq: Sophomore classification. For fourth credit, 6 credits in German at the 300 level

Examination of such topics as the origins and expressions of Anti-Semitism in central Europe, the political events and structures of the Holocaust, the reality of ghettos and concentration camps, the impact of technological modernization on the Final Solution, and resistance to the Nazis. Materials will include non-fictional texts, literature, art, and music. Three credits: English, open to all students. Four credits: required for German major credit, supplementary readings and compositions in German. Four credits: required for German concentration credit, supplementary readings and compositions in German.

Meets International Perspectives Requirement.

GER 375: Grimms' Tales

(3-0) Cr. 3-4.

Prereq: Sophomore classification. For fourth credit, 6 credits in German at the 300 level

Introduction to Germanic antiquities, mythology, and heroic legends; Herder's concept of Naturpoesie. Emphasis on the Grimm tales: theoretical approaches to the tales from the late 19th and early 20th centuries; perversions of these traditional tales by the National Socialists (Nazis). Readings in contemporary Grimm scholarship. Taught in English. Three credits: English, open to all students. Four credits: required for German concentration credit, supplementary readings and compositions in German.

Meets International Perspectives Requirement.

GER 378: German Film and Media Studies

(3-0) Cr. 3-4. S.

Prereq: Sophomore classification. For fourth credit, 6 credits in German at the 300 level

Analysis and interpretation of film or media in German society. Study of media production and reception within multicultural and global contexts. Thematic emphases based on faculty and student interest including: 1) film directors, genres, movements (e.g. New German Cinema), aesthetics, and cinematography or 2) media studies (e.g. television, mass press, popular culture). Three credits: English, open to all students. Four credits: required for German concentration credit, supplementary readings and compositions in German.

Meets International Perspectives Requirement.

GER 395: Study Abroad

Cr. 1-10.

Prereq: 2 years university-level German

Supervised instruction in language and culture of Germany; formal class instruction at level appropriate to student's training, augmented by practical living experience.

Meets International Perspectives Requirement.

GER 476: Topics in German Cultural Studies

(3-0) Cr. 3-4. S.

Prereq: Sophomore classification. For fourth credit, six credits in German at the 300-level courses instructed in German

Key topics and themes in German history and culture up to the modern era. Three credits: Taught in English, open to all students. Four credits: Required for German concentration credit, supplementary readings and compositions in German.

Meets International Perspectives Requirement.

GER 490: Independent Study

Cr. 1-6. Repeatable, maximum of 9 credits.

Prereq: 6 credits in German and permission of department chair

Designed to meet the needs of students who seek work in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. No more than 9 credits of Ger 490 may be counted toward graduation.

GER 499: Internship in German

Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

Prereq: 9 credits of German at the 300 level; permission of advisor and the World Languages and Cultures Internship coordinator

Work experience using German language skills in the public or private sector, combined with academic work under faculty supervision. Available only to majors and minors. Offered on a satisfactory-fail basis only. Ger 499 may be repeated to a maximum of 6 credits. No more than 3 credits of Ger 499 may be applied to the major.

Courses primarily for graduate students, open to qualified undergraduates:

GER 590: Special Topics in German
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level German

GER 590A: Special Topics in German: Literature or Literary Criticism
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level German

GER 590B: Special Topics in German: Linguistics
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level German

GER 590C: Special Topics in German: Language Pedagogy
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level German

GER 590D: Special Topics in German: Civilization
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level German

Gerontology (GERON)

Courses primarily for undergraduates:

GERON 234: Adult Development
(Cross-listed with HD FS). (3-0) Cr. 3. S.
Prereq: HD FS 102
Introductory exploration of the health, individual and social factors associated with adult development including young adulthood, middle age and older adulthood. Information is presented from a life-span developmental framework.

GERON 373: Death as a Part of Living
(Cross-listed with HD FS). (3-0) Cr. 3. F.S.Alt. SS., offered even-numbered years.
Prereq: HD FS 102
Consideration of death in the life span of the individual and the family with opportunity for exploration of personal and societal attitudes.

GERON 377: Aging and the Family
(Cross-listed with HD FS). (3-0) Cr. 3. F.Alt. SS., offered odd-numbered years.
Prereq: HD FS 102
Interchanges of the aged and their families. Emphasis on role changes, social interaction, and independence as influenced by health, finances, life styles, and community development.
Meets U.S. Diversity Requirement

GERON 378: Retirement Planning and Employee Benefits
(Cross-listed with ECON, HD FS). (3-0) Cr. 3. S.
Prereq: 3 credits in Principles of Economics and 3 credits in Human Development and Family Studies
Economic well-being in the context of demographic change, the present and future of Social Security, family retirement needs analysis, investment strategies and characteristics of retirement plans, helping others to work towards financial security, family economic issues for retired persons. Overview of employee and retirement benefits.
Meets U.S. Diversity Requirement

GERON 414: Gerontechnology in Smart Home Environments
(3-0) Cr. 3. F.
Prereq: Com S 227 or (Com S 207 or Geron 377 or ArtGr 271) or equivalent.
An interdisciplinary course designed for students who are interested in assistive technology, pervasive computing, mobile computing and principles of universal and inclusive design for end users, in particular, the elderly population. Students will work in semester-long projects as interdisciplinary teams to apply knowledge obtained from lectures and mutual presentations. For graduate credit students are required to submit a research report and give an oral presentation.

GERON 415: Gerontechnology in Smart Home Environments
(3-0) Cr. 3. F.
Prereq: Com S 227 or (Com S 207 or Geron 377)
An interdisciplinary course designed for students who are interested in assistive technology, pervasive computing, mobile computing and principles of universal software design for end users, in particular the elderly population. Students will have the chance to learn both about the theories and principles about aging and assistive technology, as well as to engage in the practical semester-long project while working with students from other disciplines.

GERON 463: Environments for the Aging
(Dual-listed with GERON 563). (Cross-listed with ARTID, HD FS). (3-0) Cr. 3. S.
Prereq: HD FS 360 or 3 credits in housing, architecture, interior design, rehabilitation, psychology, or human development and family studies or permission of instructor
Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (on-line course offering via Distance Education).
Meets U.S. Diversity Requirement

GERON 466: Gerontology Prepracticum Seminar
(1-0) Cr. 1. F.S.SS.
Prereq: 9 credits in core courses for the gerontology minor and approval of the gerontology undergraduate coordinator
Prepracticum training for students planning a gerontology practicum. Exploration of possible agencies for the practicum, in-depth study of a selected agency, and development of goals and objectives for the practicum.

GERON 467: Gerontology Practicum
Cr. 3-6. Repeatable. F.S.SS.
Prereq: GERON 466, advance reservation
Supervised field experience related to aging. Offered on a satisfactory-fail basis only.

GERON 490: Independent Study
Cr. arr.
Consult program coordinator for procedure.

Courses primarily for graduate students, open to qualified undergraduates:

GERON 501: Seminar
Cr. arr. Repeatable. F.S.SS.

GERON 510: Survey of Gerontology
Cr. 1-3. Repeatable. S.
Provides an overview of important gerontological issues.

GERON 514: Gerontechnology in Smart Home Environments
(3-0) Cr. 3. F.
Prereq: COM S 227 or (COM S 207 or GERON 377 or ARTGR 271) or equivalent.
An interdisciplinary course designed for students who are interested in assistive technology, pervasive computing, mobile computing and principles of universal and inclusive design for end users, in particular, the elderly population. Students will work in semester-long projects as interdisciplinary teams to apply knowledge obtained from lectures and mutual presentations. For graduate credit students are required to submit a research report and give an oral presentation.

GERON 520: Women and Aging
(3-0) Cr. 3. SS.
Women and Aging is the study of theory, research and application of issues related to women and the aging experience. This course will examine gender differences in areas such as health, mental health, income security, crime, and public policy. Attention will be given to ways in which younger women can prepare to meet the challenges and opportunities awaiting them as they age.

GERON 521: Biological Principles of Aging
(3-0) Cr. 3. SS.
Basic biological principles of aging. Course modules include an introduction to the aging process, body systems and normal aging, and environment and the biology of aging. In addition, disorders and diseases of aging, prevention and treatment and exercise and aging topics will be covered.

GERON 522: Long-Term Care
(3-0) Cr. 3. F.
Administration principles involved in the planning, organizing and directing of long-term care agencies. Includes an in-depth exposure to federal and state standards and regulations governing long-term care.

GERON 523: Mental Health and Aging
(3-0) Cr. 3. S.
Introduction to the range of issues involved in aging and mental health. From a systems framework the major emotional and psychiatric problems encountered in old age will be examined including mood, anxiety, adjustment and personality disorders, dementia, cognitive problems, substance abuse, and suicide. Barriers to treatment and cohort and cultural issues will be explored.

GERON 524: Cognitive Health
(3-0) Cr. 3. SS.
Cognitive skills form the foundation for functioning in everyday life and these skills take on added importance in older adulthood. This course focuses on selected theoretical approaches and current research related to cognitive aging. We will review normative and non-normative cognitive changes, assessment techniques, and prevention/intervention efforts. Throughout the course we will keep the role of environment and life-span implications in the forefront of our discussion.

GERON 530: Perspectives in Gerontology
(Cross-listed with HD FS). (3-0) Cr. 3. F.
Overview of current aging issues including theory and research, critical social and political issues in aging, the interdisciplinary focus of gerontology, career opportunities, and aging in the future. (on-line course offering via Distance Education).

GERON 534: Adult Development
(Cross-listed with HD FS). (3-0) Cr. 3. S.
Exploration of the biological, psychological and social factors associated with aging. Although the focus is on the later years, information is presented from a life-span developmental framework. Empirical studies are reviewed and their strengths, limitations and implications for normative and optimal functioning are discussed. (on-line course offering via Distance Education).

GERON 540: Nutrition and Physical Activity in Aging
(Cross-listed with DIET). (3-0) Cr. 3. F.
WWW only. Basic physiologic changes during aging and their impacts in health and disease. The focus will be on successful aging with special emphasis on physical activity and nutrition. Practical application to community settings is addressed.

GERON 545: Economics, Public Policy, and Aging
(Cross-listed with HD FS). (3-0) Cr. 3. F.
Policy development in the context of the economic status of the older adult population. Retirement planning and the retirement decisions; social security and public transfer programs; intra-family transfers to/from the aged; private pensions; financing medical care; prospects and issues for the future.

GERON 563: Environments for the Aging
(Dual-listed with GERON 463). (Cross-listed with ARTID, HD FS). (3-0) Cr. 3. S.
Prereq: HD FS 360 or 3 credits in housing, architecture, interior design, rehabilitation, psychology, or human development and family studies or permission of instructor
Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (on-line course offering via Distance Education).
Meets U.S. Diversity Requirement

GERON 571: Design for All People
(Cross-listed with ARCH). (3-0) Cr. 3. S.
Prereq: Graduate or Senior classification
Principles and procedures of universal design in response to the varying ability level of users. Assessment and analysis of existing buildings and sites with respect to standards and details of accessibility for all people, including visually impaired, mentally impaired, and mobility restricted users. Design is neither a prerequisite nor a required part of the course. Enrollment open to students majoring in related disciplines. Credit counts toward fulfillment of History, Theory, Culture requirements.
Meets U.S. Diversity Requirement

GERON 577: Aging in the Family Setting
(Cross-listed with HD FS). (3-0) Cr. 3. S.
Prereq: 9 credits in social sciences or permission of instructor
Theories and research related to personal and family adjustments in later life affecting older persons and their intergenerational relationships. Related issues including demographics also are examined through the use of current literature. (on-line course offering via Distance Education).

GERON 584: Program Evaluation and Research Methods in Gerontology
(Cross-listed with HD FS). (3-0) Cr. 3. S.
Overview of program evaluation, research methods, and grant writing in gerontology. Includes application of quantitative and qualitative methods in professional settings. (on-line course offering via Distance Education).

GERON 590: Special Topics
Cr. arr. Repeatable.
Consult program coordinator for procedure.

GERON 591: Internship
Cr. 1-9. Repeatable, maximum of 9 credits. F.S.SS.
Supervised experience in an area of gerontology.

GERON 594: Professional Seminar in Gerontology
(Cross-listed with HD FS). (3-0) Cr. 3. SS.
An integrative experience for gerontology students designed to be taken near the end of the degree program. By applying knowledge gained in earlier coursework, students will strengthen skills in ethical decision-making behavior, applying these skills in gerontology-related areas such as advocacy, professionalism, family and workplace issues. Students from a variety of professions will bring their unique perspectives to bear on topics of common interest. (on-line course offering via Distance Education).

GERON 599: Creative Component
Cr. arr. Repeatable. F.S.SS.

Courses for graduate students:

GERON 635: Adult Development, Aging, and Health
(Cross-listed with HD FS). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: HD FS 510 or permission of instructor
Review of the impact of the growing older adult population as well as individual development and aging on individuals, families, and society. Exploration of theoretical perspectives applied to adult development and aging and distinction of normative and non-normative changes in adulthood. Discussion of methods to assess development across adulthood and consideration of the role of individual and environmental factors impacting efforts to optimize adult development.(on-line course offering via Distance Education).

GERON 699: Research
Cr. arr. Repeatable. F.S.SS.

Global Resource Systems (GLOBE)

Courses primarily for undergraduates:

GLOBE 110: Orientation
(1-0) Cr. 1. F.
An introduction to Global Resource Systems (GRS) program. University and career acclimation, development of educational and professional skills, participation in GRS Learning Community. Assessed service-learning component.

GLOBE 120: Geography of Global Resource Systems
(3-0) Cr. 3. F.S.SS.
A survey of geographic concepts with a specific focus on the distribution of natural and human-generated resources and the demand for those resources on a global scale.
Meets International Perspectives Requirement.

GLOBE 201: Global Resource Systems
(3-0) Cr. 3. F.S.
A comparative analysis of global resources and the various natural and human systems affecting those resources. Assessed service-learning component.

GLOBE 211: Issues in Global Resource Systems
(1-0) Cr. 1. Repeatable, maximum of 3 credits. F.S.
Discussion of topics of current importance in global resource systems. Offered on a satisfactory-fail basis only. A maximum of 3 credits of 211 may be used towards degree requirements.

GLOBE 220: Globalization and Sustainability
(Cross-listed with ANTHR, ENV S, M E, MAT E, SOC, T SC). (3-0) Cr. 3. F.S.
An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.
Meets International Perspectives Requirement.

GLOBE 221: Apprenticeship
Cr. R. Repeatable. F.S.SS.
Prereq: Approval by the Global Resource Systems Faculty Coordinator
Practical work experience in approved domestic or international settings such as with a company, research laboratory, governmental agency or non-governmental organization. Offered on a satisfactory-fail basis only.

GLOBE 290: Independent Study
Cr. 1-2. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for first-year students and sophomores.

GLOBE 290H: Independent Study, Honors
Cr. 1-2. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for first-year students and sophomores.

GLOBE 303: Agricultural, Food and Natural Global Resource Systems
(3-0) Cr. 3. F.
Prereq: GLOBE 201, ECON 101 or ECON 102
In-depth analysis of the opportunities, constraints and consequences of agricultural, food and natural resource systems. Topics integrate global natural resources with agriculture and food systems, nutrition and health, sustainable development, and societal structures, including gender, migration and urbanization. Course content utilizes a systems approach.

GLOBE 304: Socio-Economic Global Resource Systems
(3-0) Cr. 3. S.
Prereq: GLOBE 201, ECON 101 or ECON 102
In-depth analysis of the opportunities, constraints and consequences of social, economic and political global resource systems. Topics integrate agriculture and food production, globalization, population, economic planning, energy, security, trade, and policy and their role in defining different world regions. Course content utilizes a systems approach.

GLOBE 320: Global Resource Systems Internship Preparation
(1-0) Cr. 1. S.
Prereq: Permission of instructor.
Students enrolled in this course intend to enroll in Globe 321 or 322 in the following term. Topics provide a pre-departure orientation, including logistical, academic, cultural, and personal requirements for completion of an experiential supervised work experience.

GLOBE 321: Internship - Global

Cr. 3-6. Repeatable. F.S.SS.

Prereq: GLOBE 320, Junior or Senior and enrollment in Global Resource Systems major; permission of the instructor and approval by the Global Resource Systems Faculty Coordinator

A supervised learning experience including an analysis of an international location's resource system via immersion in a foreign culture lasting at least five weeks. The experience should focus on the region consistent with the student's degree track. Course expenses paid by student. A maximum of 12 credits of GLOBE 321 and 322 may be used for degree requirements.

GLOBE 322: Internship - United States

Cr. 3-6. Repeatable. F.S.SS.

Prereq: GLOBE 320, Junior or Senior and enrollment in Global Resource Systems major; permission of the instructor and approval by the Global Resource Systems Faculty Coordinator

A supervised learning experience including an analysis of a domestic location's resource system via immersion in a different culture within the United States lasting at least five weeks. Designed for international students and for students who are not in a position to leave the United States. Course expenses paid by student. A maximum of 12 credits of Globe 321 and 322 may be used for degree requirements.

GLOBE 335: The Economics of Global Agricultural Food and Bio-energy

(Cross-listed with ECON). (3-0) Cr. 3.

Prereq: ECON 101

Applied economic analysis of the determinants of world agricultural production, marketing, and use in feed, food, fiber, biofuel, and other applications, and global food processing and consumption. Analysis of market case studies and various data on global agricultural production and transformation, land and resource use, demography, economic activity, nutrition and health trends.

Meets International Perspectives Requirement.

GLOBE 385: Economic Development

(Cross-listed with ECON). (3-0) Cr. 3.

Prereq: ECON 101, ECON 102

Current problems of developing countries, theories of economic development, agriculture, and economic development, measurement and prediction of economic performance of developing countries, alternative policies and reforms required for satisfying basic needs of Third World countries, interrelationships between industrialized countries and the developing countries, including foreign aid.

Meets International Perspectives Requirement.

GLOBE 398: Cooperative Education

Cr. R. F.S.SS.

Prereq: Permission of faculty coordinator for the major.

Students must complete GLOBE 398 Cooperative Education Approval Form and register for GLOBE 398 before commencing each work period. Work periods for students in cooperative education related to Global Resource Systems. Offered on a satisfactory-fail basis only.

GLOBE 401: Senior Project

Cr. 3. F.S.SS.

Prereq: Senior classification in Global Resource Systems

Research project in collaboration with faculty that complements and furthers a student's experiences from Globe 321 and 322 while simultaneously bringing into focus entire four-year experience. Student will write a research report and make either an oral or poster presentation.

GLOBE 401H: Senior Project, Honors

Cr. 3. F.S.SS.

Prereq: Senior classification in Global Resource Systems

Research project in collaboration with faculty that complements and furthers a student's experiences from Globe 321 and 322 while simultaneously bringing into focus entire four-year experience. Student will write a research report and make either an oral or poster presentation.

GLOBE 402: Responses to Global Resource System Challenges

(3-0) Cr. 3. S.

Capstone analysis of critical global resource challenges facing both developed and developing countries. Students will use research skills to investigate specific global resource issues and use communications skills to work as a team to integrate their research, develop an interdisciplinary perspective, and evaluate potential solutions to resource challenges.

GLOBE 441: International Animal Agriculture

(Cross-listed with AN S). (3-0) Cr. 3. S.

Prereq: Two courses from AN S 223, AN S 225, AN S 226, AN S 229, AN S 235

An overview of animal agriculture with emphasis on animal agriculture in developing countries. Historical, economic, environmental; and political considerations will be assessed and evaluated. Issues related to gender, resilience and sustainability for different production systems will be investigated.

Meets International Perspectives Requirement.

GLOBE 446: International Issues and Challenges in Sustainable Development
(Cross-listed with AGRON, INTST). Cr. 3. F.S.
Prereq: 3-credit biology course, Sophomore or higher classification, permission of Instructor
Interdisciplinary study and analysis of agricultural systems, sustainable management, and impact on plants and animal biodiversity. International field experience in evaluating different agricultural systems and impact on biodiversity may be required. A program fee is charged to students for international study abroad.
Meets International Perspectives Requirement.

GLOBE 490: Independent Study
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for juniors and seniors. A maximum of 9 credits of all (university-wide) 490 courses may be used for degree requirements.

GLOBE 490A: Independent Study: General
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for juniors and seniors. A maximum of 9 credits of all (university-wide) 490 courses may be used for degree requirements.

GLOBE 490E: Independent Study: Entrepreneurship
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for juniors and seniors. A maximum of 9 credits of all (university-wide)490 courses may be used for degree requirements.

GLOBE 490H: Independent Study: Honors
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for juniors and seniors. A maximum of 9 credits of all (university-wide) 490 courses may be used for degree requirements.

GLOBE 490Z: Independent Study: Service Learning
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for juniors and seniors. Assessed service-learning component. A maximum of 9 credits of all (university-wide) 490 courses may be used for degree requirements.

GLOBE 494: Service Learning
Cr. arr. F.S.SS.
Prereq: Permission of instructor.
Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling a professional ethics and accomplishing student learning goals. Course expenses paid by student. Assessed service-learning component.

GLOBE 494A: Service Learning: International
Cr. arr. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission of instructor.
Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling a professional ethics and accomplishing student learning goals. Course expenses paid by student. Assessed service-learning component.

GLOBE 494B: Service Learning: Domestic
Cr. arr. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission of instructor.
Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling a professional ethics and accomplishing student learning goals. Course expenses paid by student. Assessed service-learning component.

GLOBE 495: Global Resource Systems Study Abroad Course Preparation
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor
Global resource systems topics will include the agricultural industries, climate, crops, culture, economics, food, geography, government, history, livestock, marketing, natural resources, public policies, soils, and preparation for travel to locations to be visited. Students enrolled in this course intend to register for Globe 494A, 496 or 497 the following term.

GLOBE 496: Global Resource Systems Study Abroad
Cr. 2-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
Extended field trips abroad to study global resource systems. Location and duration of trips will vary. Pre-trip sessions arranged through Globe 495. Trip expenses paid by student.
Meets International Perspectives Requirement.

GLOBE 497: Deans Global Ag and Food Leadership Program
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
An integrated agricultural and food production and policy program that allows students to assess, analyze and evaluate complex, country-specific situations and to develop their skills, knowledge and abilities via team-oriented projects that involve complex issues such as development of effective foreign food aid and agricultural and food production systems, drivers of world hunger, sustainable resource management and efficacy of policy, and the role of the USA and the United Nations and other development agencies in these systems. International location and duration of program will vary. Pre-trip sessions arranged through Globe 495. Trip expenses paid by students.
Meets International Perspectives Requirement.

GLOBE 499: Undergraduate Research
Cr. arr. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Research projects in collaboration with faculty.

Graduate Studies (GR ST)

Courses primarily for graduate students, open to qualified undergraduates:

GR ST 529: Preparing Publishable Thesis Chapters
(3-0) Cr. 3. S.
Prereq: Instructor permission
Reporting original research results within the norms for writing of a student's discipline. Emphasis on preparing thesis/dissertation chapters that will be both acceptable to the Graduate College and ready for submission to a refereed journal in the student's discipline. Focus on reporting student-generated data, norms for discourse within disciplines, and how thesis chapters differ from journal manuscripts.

GR ST 565: Responsible Conduct of Research in Science and Engineering
(1-0) Cr. 1. F.S.
Prereq: Graduate classification
Ethical and legal issues facing researchers in the sciences and engineering.

GR ST 566: Communications in Science
(0.5-0) Cr. 0.5. Alt. S., offered odd-numbered years.
Prereq: graduate classification
Reading and reviewing manuscripts; publishing papers; oral and poster presentations.

GR ST 567: Time Management and Mentoring
(0.5-0) Cr. 0.5. Alt. F., offered even-numbered years.
Prereq: graduate classification
Balancing life and career; mentoring; lab management.

GR ST 568: The Interview Process
(0.5-0) Cr. 0.5. Alt. S., offered odd-numbered years.
Prereq: graduate classification.
Applying and interviewing for academia, industry and government.

GR ST 569: Grant Writing
(1-0) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: at least two prior years of graduate classification.
Writing a winning proposal.

GR ST 570: Teaching Practices
(0.5-0) Cr. 0.5. Alt. S., offered even-numbered years.
Prereq: graduate classification.
Preparation of a teaching portfolio and course materials; lecturing, technology.

GR ST 585: Preparing Future Faculty Introductory Seminar
Cr. 2. F.
Prereq: One year of graduate course work; admission into PFF program
Introduction to faculty life issues such as hiring, tenure, teaching, and service at a variety of higher education institutions. Includes presentations from faculty at other institutions.

GR ST 586: Preparing Future Faculty Intermediate Seminar
Cr. 1-3. S.
Prereq: Admission into PFF program; completion of 585 or permission of instructor
Consideration of a wide range of faculty life issues. Includes topics such as higher education trends, diversity issues, learning styles, assessment, grant and proposal writing, and legal and ethical issues. Written components include job and teaching portfolios.

GR ST 587: Preparing Future Faculty Teaching Practicum
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor, GR ST 585, credit for or concurrent enrollment in GR ST 586
Students complete a stand-alone teaching assignment at Iowa State or another higher education institution. Written components include pedagogical documents.

GR ST 588: Preparing Future Faculty Special Topics
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor, GR ST 585, credit for or concurrent enrollment in GR ST 586
In-depth study of topic providing academic professional development.

Courses for graduate students:

GR ST 633: Summer Graduate Assistant
Cr. R. SS.
Only for students not registered in other courses in the summer term.

GR ST 680: Doctoral Post Prelim (Continuous) Registration
Cr. R. Repeatable.
Reserved for Ph.D. candidates only. See the Graduate College Handbook for specific requirements.

GR ST 681: Required Registration
Cr. 1. Repeatable. F.S.SS.
Required registration for graduate students when they have no mandatory classes left to take. Students need to register for Section A, B, or C. Offered on a satisfactory-fail basis only.

GR ST 681A: Required Registration: Doctoral Continuous Registration
Cr. 1. Repeatable, maximum of 6 times.
Prereq: Must have taken and passed preliminary oral exam.
Offered on a satisfactory-fail basis only. Credits may not count toward graduation.

GR ST 681B: Required Registration: Final Exam Only
Cr. 1. Repeatable, maximum of unlimited times.
Prereq: Completed all necessary program requirements to take final exam.
Offered on a satisfactory-fail basis only. This course cannot be used toward graduation.

GR ST 681C: Required Registration: Graduate Assistant Enrollment
Cr. 1. Repeatable, maximum of Unlimited times.
Prereq: Student needs to be a Graduate Assistant
Offered on a satisfactory-fail basis only. The course cannot count toward graduation.

GR ST 697: Curricular Practical Training
Cr. R. Repeatable. F.S.SS.
Professional work period.

Graphic Design (ARTGR)

Courses primarily for undergraduates:

ARTGR 270: Graphic Design Studio I
(0-6) Cr. 3. F.
Prereq: DSN S 102, DSN S 131 and enrollment in ARTGR 275; admission to the graphic design program through department review
Basic design concepts and color principles used for visual communication.

ARTGR 271: Graphic Design Studio II
(0-6) Cr. 3. S.
Prereq: ART 230, ARTGR 270, ARTGR 275 and enrollment in ARTGR 276
Principles of typographic composition, structure and hierarchy. Formal and conceptual principles of symbology.

ARTGR 272: Digital Photography for Graphic Design
(0-6) Cr. 3. F.S.
Prereq: Concurrent enrollment in ARTGR 270 OR ARTGR 271
This course will address the development of "seeing" as a medium design, expression, and visual communication including compositional dynamics, advanced digital image manipulation, software usage and support, digital camera operations along with scanning and other digital input devices, color management, digital format for presentation and printing with digital ready formats.

ARTGR 275: Graphic Technology I
(0-4) Cr. 2. F.
Prereq: concurrent enrollment in ARTGR 270
Basic 2-dimensional computer skills for graphic design.

ARTGR 276: Graphic Technology II
(1-2) Cr. 2. S.
Prereq: ARTGR 275 and concurrent enrollment in ARTGR 271
Basic 3-dimensional computer skills for graphic design.

ARTGR 281: Visual Communication and Branding
(3-0) Cr. 3. F.
Introduction to basic principles of visual communication that contribute to the successful comprehension of intended visual messages; these include promotional messages, such as corporate branding and marketing campaigns, as well as informational messages, such as those used in computer interface design or in the clear presentation of diagrammatic data. Emphasis is placed on sensitivity to the diversity of the intended American or global audience, and to the cross-cultural differences that may affect the ways that visual messages are interpreted. Methods for creating brand experiences are explored as they apply to both small and large enterprises, ranging from personal brand to corporate brand identities.

ARTGR 370: Graphic Design Studio III
(0-6) Cr. 3. F.
Prereq: ARTGR 271, ARTGR 276, and credit or concurrent enrollment in ARTGR 387
Creation and design of images and symbols for communication. Application and integration of typography with images and symbols.

ARTGR 371: Graphic Design Studio IV
(0-6) Cr. 3. S.
Prereq: ARTGR 370 and ARTGR 387
Development and preparation of design concepts for application to the printing and electronic publishing process. Creative problem-solving skills, introduction to systems design.

ARTGR 372: Graphic Design Materials and Processes
(3-0) Cr. 3. S.
Prereq: Credit or concurrent enrollment in ARTGR 371
Lecture about the processes and materials involved in graphic design arts reproduction. Course covers pre-press, paper selection and specification, ink systems, type systems and fonts, output technology, printing presses and bindery operations.

ARTGR 377: Graphic Design Internship Seminar
(1-0) Cr. 1. S.
Prereq: Credit or concurrent enrollment in ARTGR 370 or ARTGR 371
Procedural and ethical concerns related to the graphic design internship. Personal goals, preparation of resume and plans for internship. Study and tours of areas of interest within the graphic design profession.

ARTGR 378: Critical Issues in Graphic Design
(2-0) Cr. 2.
Prereq: Credit or concurrent enrollment in ARTGR 370
Lecture, discussion and writing about the critical issues facing the communications field today and in the future.

ARTGR 387: Graphic Design History/Theory/ Criticism I
(Dual-listed with ARTGR 587). (3-0) Cr. 3. F.
Late nineteenth century to the 1990s. This course will explore the cultural, social, political, industrial, and technological forces that have influenced the practice of graphic design in Britain, Europe, and the United States. Students will study the historical issues and problems facing designers, their clients, and their publics.

ARTGR 388: Graphic Design History/Theory/ Criticism II
(Dual-listed with ARTGR 588). (3-0) Cr. 3. S.
Critical issues that affect the contemporary practice of graphic design as it relates to the United States. Students will study a variety of issues that include, but are not exclusive to, new media, gender, class, design and the public sphere, design as social action, postmodern design theory, sustainability, and ethical practice.
Meets U.S. Diversity Requirement

ARTGR 391: Graphic Design Field Study
(0-1) Cr. 1. Repeatable, maximum of 2 credits.
Prereq: Concurrent enrollment in 300 or 400 level graphic design studio course
Travel, study, and tours of areas of interest within the graphic design profession such as print production companies, design studios, and museums. Offered on a satisfactory-fail basis only.

ARTGR 463: 3D Motion Graphics
(Dual-listed with ARTGR 563). (0-6) Cr. 3. S.
Prereq: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470
3D visualization in a Motion Graphics context. Emphasis on design in 3D computer animation as it relates to various electronic media.

ARTGR 464: Digital Imaging
(Dual-listed with ARTGR 564). (0-6) Cr. 3. F.
Prereq: Concurrent enrollment in ARTGR 370, ARTGR 371 or ARTGR 470.
Studio in experimental techniques using the digital drawing tablet combined with manual drawing mediums, exploring the digital tablet, scanner, and camera as ways to collect and make images, conceptual and compositional development of digital techniques and software, and connecting digital techniques to visual processes and ideation. Students will have a better understanding of different ways of working digitally while exploring image-making processes.

ARTGR 470: Graphic Design Studio V
(0-6) Cr. 3. F.
Prereq: ARTGR 371
Advanced design systems as applied to corporate identity and environmental graphic design. Symbology as an integrated component of communication systems.

ARTGR 471: Graphic Design Capstone
(0-6) Cr. 3. S.
Prereq: ARTGR 470 or permission of instructor
Experience design and innovation in a multi-disciplinary design studio. Class will use unique research, design, evaluation, creativity, and innovation methodologies to solve human problems on special topics. Designed solutions will be in the form of products, artifacts, interfaces, information, and human environments.

ARTGR 472: Photography and Narrative Message
(Dual-listed with ARTGR 572). (0-6) Cr. 3.
Prereq: Enrollment in ARTGR 370, ARTGR 371, ARTGR 470, or ARTGR 471
Photography as a tool for creating conceptually-driven images and metaphors. Emphasis is on photography as an evocative storytelling device for a range of audiences and design applications. Compositional and technical aspects are explored to ensure successful interpretation of the photograph's intended message.

ARTGR 473: Multimedia Design
(Dual-listed with ARTGR 573). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470 Graduate: graduate enrollment in College of Design
The design of visual, aural and textual communication for electronic media.

ARTGR 474: Exhibition Design
(Dual-listed with ARTGR 574). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470 Graduate: graduate enrollment in College of Design
Visual communication applied to exhibition design focusing on educational or interactive museum exhibitions, trade show booth design, and modular unit design for traveling exhibitions. Translation of graphic information to a three-dimensional space.

ARTGR 475: Advanced Typography
(Dual-listed with ARTGR 575). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470 Graduate: graduate classification in College of Design
Typographic theory exploring traditional and non-traditional forms, both historical and contemporary typographic achievements.

ARTGR 476: Graphic Design Methodology
(Dual-listed with ARTGR 576). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371 or ARTGR 470 Graduate: graduate enrollment in College of Design
Analysis and application of scientific, systematic, and non-traditional problem-solving and problem-seeking techniques.

ARTGR 477: Graphic Design Practicum
(0-6) Cr. 3.
Prereq: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470
Graphic design outreach and problem solving. Individual and group projects for non-profit clients selected by the instructor.

ARTGR 478: Design for E-Commerce/Graphic Applications
(Dual-listed with ARTGR 578). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470. Graduate: Graduate enrollment in College of Design
The development of advanced and experimental web design for the applications of e-commerce, education and the communication of visual information.

ARTGR 479: Wayfinding Design
(Dual-listed with ARTGR 579). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470. Graduate: Graduate enrollment in College of Design
Study of the navigational challenges of built environments and outdoor spaces, including site analysis, development of navigational plans, and design of wayfinding sign systems. Issues of function, accessibility, legibility, and fabrication are considered.

ARTGR 480: Graphic Design Internship
(3-0) Cr. 3. SS.
Prereq: ARTGR 377, 12 credits in graphic design; permission of instructor, registration in advance of enrollment
Graphic design experience in an off-campus professional environment.

ARTGR 481: Graphic Design Professional Practices
(3-0) Cr. 3. S.
Prereq: Credit or concurrent enrollment in ARTGR 470
Professional design management: ethics, setting up a new business, client/designer relationships, contractual options, billing practices, and effective operating procedures.

ARTGR 482: Professional Presentation
(0-4) Cr. 2. S.
Prereq: ARTGR 470 and concurrent enrollment in ARTGR 471
Exploration and development of the graphic design portfolio and resume in electronic, print, and photographic form.

ARTGR 484: Selected Studies in Graphic Design
(Dual-listed with ARTGR 584). Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Graduate classification in the College of Design
Special issues related to graphic design. Topics vary each time offered.

ARTGR 490: Independent Study
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTGR 490A: Independent Study: Theory, Criticism, and Methodology
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTGR 490B: Independent Study: Two-Dimensional Design
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTGR 490C: Independent Study: Three-Dimensional Design
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTGR 490H: Independent Study: Honors
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTGR 490I: Internship/Cooperative (in-depth experience other than ArtGr 480)
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTGR 491: Publication Design: Magazines
(Dual-listed with ARTGR 591). (0-6) Cr. 3.
Prereq: Graduate enrollment in College of Design
The philosophy, concepts and structures of magazine design.

ARTGR 492: Publication Design: Books
(Dual-listed with ARTGR 592). (0-6) Cr. 3.
Prereq: Graduate enrollment in College of Design
The philosophy, concepts and structures of book design.

ARTGR 493: Workshop
Cr. 1-3. Repeatable.
Prereq: Evidence of satisfactory experience in area of specialization
Intensive 2 to 4 week studio exploration. Topics vary each time offered.

ARTGR 494: Graphic Design in Europe Seminar
(1-0) Cr. 1.
Prereq: Permission of instructor and planned enrollment in ARTGR 495.
Cultural and historical aspects of art and design in Western Europe in preparation for study abroad. Area of study varies each time offered. Offered on a satisfactory-fail basis only.

ARTGR 495: Graphic Design in Europe
(Dual-listed with ARTGR 595). Cr. 3. SS.
Prereq: ARTGR 494, permission of instructor
International study abroad program in western Europe. Visits to design studios, art museums, and educational facilities.

ARTGR 496: Graphic Design Field Study
Cr. R. Repeatable.
Prereq: Concurrent enrollment in a graphic design studio and permission of instructor.
Study and tours of museums, galleries, artist and/or designer studios and other areas of interest within art and design. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

ARTGR 563: 3D Motion Graphics
(Dual-listed with ARTGR 463). (0-6) Cr. 3. S.
Prereq: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470
3D visualization in a Motion Graphics context. Emphasis on design in 3D computer animation as it relates to various electronic media.

ARTGR 564: Digital Imaging
(Dual-listed with ARTGR 464). (0-6) Cr. 3. F.
Prereq: Concurrent enrollment in ARTGR 370, ARTGR 371 or ARTGR 470.
Studio in experimental techniques using the digital drawing tablet combined with manual drawing mediums, exploring the digital tablet, scanner, and camera as ways to collect and make images, conceptual and compositional development of digital techniques and software, and connecting digital techniques to visual processes and ideation. Students will have a better understanding of different ways of working digitally while exploring image-making processes.

ARTGR 570: Advanced Studies in Visual Communication
(0-6) Cr. 3. F.
Prereq: Graduate classification in College of Design
Theory and investigation of systems, structures, principles of visual organization, and typography for communication. Studio problems will be influenced by social, cultural, environmental, or technological factors.

ARTGR 571: Signs, Symbols, Images
(0-6) Cr. 3. S.
Prereq: Graduate Classification in College of Design
Investigation and application of signs, symbols and semiotic theory for communication. Studio problems influenced by social, cultural, environmental, or technological factors.

ARTGR 572: Photography and Narrative Message
(Dual-listed with ARTGR 472). (0-6) Cr. 3.
Prereq: Enrollment in ARTGR 370, ARTGR 371, ARTGR 470, or ARTGR 471
Photography as a tool for creating conceptually-driven images and metaphors. Emphasis is on photography as an evocative storytelling device for a range of audiences and design applications. Compositional and technical aspects are explored to ensure successful interpretation of the photograph's intended message.

ARTGR 573: Multimedia Design
(Dual-listed with ARTGR 473). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470 Graduate: graduate enrollment in College of Design
The design of visual, aural and textual communication for electronic media.

ARTGR 574: Exhibition Design
(Dual-listed with ARTGR 474). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470 Graduate: graduate enrollment in College of Design
Visual communication applied to exhibition design focusing on educational or interactive museum exhibitions, trade show booth design, and modular unit design for traveling exhibitions. Translation of graphic information to a three-dimensional space.

ARTGR 575: Advanced Typography
(Dual-listed with ARTGR 475). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470 Graduate: graduate classification in College of Design
Typographic theory exploring traditional and non-traditional forms, both historical and contemporary typographic achievements.

ARTGR 576: Graphic Design Methodology
(Dual-listed with ARTGR 476). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371 or ARTGR 470 Graduate: graduate enrollment in College of Design
Analysis and application of scientific, systematic, and non-traditional problem-solving and problem-seeking techniques.

ARTGR 578: Design for E-Commerce/Graphic Applications
(Dual-listed with ARTGR 478). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470. Graduate: Graduate enrollment in College of Design
The development of advanced and experimental web design for the applications of e-commerce, education and the communication of visual information.

ARTGR 579: Wayfinding Design
(Dual-listed with ARTGR 479). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470. Graduate: Graduate enrollment in College of Design
Study of the navigational challenges of built environments and outdoor spaces, including site analysis, development of navigational plans, and design of wayfinding sign systems. Issues of function, accessibility, legibility, and fabrication are considered.

ARTGR 584: Selected Studies in Graphic Design
(Dual-listed with ARTGR 484). Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Graduate classification in the College of Design
Special issues related to graphic design. Topics vary each time offered.

ARTGR 587: Graphic Design History/Theory/ Criticism I
(Dual-listed with ARTGR 387). (3-0) Cr. 3. F.
Late nineteenth century to the 1990s. This course will explore the cultural, social, political, industrial, and technological forces that have influenced the practice of graphic design in Britain, Europe, and the United States. Students will study the historical issues and problems facing designers, their clients, and their publics.

ARTGR 588: Graphic Design History/Theory/ Criticism II
(Dual-listed with ARTGR 388). (3-0) Cr. 3. S.
Critical issues that affect the contemporary practice of graphic design as it relates to the United States. Students will study a variety of issues that include, but are not exclusive to, new media, gender, class, design and the public sphere, design as social action, postmodern design theory, sustainability, and ethical practice.
Meets U.S. Diversity Requirement

ARTGR 589: Design and Ethics
(Cross-listed with HCI). (3-0) Cr. 3. F.S.
Prereq: Graduate classification or permission of instructor.
Issues in ethics and decision-making as they relate to technology, design, design research, HCI, and the design industry.

ARTGR 590: Special Topics
Cr. arr.
Prereq: Bachelor's degree in graphic design, or evidence of satisfactory equivalency in specialized area
Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTGR 590A: Special Topics: Theory, Criticism, and Methodology
Cr. arr.
Prereq: Bachelor's degree in graphic design, or evidence of satisfactory equivalency in specialized area
Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTGR 590B: Special Topics: Two-Dimensional Design
Cr. arr.
Prereq: Bachelor's degree in graphic design, or evidence of satisfactory equivalency in specialized area
Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTGR 590C: Special Topics: Three-Dimensional Design
Cr. arr.
Prereq: Bachelor's degree in graphic design, or evidence of satisfactory equivalency in specialized area
Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTGR 591: Publication Design: Magazines
(Dual-listed with ARTGR 491). (0-6) Cr. 3.
Prereq: Graduate enrollment in College of Design
The philosophy, concepts and structures of magazine design.

ARTGR 592: Publication Design: Books
(Dual-listed with ARTGR 492). (0-6) Cr. 3.
Prereq: Graduate enrollment in College of Design
The philosophy, concepts and structures of book design.

ARTGR 593: Workshop
Cr. 1-3. Repeatable.
Prereq: Graduate classification; evidence of satisfactory experience in area of specialization
Intensive 2 to 4 week studio exploration. Topics vary each time offered.

ARTGR 595: Graphic Design in Europe
(Dual-listed with ARTGR 495). Cr. 3. SS.
Prereq: ARTGR 494, permission of instructor
International study abroad program in western Europe. Visits to design studios, art museums, and educational facilities.

ARTGR 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

ARTGR 611: Teaching in Higher Education and Design Practice
(3-0) Cr. 3.
Prereq: Graduate classification
Introduction to teaching methods, curriculum design, project development, and business strategies for Design Education and Professional Practice.

ARTGR 672: Graphic Design and Human Interaction
(0-6) Cr. 3. F.S.
Prereq: ARTGR 570, ARTGR 571, and graduate enrollment in College of Design or permission of instructor
The theory and investigation of experience design as it applies to human interactions in contemporary society and culture. Studio problems may involve such areas as: exhibition design, electronic interface design, wayfinding, package design, and publication design.

ARTGR 672A: Usability
(0-6) Cr. 3.
Prereq: ARTGR 570, ARTGR 571, and graduate enrollment in College of Design or permission of instructor
The exploration and design of interface/interaction with products, systems, and technologies.

ARTGR 672B: Design for Behavioral Change.
(0-6) Cr. 3.
Prereq: ARTGR 570, ARTGR 571, and graduate enrollment in College of Design or permission of instructor
The exploration and design of educational experiences and artifacts as they relate to the social, emotional, and behavioral aspects of society.

ARTGR 672C: Consumer Experience Design and Branding.
(0-6) Cr. 3.
Prereq: ARTGR 570, ARTGR 571, and graduate enrollment in College of Design or permission of instructor
The theory and investigation of experience design as it applies to human interactions in contemporary society and culture. Studio problems may involve such areas as: exhibition design, electronic interface design, wayfinding, package design, and publication design.

ARTGR 690: Advanced Topics
Cr. arr. Repeatable.

ARTGR 698: Current Issues in Graphic Design
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: Graduate enrollment in College of Design or permission of instructor
Selected issues in contemporary graphic design. Topics and readings vary each time offered.

ARTGR 699: Research-Thesis
Cr. arr. Repeatable.

Greek (GREEK)

Courses primarily for undergraduates:

GREEK 101: Elementary Ancient and New Testament Greek I
(5-0) Cr. 5. F.
Grammar and vocabulary of ancient Greek, within the context of Greek culture; reading knowledge through texts adapted from classical and New Testament works.

GREEK 102: Elementary Ancient and New Testament Greek II
(5-0) Cr. 5. S.
Prereq: GREEK 101
Grammar and vocabulary of ancient Greek, within the context of Greek culture; reading knowledge through texts adapted from classical and New Testament works.
Meets International Perspectives Requirement.

GREEK 201: Intermediate Classical Greek
Cr. arr. F.
Prereq: GREEK 102
Emphasis on grammatical principles, composition and reading classical or Hellenistic texts.
Meets International Perspectives Requirement.

GREEK 332: Introduction to Classical Greek Literature
Cr. arr. S.
Prereq: GREEK 201
Readings in ancient Greek Literature with emphasis on critical analysis of style, structure or thought.
Meets International Perspectives Requirement.

GREEK 490: Independent Study
Cr. 1-6. Repeatable, maximum of 9 credits.
Prereq: 6 credits in Greek and permission of department chair
Designed to meet the needs of students who seek work in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. No more than 9 credits of Greek 490 may be counted toward graduation.

Health Studies (H S)

Courses primarily for undergraduates:

H S 105: First Aid and Emergency Care
(1-2) Cr. 2. F.S.SS.
Discussion and application of the basic techniques of utilizing bloodborne pathogen safety measures, administering first aid and cardiopulmonary resuscitation. ARC layperson certification available.

H S 110: Personal and Consumer Health
(3-0) Cr. 3. F.S.
Physical, mental, emotional and social aspects of health as a basis for understanding and promoting health, and preventing poor health conditions. Study of personal responsibility on the long-term benefits of maintaining a high level of wellness and health. Identification and mitigation of negative lifestyle habits.

H S 215: Drug Education
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101 or PSYCH 230
Discussion of use, abuse and addiction of mood modifying substances in contemporary society. Includes study of tobacco, alcohol, and other drugs.

H S 275: Health Education in the Elementary School
(3-0) Cr. 3. F.S.
Prereq: HD FS 102 or HD FS 226
The application of instructional strategies related to health education and physical education for teachers at the elementary level. Credit for both H S 275 and 375 may not be applied toward graduation.

H S 285: Pre-Internship in Kinesiology and Health
(Cross-listed with KIN). Cr. 1-2. F.S.SS.
Prereq: Kinesiology and Health major and permission of internship coordinator
Pre-internship experience with a health or fitness organization based on option. Offered on a satisfactory-fail basis only.

H S 305: Instructor's First Aid and Cardio-pulmonary Resuscitation
(1-2) Cr. 2. F.S.
Prereq: H S 105
Discussion and practice of skills needed to teach first aid and cardiopulmonary resuscitation. ARC certification available.

H S 310: Community and Public Health
(3-0) Cr. 3. F.S.
Prereq: H S 110
Introduction to community health problems, programs of prevention, environmental health agencies, and health services. Study of local, state, and national community health agencies, their purposes and functions.

H S 350: Human Diseases
(3-0) Cr. 3. F.S.SS.
Prereq: H S 110 and BIOL 255, BIOL 256
Discussion of disease process and ill-health in the twentieth century. Emphasis on epidemiology, prevention, treatment, and the understanding of the etiology of communicable and noncommunicable diseases.

H S 375: Teaching-Learning Process in Health Education
(3-0) Cr. 3. F.
Prereq: H S 105, H S 110, H S 215
Principles, methods, materials, and resources involved in the teaching of health. Includes organization and development of the health education curriculum (K-12). Credit for both H S 275 and 375 may not be applied toward graduation.

H S 380: Worksite Health Promotion
(3-0) Cr. 3. F.S.
Prereq: KIN 258, KIN 366
The design and implementation of worksite health promotion programs and the benefits these programs have for both employees and employers. Review of various health risk appraisals and planning theory-based incentive programs designed to promote positive lifestyles.

H S 385: Strategies for Professional School and Field Experience Opportunities
(Cross-listed with KIN). Cr. 0.5. F.S.
Prereq: Junior classification; to be taken minimum of two semesters prior to graduation or field experience placement.
Search techniques and preparation of relevant material for work and/or professional school admission. Information specifically related to health care and kinesiology fields. Field experience process and procedures will be reviewed.

H S 390: Administration of the School Health Program
(3-0) Cr. 3. F.
Prereq: H S 310
History and legal basis of school health programs. Procedures for developing, organizing, administering, and evaluating a modern program of health services, healthful school living, and health instruction. Includes administration, community and school relationships.

H S 417: Supervised Teaching in Health Education in the Secondary School
Cr. 12. F.S.
Prereq: H S 375
Advance registration required.

H S 417A: Supervised Teaching in Health Education in the Secondary School: Initial Endorsement
Cr. 16. F.S.
Prereq: H S 375
Students must be fully admitted to Teacher Education and must apply for approval to enroll at the beginning of the semester prior to registering.

H S 417B: Supervised Teaching in Health Education in the Secondary School: Additional Endorsement
Cr. arr. F.S.
Prereq: H S 375
Students must be fully admitted to Teacher Education and must apply for approval to enroll at the beginning of the semester prior to registering.

H S 430: Community Health Program Development
(3-0) Cr. 3. F.
Prereq: H S 380
Techniques of needs assessment, program design, administration, and evaluation of community health education programs in various settings.

H S 464: Physical Activity Epidemiology
(Dual-listed with H S 564). (3-0) Cr. 3. S.
Prereq: KIN 358 or H S 350; STAT 101 or STAT 401
Understanding health benefits of physical activity on chronic disease prevention and health promotion throughout the life span, from clinical and public health perspectives. Discussion and application of real-life physical activity assessment, research, guidelines, and promotion in population levels.

H S 485: Directed Field Experience in Health Promotion
Cr. 8-16.
Prereq: All required health studies courses and permission of coordinator
Advance registration required. Supervised experience in health promotion field. Offered on a satisfactory-fail basis only.

H S 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in health studies and permission of coordinator

Courses primarily for graduate students, open to qualified undergraduates:

H S 564: Physical Activity Epidemiology
(Dual-listed with H S 464). (3-0) Cr. 3. S.
Prereq: KIN 358 or H S 350; STAT 101 or STAT 401
Understanding health benefits of physical activity on chronic disease prevention and health promotion throughout the life span, from clinical and public health perspectives. Discussion and application of real-life physical activity assessment, research, guidelines, and promotion in population levels.

Higher Education (HG ED)

Courses primarily for graduate students, open to qualified undergraduates:

HG ED 504: History of Higher Education in the United States
(3-0) Cr. 3.
Prereq: Graduate classification
Survey course in the history of higher education in the United States, from the colonial era to the present. Emphasis is placed on enduring debates about the purpose(s) of higher education and issues of equity and access along lines of race, class, and gender. Readings include primary and secondary materials.

HG ED 540: Foundations of Leadership: Learning, Ethics, Self and Interaction
(2-0) Cr. 2. F.
Prereq: permission of instructor
Serving as an introduction to developing practicing leaders, this course will create the foundation upon which enduring understanding of leadership will be built. Specifically explored will be learning as the foundation of human enterprise, everyday leadership, determination of common good, roots of individual's actions, sensitivity to others, merits of divergent ideas, questioning the status quo, ethics as personal responsibility and choosing to grow.

HG ED 541: Learning, Leadership, Ethics and Community
(2-0) Cr. 2. S.
Prereq: permission of instructor
Serving as the second semester in a program to develop practicing leaders, this course will build upon the foundation started first semester to help students embrace the enduring understandings of leadership. Specifically explored will be team learning and the effect on individuals, skills required for a team to move forward, importance of decisions based on the good of the community, reflection as a means of enhancing learning, and interconnectedness of the individual, the community, and the world.

HG ED 542: Learning, Leadership, Ethics, and Teams; Knowing, Doing and Being
(2-0) Cr. 2. F.
Prereq: permission of instructor
The overall purpose of this course is to expand the foundation started in Foundations of Leadership: Learning, Ethics, Self and Interactions and Learning, Leadership, Ethics and Community for developing practicing leadership. The focus will shift from a naive understanding of the concepts of self within a team and community to a more sophisticated understanding of knowing, being and doing leadership.

HG ED 543: Learning, Leadership, Ethics and Teams in Action
(2-0) Cr. 2. S.
Prereq: permission of instructor
The purpose of this last (in a series of four) course is to allow students to put their knowledge, skills, and abilities related to leadership, learning, Ethics and Teams into practice. In addition to planning and implementing a major service learning project, the focus will be on the next wave of the study of leadership - connecting leadership to the research about the brain and human learning.

HG ED 544: Foundations of Leadership & Learning
(3-0) Cr. 3. F.
Prereq: graduate student classification
First of two-course series to help leaders develop the knowledge and skills to engage the collective capacity of a group to think, learn, and achieve important purpose. The foundation for developing deep understanding about leadership, learning, and the relationships therein. Focus on application of recent knowledge about human learning in the professional practice of leadership. Relationship leadership model and relationship to other leadership models, theories, and concepts; current theories of human learning (including expert/novice and transfer of learning), and interrelationships with leadership practice; critical understanding of self; facilitating learning for others; metacognition as a habit of mind; fundamentals of group interaction theories; social interdependence, communication, trusting, trustworthy goals, decision-making, cohesion, controversy, team development; power, resources, and development of community.

HG ED 545: Connecting Leadership & Learning in Practice
(3-0) Cr. 3. F.
Prereq: Graduate student classification and completion of HG Ed 544
Second of a two-course series designed to help leaders develop the knowledge and skills to best engage the collective capacity of a group to think, learn and achieve important purpose. Builds on foundation course to support students in creating applications of the relationships between leadership and learning. Focus on developing the habits of mind and habits of practice to best use knowledge about human learning in the professional practice of leadership. Applications of relational leadership model; applications of group interaction theories; development and implementation of action plans to achieve measurable goals; application of current theories of human learning as they relate to leadership; exploration of the fundamentals of emotional intelligence and the impacts on leadership; developing critical habits of mind to practice leadership focused on learning.

HG ED 550: Teaching, Learning and Leadership
(3-0) Cr. 3. F.
Prereq: Teacher licensure
Current issues and practices in community college teaching and learning, and the roles and responsibilities of teachers as leaders.

HG ED 561: College Teaching
(3-0) Cr. 3.
Prereq: 6 graduate credits
Educational theories, methods and strategies for the improvement of college instruction. Assist potential college instructors in developing knowledge of protocol, assessment, and the scholarship and art of teaching. Emphasis on the unique challenge of college teaching in a changing student population environment.

HG ED 562: Curriculum Development in Colleges
(3-0) Cr. 3.
Prereq: Graduate classification
Modes of curriculum design, development, and change in colleges. Development of curricular leadership and evaluation strategies.

HG ED 568: Global Education Policy Analysis
(3-0) Cr. 3.
Prereq: HG ED 504
Assessment of global education policy issues in education. Analysis of policies, implementation strategies, and policy outcomes.

HG ED 570: Current Topics in Student Affairs
Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in student affairs practice. Topics developed to the specific needs of student affairs professionals. Primarily for off-campus.

HG ED 570D: Current Topics in Student Affairs: Residential Life
Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in student affairs practice. Topics developed to the specific needs of student affairs professionals. Primarily for off-campus.

HG ED 570G: Current Topics in Student Affairs: Student Affairs Institute
Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in student affairs practice. Topics developed to the specific needs of student affairs professionals. Primarily for off-campus.

HG ED 570H: Current Topics in Student Affairs: Student Diversity
Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in student affairs practice. Topics developed to the specific needs of student affairs professionals. Primarily for off-campus.

HG ED 573: Equity, Diversity, and Inclusion in Student Affairs
(3-0) Cr. 3. F.S.
Prereq: Graduate Standing
Explores theories of equity, diversity, and inclusion to build knowledge and skills related to multicultural competence in student affairs practice.

HG ED 574: Student Affairs Practice in Higher Education
(3-0) Cr. 3. F.
Prereq: Graduate classification, admission to Higher Education Program
Introduction to the profession of Student Affairs in higher education. Survey of readings, learning artifacts, and class discussions of topics related to the student affairs profession. History, philosophical underpinnings, values, ethics, and standards espoused, as well as the concepts of learning and community development.

HG ED 575: Organization and Administration of Student Affairs
(3-0) Cr. 3. S.
Prereq: Admission to Higher Education Program, HG ED 574
Topics concerned with the organization and administration of student affairs in higher education. The course surveys organizational and administrative aspects of student affairs within the broader context of postsecondary education with particular attention paid to organizational development, budget and finance, and law and policy.

HG ED 576: Student Development in Higher Education
(3-0) Cr. 3. F.
Prereq: Admission to Higher Education Program
Theories of student and adult development and their applications in student affairs programs, services, and activities are reviewed. Emphasis is placed on theories exploring psychosocial, cognitive, moral, and social identity development as well as on integrated theories of development.

HG ED 577: Campus Environments and Cultures
(3-0) Cr. 3. F.
Prereq: Admission to Higher Education Program
Study of the impact of the college environment on students and use of environmental theory to create positive learning situations for students.

HG ED 578: Students in American Higher Education
(3-0) Cr. 3. F.
Prereq: Admission to Higher Education Program
The relationship between college students and characteristics from 1950 to the present. Traditional assumptions about the impact of higher education on students will be reviewed and challenged. Campus issues and concerns relative to commuters and residential life. Participants will analyze institutional responses to students through college missions, organizational development, structure, core curriculum and retention.

HG ED 579: Advising and Helping Skills
(3-0) Cr. 3. F.
Prereq: HG ED 574, HG ED 576
Development of effective, basic counseling skills. Understanding of group dynamics. Ability to work effectively in groups.

HG ED 580: Current Topics in Community Colleges
(1-3) Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in community college education. Topics developed to the specific needs of colleges. For off-campus.

HG ED 580A: Current Topics in Community Colleges: Student Needs
(1-3) Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in community college education. Topics developed to the specific needs of colleges. For off-campus.

HG ED 580B: Current Topics in Community Colleges: General and Liberal Education
(1-3) Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in community college education. Topics developed to the specific needs of colleges. For off-campus.

HG ED 580C: Current Topics in Community Colleges: Counseling and Advising
(1-3) Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in community college education. Topics developed to the specific needs of colleges. For off-campus.

HG ED 580D: Current Topics in Community Colleges: Adult and Continuing Education
(1-3) Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in community college education. Topics developed to the specific needs of colleges. For off-campus.

HG ED 580E: Current Topics in Community Colleges: Development and Remedial Education
(1-3) Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in community college education. Topics developed to the specific needs of colleges. For off-campus.

HG ED 580F: Current Topics in Community Colleges: Student Services
(1-3) Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in community college education. Topics developed to the specific needs of colleges. For off-campus.

HG ED 580G: Current Topics in Community Colleges: Faculty and Staff Evaluation
(1-3) Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in community college education. Topics developed to the specific needs of colleges. For off-campus.

HG ED 580H: Current Topics in Community Colleges: Organization and Administration
(1-3) Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in community college education. Topics developed to the specific needs of colleges. For off-campus.

HG ED 580I: Current Topics in Community Colleges: Learning and Teaching
(1-3) Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in community college education. Topics developed to the specific needs of colleges. For off-campus.

HG ED 580J: Current Topics in Community Colleges: Human Relations
(1-3) Cr. 1-3.
Prereq: Graduate classification
Current issues and new directions in community college education. Topics developed to the specific needs of colleges. For off-campus.

HG ED 582: The Comprehensive Community College
(3-0) Cr. 3.
Prereq: Graduate classification
The community college as a unique social and educational institution: its history, philosophy, functions, programs, faculty and student characteristics, organization and finance, trends, and issues. Reviews current research and exemplary community college practices internationally, nationally, and in Iowa.

HG ED 590: Special Topics
Cr. 1-4.
Prereq: 9 credits in education
Independent study on specific topics arranged with an instructor.

HG ED 590A: Special Topics: Student Services
Cr. 1-4.
Prereq: 9 credits in education
Independent study on specific topics arranged with an instructor.

HG ED 590B: Special Topics: Community Colleges
Cr. 1-4.
Prereq: 9 credits in education
Independent study on specific topics arranged with an instructor.

HG ED 590C: Special Topics: Current Issues
Cr. 1-4.
Prereq: 9 credits in education
Independent study on specific topics arranged with an instructor.

HG ED 590D: Special Topics: International Higher Education
Cr. 1-4.
Prereq: 9 credits in education
Independent study on specific topics arranged with an instructor.

HG ED 590E: Special Topics: Federal and State Affairs
Cr. 1-4.
Prereq: 9 credits in education
Independent study on specific topics arranged with an instructor.

HG ED 590F: Special Topics: Law in Higher Education
Cr. 1-4.
Prereq: 9 credits in education
Independent study on specific topics arranged with an instructor.

HG ED 590G: Special Topics: Institutional Research
Cr. 1-4.
Prereq: 9 credits in education
Independent study on specific topics arranged with an instructor.

HG ED 591: Supervised Field Experience
Cr. 1-4. Repeatable.
Prereq: 9 credits graduate work
Supervised on-the-job field experience.

HG ED 593: Workshops
Cr. 1-5. Repeatable.
Prereq: 15 credits in education

HG ED 598: Capstone Seminar
(3-0) Cr. 3. S.
Advanced students will demonstrate their preparedness to progress student affairs field as educators who are able to apply concepts and formal (and informal) theories addressed in previous course and fieldwork to their professional student affairs thinking and practices.

HG ED 599: Creative Component
Cr. arr.
Prereq: 9 credits in education

Courses for graduate students:

HG ED 615: Seminars in Higher Education
Cr. 1-4.

HG ED 615A: Seminars in Higher Education: Student Services
Cr. 1-4.

HG ED 615B: Seminars in Higher Education: Community Colleges
Cr. 1-4.

HG ED 615C: Seminars in Higher Education: Current Issues
Cr. 1-4.

HG ED 615D: Seminars in Higher Education: International Higher Education
Cr. 1-4.

HG ED 615E: Seminars in Higher Education: Federal and State Affairs
Cr. 1-4.

HG ED 615F: Seminars in Higher Education: Law in Higher Education
Cr. 1-4.

HG ED 615G: Seminars in Higher Education: Institutional Research
Cr. 1-4.

HG ED 615H: Seminars in Higher Education: Research Designs in Higher Education
Cr. 1-4.

HG ED 664: College Organization and Administration
(3-0) Cr. 3. F.
Administrative organization and behavior: communications, leadership, finance, strategic planning, and institutional governance.

HG ED 665: Financing Higher Education
(3-0) Cr. 3. S.
Lectures, discussions, and individual investigation relating to financial administration in colleges and universities. Budgeting, auxiliary enterprises, administration of financial planning, fund raising, examination of theories on expenditures. Designed for persons aspiring to serve as college administrators.

HG ED 666: Academic Issues and Cultures
(3-0) Cr. 3. S.
Examination of institutional culture and issues in higher education focusing on the roles and responsibilities of faculty and academic administrators.

HG ED 676: Student Development Theory II
(3-0) Cr. 3. S.
Prereq: HG ED 576
An examination of social identity theories including those exploring race, ethnicity, gender, class, ability, sexuality, and spirituality. An exploration of how social identity is influenced by the dynamics of power and oppression in education and society and how to enhance the college experiences of students from diverse backgrounds.

HG ED 690: Advanced Special Topics
Cr. 1-4. Repeatable.
Prereq: 9 credits in education

HG ED 699: Research
Cr. arr. Repeatable.
Prereq: 9 credits in education

Historical, Philosophical, and Comparative Studies in Education (H P C)

H P C : Student Teaching: Social Studies-Middle School
Cr. arr.

H P C 504: Studies in the Foundations of Education in the United States
(3-0) Cr. 3. SS.
Prereq: Admission to graduate licensure program in teacher education or permission of instructor
Introduction to the historical and contemporary landscape of schooling in the United States. Emphasis is placed on topics and tensions in the relationship between school and society (e.g. equity of access to education and competing purposes of education) and the implications of these topics and tensions for teaching and learning in public schools. Designed for students in a graduate licensure program.

H P C 581: Philosophy of Education
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Introduction to Western philosophy of education. Emphasis is placed on enduring debates about the purposes(s) of education in a just society. Readings include classic and contemporary texts.

H P C 582: History of Education in the United States
(3-0) Cr. 3.
Prereq: Graduate classification
Survey course in the history of education in the United States, from the colonial era to the present. Emphasis is placed on enduring debates about the purpose(s) of public schooling. Readings include primary and secondary materials.

H P C 590: Special Topics
Cr. 1-5. F.S.
Prereq: 9 graduate credits in education

H P C 590A: Special Topics: History of Education
Cr. 1-3. Repeatable.
Prereq: 9 graduate credits in education
Topics vary each time offered.

H P C 590B: Special Topics: Philosophy of Education
Cr. 1-5. F.S.
Prereq: 9 graduate credits in education

H P C 590C: Special Topics: Comparative Education
Cr. 1-5. F.S.
Prereq: 9 graduate credits in education

H P C 599: Creative Component
Cr. 1-3. F.S.

Courses for graduate students:

H P C 615: Seminar
(1-0) Cr. arr. Repeatable, maximum of 3 credits.
Selected topics in history of education, philosophy of education, and comparative education.

H P C 615A: Seminar: History of Education
Cr. 1. Repeatable.
Seminar in History of Education.

H P C 615B: Seminar: Philosophy of Education
(1-3) Cr. 1-3. Repeatable.

H P C 615C: Seminar: Comparative Education
(1-3) Cr. 1-3. Repeatable.

H P C 690: Advanced Special Topics
Cr. 1-3. Repeatable. F.S.
Advanced special topics.

H P C 699: Research
Cr. arr. Repeatable.

History (HIST)

Courses primarily for undergraduates:

HIST 195: Introduction to History
(1-0) Cr. 1.
Prereq: classification as history major
Introduction to the discipline of history and how historians think and work. Focus on research methodologies, writing and analytical practices of historians, and specialization in the discipline.

HIST 201: Introduction to Western Civilization I
(3-0) Cr. 3. F.
Western civilization from ancient Mediterranean world to 1500. Social and cultural developments; economic and political ideas and institutions; problems of historical change and continuity.
Meets International Perspectives Requirement.

HIST 202: Introduction to Western Civilization II
(3-0) Cr. 3. S.
Western civilization from 1500 to present. Social and cultural developments; economic and political ideas and institutions; problems of historical change and continuity.
Meets International Perspectives Requirement.

HIST 207: Chinese Civilization
(3-0) Cr. 3.
Origins, development, decline and transformation of China from earliest times to 1911.
Meets International Perspectives Requirement.

HIST 221: Survey of United States History I
(3-0) Cr. 3-5. F.
Colonial foundations: revolution, confederation, and constitution; nationalism and democracy; sectional disunity, Civil War, and reunion.

HIST 222: Survey of United States History II
(3-0) Cr. 3. S.
Industrialization; emergence as a great power; boom and depression; war, internationalism and Cold War; modern industrial society.

HIST 225: Introduction to Asian American Studies
(3-0) Cr. 3.
An interdisciplinary and chronological examination of Asian American immigration experiences from the early 19th century to the 21st century. Focus on how these immigration histories are accompanied by changing racial constructions. Discussion of racial stereotyping, the model minority myth, identity development, and efforts for social justice.
Meets U.S. Diversity Requirement

HIST 240: Latina/o History
(Cross-listed with US LS). (3-0) Cr. 3.
Historical and cultural heritage of Latinas/os in the United States. The histories of Mexican, Puerto Rican, Cuban, and other Latin American peoples in the U.S. emphasizing political and cultural convergence and congruencies.
Meets U.S. Diversity Requirement

HIST 280: Introduction to History of Science I
(3-0) Cr. 3.
Ideas of nature from ancient Greece to the seventeenth-century scientific revolution.
Meets International Perspectives Requirement.

HIST 281: Introduction to History of Science II
(3-0) Cr. 3.
Science from seventeenth-century scientific revolution to Darwin and Einstein.
Meets International Perspectives Requirement.

HIST 284: Wonders of the World, Global History of Innovation
(3-0) Cr. 3. F.
Innovation across cultures from the ancient "Seven Wonders of the World" to the modern world, with developments in Egypt, Greece, Rome, the Islamic World, India, China, Europe, and the Americas. Topics include major inventions, agricultural technologies, architecture, manufacturing, warfare, engineering, printing, entertainment, transport, and communications.
Meets International Perspectives Requirement.

HIST 304: Cultural Heritage of the Ancient World
(Cross-listed with CL ST). (3-0) Cr. 3.
Prereq: Sophomore classification
Historical examination of art, literature, thought, and religious beliefs of major civilizations of the ancient Mediterranean countries until the end of the 8th century.

HIST 307: American Popular Culture
(3-0) Cr. 3.
Prereq: Sophomore classification
Social practices, beliefs and material traits of everyday life in America from the mid-19th century to the present. Includes literature, music, theater and other entertainments. Dime novels, vaudeville, rock and roll music, Hollywood and establishment of professional athletic leagues are among the cultural artifacts and phenomena considered.

HIST 311: Africa under Colonial Rule
(Cross-listed with AF AM). (3-0) Cr. 3.
Prereq: 3 credits of 200-level HIST at Iowa State, and sophomore classification.
Development of Africa from imposition of colonial rule to independence, including processes of European domination, African reaction and resistance, emergence of nationalism, and dismantling of colonialism.
Meets International Perspectives Requirement.

HIST 316: History of Medieval Europe, 300-1500
(3-0) Cr. 3.
Prereq: Sophomore classification
Survey of political, social, and cultural developments in western Europe for the entire medieval period, 300-1500.

HIST 318: History of Early Modern Europe, 1450-1789
(3-0) Cr. 3.
Prereq: Sophomore classification
Survey of major themes in the social, political, cultural, and religious history of early modern Europe, including the eras of renaissance and reformation, the age of exploration, development of the modern individual and household, and enlightenment.

HIST 320: History of Modern Europe, 1789 to Present
(3-0) Cr. 3. F.
Prereq: 3 credits of 200-level HIST at Iowa State, and sophomore classification.
Survey of major themes in the social, political, and religious history of Europe from the French Revolution to the present. Topics to be covered include the French Revolution, nationalism, the Industrial Revolution, the Russian Revolution, World Wars I and II, the Cold War, the fall of the Soviet Union, and the history of globalization.

HIST 325: Society and Politics in England, 1525-1700
(3-0) Cr. 3.
Prereq: Sophomore classification
Social, cultural, demographic, and economic experiences. Religious Reformation. Growth of the State (and Empire) and political institutions.

HIST 331: History of the Islamic World to 1800
(3-0) Cr. 3. F.
Prereq: 3 credits of 200-level HIST at Iowa State and sophomore classification.
Survey of the Islamic world from pre-Islamic Arabia to the 19th century covering the life of the Prophet Muhammad, the spread of Islam through the Arab conquests and the Caliphal dynasties of the Umayyads and the Abbasids, the Mongol conquests, Turkic migrations from Central Asia, and the rise of the Ottoman Empire.

HIST 333: Asian American Material Cultures
(Cross-listed with ANTHR). (3-0) Cr. 3.
Examination of material objects made and used by Asian Americans with both historical and contemporary focuses; transnational and interdisciplinary lenses to interpret the material world; contemporary approaches to analysis of artifacts.
Meets U.S. Diversity Requirement

HIST 336: History of Modern China I
(3-0) Cr. 3.
Prereq: Sophomore classification
China from 1644 to 1912; internal and external stimuli on traditional structure leading to reform and revolution.
Meets International Perspectives Requirement.

HIST 337: History of Modern China II
(3-0) Cr. 3.
Prereq: Sophomore classification
China from 1912 to present; search for a new order and continuing Chinese revolution.
Meets International Perspectives Requirement.

HIST 338: Modern Japanese History
(3-0) Cr. 3.
Prereq: Sophomore classification
Japan 1600 to the present; emphasis on transformation of feudal Japan into a post-industrial society.
Meets International Perspectives Requirement.

HIST 340: History of Latin America I
(3-0) Cr. 3.
Prereq: Sophomore classification
Colonial Latin America from European discovery and colonization to wars for independence.

HIST 341: History of Latin America II
(3-0) Cr. 3.
Prereq: Sophomore classification
Modern Latin America national origins from 1800 to present.
Meets International Perspectives Requirement.

HIST 353: History of African Americans I
(Cross-listed with AF AM). (3-0) Cr. 3.
Prereq: Sophomore classification
Examines African roots of black culture and the African American experience in the United States from the colonial period through the Civil War. Topics include Atlantic Slave Trade, slavery and American identity, abolition, the emergence of Black Nationalism, and black participation in the Civil War.
Meets U.S. Diversity Requirement

HIST 354: History of African Americans II
(Cross-listed with AF AM). (3-0) Cr. 3.
Prereq: Sophomore classification
Explores African American political thought and political action from Reconstruction to the present. Topics include rise of Jim Crow segregation, urban migration, Garvey movement, Harlem Renaissance, Depression and world wars, Pan-Africanism, civil rights, Black Power, and black feminism.
Meets U.S. Diversity Requirement

HIST 355: Early American Republic
(3-0) Cr. 3.
Prereq: Sophomore classification
Examination of the United States from the Constitutional Convention up to the Mexican War. Topics include the Washington, Jefferson, and Jackson administrations, the War of 1812, slavery and the South, economic and social development, Westward expansion and reform.

HIST 356: U.S. Civil War and Reconstruction Era
(3-0) Cr. 3.
Prereq: Sophomore classification
Examination of the social and economic contradictions that led to Civil War and the reconstruction of American freedom and democracy. Topics include the Mexican War, sectional conflict and the crisis of disunion, economic, political and social aspects of civil war, emancipation, and reconstruction.

HIST 360: U.S. 1900 to 1945
(3-0) Cr. 3.
Prereq: Sophomore classification
America in transition and crisis: Progressivism, World War I, the twenties, the Great Depression, and World War II.

HIST 361: U.S. 1945 to the Present
(3-0) Cr. 3.
Prereq: Sophomore classification
Modern American history with an emphasis on political, socio-cultural, ethno-racial, and military history. Topics include the Cold War, the wars in Korea and Vietnam, civil rights and Black/ethnic Power, modern feminism, and the conservative movement.

HIST 365: American Agriculture I: The Maya to McCormick's Reaper
(3-0) Cr. 3.
Prereq: Sophomore classification
North American agricultural development to 1865. American Indian agricultural systems, European background and agricultural revolution, agriculture in the colonial era, early republic and antebellum period. Topics include origins of modern crops, agriculture's role in the economy, politics, and settlement of the U.S., slavery, rural and frontier life, and mechanization.

HIST 366: American Agriculture II: Homestead Act to GMOs
(3-0) Cr. 3.
Prereq: Sophomore classification
American agricultural development since 1865. Post-Civil War adjustments; westward expansion; economic boom and bust; mechanization; Dust Bowl and environmental challenges; Great Depression and New Deal; changing rural life; scientific and technological advances; farm crisis and late twentieth century challenges.

HIST 367: America Eats
(3-0) Cr. 3.
Prereq: Sophomore classification
Thematic approach to the development of the American agricultural system through the topics of food and eating. Changes in American food systems from Native American, pre-contact diets through modern innovations such as fast food, organics, and eating locally.

HIST 370: History of Iowa
(3-0) Cr. 3.
Prereq: Sophomore classification
Survey of major social, cultural and economic developments in Iowa from the late 1700s. Emphasis on minority groups, pioneer life, early economic development, industrial development, educational and religious development, and outstanding personalities.

HIST 371: Mexican American History
(Cross-listed with US LS). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 3 credits of 200-level HIST at Iowa State and sophomore classification.
History of the Mexican American community in the U.S. from the 1820s to the present. Topics include community development, employment, social marginalization, racism/discrimination, depression and world wars, civil rights, ethnic power and politics.
Meets U.S. Diversity Requirement

HIST 374: Sex, Gender, and Culture in the Ancient Mediterranean World
(Cross-listed with CL ST, W S). (3-0) Cr. 3. S.
Prereq: Any one course in Cl St, W S, Latin, or Greek
Chronological and topical survey of the status of women and men, focusing on sex and gender issues in the Ancient Mediterranean world; study of constructs of the female and the feminine. Readings from ancient and modern sources. Emphasis on ancient Greece, Rome, and Egypt.
Meets International Perspectives Requirement.

HIST 380: History of Women in Science, Technology, and Medicine
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: Sophomore classification
History of women's relationship to the fields of science, technology, and medicine, as students and professionals, consumers, subjects and patients, family members, workers and citizens. Concentrates especially on 19th and 20th century United States, concluding with an examination of current issues of special interest to women in science, technology, and medicine.
Meets U.S. Diversity Requirement

HIST 382: History and Philosophy of the Scientific Revolution.
(Cross-listed with PHIL). (3-0) Cr. 3. S.
The emergence of empirical science as the authoritative methodology for production of knowledge about the natural world in the period between Copernicus and Kant. Scientific progress achieved during the period, including the work of Galileo, Descartes, and Newton. The re-shaping of epistemology in the Western intellectual tradition. Implications for philosophy and historiography.

HIST 383: Technology, Public Science, and European Culture, 1715-Present
(3-0) Cr. 3.
Prereq: Sophomore classification
A survey from the Age of Enlightenment to the end of the twentieth century of the relationship between science, technology, and public or popular culture in a comparative European context (including Russia and the former Soviet Union).
Meets International Perspectives Requirement.

HIST 384: Roman Italy: An Introduction
(Cross-listed with CL ST). Cr. 2.
Prereq: Enrollment limited to students participating in CL ST 385/HIST 385. Instructor permission required.
Introduction to the topography, history, archaeology, monuments, and art of Rome from the Regal period through late Antiquity; attention given to the culture of modern Italy, preparatory to study abroad in Rome.
Meets International Perspectives Requirement.

HIST 385: Study Abroad: Roman Italy: Building the Empire
(Cross-listed with CL ST). Cr. 3.
Prereq: CL ST 384/HIST 384 and instructor's permission.
Supervised on-site instruction in the history, archaeology, monuments, and art of Rome and environs from the 8th center BCE to the 5th century CE; attention given to the culture of modern Italy.
Meets International Perspectives Requirement.

HIST 386: History of Women in America
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: Sophomore classification
A survey of social, economic, and political aspects of women's role from colonial era to present; emphasis on employment, education, concepts of sexuality, and changing nature of the home.
Meets U.S. Diversity Requirement

HIST 389: American Military History
(3-0) Cr. 3.
Prereq: Sophomore classification
American military experience from the Pequot War to Vietnam, including King Philip's War, the French & Indian Wars, the American Revolution, the War of 1812, the Mexican-American War, the Civil War, the Spanish-American War, World Wars I & II, and the Korean War.
Meets International Perspectives Requirement.

HIST 390: World Military History
(3-0) Cr. 3.
Prereq: Sophomore classification
Covers military history from the Napoleonic era through the mid- and late-19th century wars, the First and Second World Wars, and wars of national liberation and regional conflicts since 1945.
Meets International Perspectives Requirement.

HIST 391: American Diplomatic History
(3-0) Cr. 3.
Prereq: Sophomore classification
A study of US foreign relations during the twentieth century, including the rise to global power, the First World War, diplomacy during prosperity and depression, the Second World War, the Cold War, relations with Latin America, East and South Asia, and Africa, the search for markets, and the perceptions of American foreign policy held by the US, its allies and adversaries, and others.

HIST 396: Topics in History
(3-0) Cr. 3.
Prereq: Sophomore classification or permission of instructor
Specialized topics in history; topics vary each time offered.

HIST 396A: Topics in History: Europe
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Sophomore classification or permission of instructor
Specialized topics in history; topics vary each time offered.

HIST 396B: Topics in History: U.S. and North America
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Sophomore classification or permission of instructor
Specialized topics in history; topics vary each time offered.

HIST 396C: Topics in History: Global
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Sophomore classification or permission of instructor
Specialized topics in history; topics vary each time offered.

HIST 402: Greek Civilization
(Cross-listed with CL ST). (3-0) Cr. 3.
Prereq: Sophomore classification
Ancient Greece from the Bronze Age to the Hellenistic period; evolution of the Greek polis and its cultural contributions, with a particular emphasis on the writings of Herodotus and Thucydides.

HIST 403: Roman Civilization
(Cross-listed with CL ST). (3-0) Cr. 3.
Prereq: Sophomore classification
Ancient Rome from the Regal Period to the fall of the Western Empire; evolution of Roman institutions and Rome's cultural contributions studied through original sources.

HIST 405: Transformations of the Early Medieval World
(3-0) Cr. 3.
Prereq: Sophomore classification
Examines major political, religious, and cultural transformations in Western Europe and the Mediterranean, 300-1000. Major topics include the fall of Rome, rise of Christianity, Germanic kingdoms, and Carolingian empire.

HIST 406: The Birth of Europe in the High Middle Ages
(3-0) Cr. 3.
Prereq: Sophomore classification
Examines political, economic, religious, and cultural forms emerging in Europe, 1000-1300, that still characterize Western society to this day. Major topics include the medieval agricultural revolution, English and French monarchies, crisis of church and state, and growth of the papacy and personal religion.

HIST 407: Crises of the Late Middle Ages
(3-0) Cr. 3.
Prereq: Sophomore classification.
Examines major political, economic, religious, and intellectual crises that beset Europe, 1300-1500, paving the way for early modernity. Major topics include Black Death, 100 Years War, papal schism, and origins of Renaissance and Reformation.

HIST 408: Europe, 1500-1648
(3-0) Cr. 3.
Prereq: Sophomore classification
Renaissance; Protestantism and the Age of Catholic reform; social, cultural, and economic changes; global expansion; religious warfare.

HIST 414: European Cultural and Intellectual History
(3-0) Cr. 3.
Prereq: Sophomore classification
A study of the development of key themes in European thought: nature, man, God, society, history, and creativity from Rousseau to Post-Modernism.

HIST 419: History of Modern France
(3-0) Cr. 3.
Prereq: Sophomore classification
From absolutism to revolution and the rise of modern democracy.

HIST 420: France's Revolutionary Century, 1715-1815
(3-0) Cr. 3.
Prereq: Sophomore classification
An in-depth investigation of the French Revolution, its causes and consequences, beginning in the Ancien Regime and ending with the fall of Napoleon.

HIST 421: History of Russia I
(3-0) Cr. 3.
Prereq: Sophomore classification
Russia to 1850. Origins of Russian people; Byzantine influences; Mongol invasion; rise of Moscow; Westernization.
Meets International Perspectives Requirement.

HIST 422: History of Russia II
(3-0) Cr. 3.
Prereq: Sophomore classification
Russia since 1850. Reform and revolution; transformation of society; USSR as a world power; recent changes.
Meets International Perspectives Requirement.

HIST 424: History of Modern Germany
(3-0) Cr. 3.
Prereq: Sophomore classification.
Political, social, and cultural history of Germany from the 19th century to the present.

HIST 427: Crime and Policing in England 1550-1850
(3-0) Cr. 3.
Prereq: Sophomore classification
Course examines different forms and ideas of criminality and the nature and development of law enforcement in England between 1550 and 1856. Significant issues will include the nature of criminal records and statistics, the legal system, the politics of the law and its links with social relations, policing, female crime, juvenile delinquency, organized crime, riots, "social crime," and the treatment of crime in creative literary texts.

HIST 428: Punishment, Mentalities, and Society in England, 1550-1868
(3-0) Cr. 3.
Prereq: Sophomore classification
Explores the history of punishing criminals in England and shows how interdisciplinary perspectives, ideas, and practices of punishment are related to mentalities, and socio-economic change. Issues of significance examined: violence, civility, manners, madness, public punishment, execution, imprisonment, transportation, mercy, the rise of asylums, and penal reform.

HIST 429: "Monstrous London": London's Histories 1500-1800
(3-1) Cr. 3-4.
Prereq: Sophomore classification
Study of London's social, economic, cultural, political, and environmental history 1500-1800, using both quantitative and qualitative methods to examine contemporary and secondary sources. Course combines standard lecture and discussion format with one week of intensive study abroad for 4th hour of course credit.

HIST 431: Modern England
(3-0) Cr. 3.
Prereq: Sophomore classification
England since 1850. Parliamentary and constitutional development; social reform and economic change; imperial Britain; welfare state.

HIST 441: History of Modern Mexico and Central America
(3-0) Cr. 3.
Prereq: Sophomore classification.
Political, economic, and social development of Mexico and Central America in nineteenth and twentieth centuries.

HIST 442: Rebellions and Revolutions in Latin America
(3-0) Cr. 3.
Prereq: Sophomore classification.
Survey of rebellions, revolutionary movements, and social revolutions in the twentieth century, including Guatemalan, Cuban, Mexican, Chilean, and Nicaraguan cases.
Meets International Perspectives Requirement.

HIST 450: Colonial America
(3-0) Cr. 3.
Prereq: Sophomore classification
Exploration, colonization, and development of political, economic, religious, and cultural institutions of North American colonies before 1754. Topics also include social history, emergence of African-American slavery, relations with American Indians.

HIST 451: American Revolutionary Era
(3-0) Cr. 3.
Prereq: Sophomore classification
Participants, ideas, and events leading to independence and the foundation of the United States, 1754 to 1789. Topics include political, military, social, cultural history, also issues of gender and race relations.

HIST 453: Law and Society in U.S. History: Crime, Race, Family, Work and Property
(3-0) Cr. 3.
Prereq: Sophomore classification.
The development of both law and the legal system from colonial times to the present, highlighting their crucial role in aspects of American life such as marriage, family, employment, racial identification, and economic exchange. Topics will include important past legal disputes, the different levels of courts, the various actors in the legal process (e.g., police, prosecutors, prisoners, judges and juries), the relationship between the individuals and institutions that comprise the legal system.

HIST 456: American Family History
(3-0) Cr. 3.
Prereq: Sophomore classification
The impact on American families from colonial times onward of agricultural change, industrialization, urbanization, and wars and depressions.

HIST 460: The Great Plains
(3-0) Cr. 3.
Prereq: Sophomore Classification
History of the Great Plains from prehistoric period. Emphasis on agricultural and rural development, Native Americans, cattle ranching, land policy, agrarian reform movements and federal policy.

HIST 461: The Rural South
(3-0) Cr. 3.
Prereq: Sophomore classification
History of the American South from colonial period to present. Emphasis on economic, social, and political change in this rural region.

HIST 465: The American West
(3-0) Cr. 3.
Prereq: Sophomore classification
History of trans-Mississippi West from 1800 to present, concentrating on settlement and regional identity. Emphasis on the state, the environment, urbanization, agriculture, Native Americans, and minority communities.

HIST 468: History of Rural America
(3-0) Cr. 3.
Prereq: Sophomore classification
History of rural America from the colonial period to the present. Emphasizes immigration, ethnicity, religion, social and cultural change, and agriculture in relation to rural settlement, institution building, demographic change, gender, class, and political and economic development.

HIST 471: Global Environmental History
(Cross-listed with ENV S). (3-0) Cr. 3. F.
Prereq: Either one of HIST 201, 202, or 207; or 3 credits of Environmental Studies; and sophomore classification.
Survey of the interactions of human communities with their environments from the beginnings of human history to the present. Topics include the domestication of animals, the agricultural revolution, industrialization, urbanization, deforestation, hydraulic management, fossil fuel consumption, and climate change.

HIST 472: U. S. Environmental History
(Cross-listed with ENV S). (3-0) Cr. 3.
Prereq: Sophomore classification
Survey of the interactions of human communities with the North American environment. Focus on the period from presettlement to the present, with a particular concentration on natural resources, disease, settlement patterns, land use, and conservation policies.

HIST 473: Civil Rights and Ethnic Power
(Cross-listed with AF AM, US LS). (3-0) Cr. 3.
Prereq: Sophomore classification
Comparative history of the civil rights and ethnic power movements (African American, Chicano, American Indian, Puerto Rican, among others) in the U.S. from World War II to the present. Topics include institutional foundations, leadership, gender and racial dynamics, and the convergences and divergences of these differing ethnic struggles for rights.
Meets U.S. Diversity Requirement

HIST 474: Tradition and Transformation of China's Foreign Affairs
(3-0) Cr. 3.
Prereq: Sophomore classification
Evolution of China's external relations from the antiquities to our own times; conceptions, practices, and relationships that characterized the inter-state relations of the so-called "Chinese world order," interactions between "Eastern" and "Western," and "revolutionary" and "conventional" modes of international behaviors.

HIST 479: China and the Cold War
(3-0) Cr. 3.
Prereq: Sophomore classification
Important events in China's Cold War involvement, connections between domestic and foreign affairs, factors and rationales in China's foreign policy making the relationship between China's Cold War experience and recent developments.

HIST 480: Field Experience for Secondary Teaching Preparation
Cr. 0.5-2. Repeatable, maximum of 2 times. F.S.
Prereq: Permission of area coordinator required prior to enrollment
Observation and participation in a variety of school settings after admission to the teacher preparation program. (S/F grading may be used in some offerings of some sections.).

HIST 480A: Pre-Student Teaching Experience III: History/Social Sciences
(Cross-listed with C I). Cr. 2. Repeatable, maximum of 2 times. F.
Prereq: Admission to Teacher Education
Supervised participation in a 5-12 school setting. Permission of History/Social Sciences coordinator required prior to enrollment. 1/2 day of time needed. Clinical Supervision Level 3.

HIST 482: Birth, Death, Medicine, and Disease
(3-0) Cr. 3.
Prereq: Sophomore classification
History of medicine, sickness, and public health from ancient times to the twenty-first century in the US, Europe, and around the world. Topics include changing ideas of health and illness, development of doctors and hospitals, social and ethical issues in health care, and epidemics from cholera to AIDS.

HIST 488: American Stuff, Colonial Times to the Present
(3-0) Cr. 3.
Prereq: Sophomore classification
Inventions, innovations, artifacts, and material culture in the United States, from homespun cloth and the Colt revolver, through the transcontinental railroad and Model T, to fast food and the iPhone.

HIST 490: Independent Study
(3-0) Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 9 credits in history; permission of department chair
Reading and reports on problems selected in conference with each student. No more than 6 credits of Hist 490 may be counted toward graduation with a major in History. No credits of Hist 490 may count toward a minor in History.

HIST 495: Historiography and Research Writing
(3-0) Cr. 3. F.S.
Prereq: Senior history majors with at least 12 credits of 300+ level history courses
Variable topics seminar that focuses on historiographical and research skills and writing. Required of majors.

HIST 496: Advanced Topics in History
(3-0) Cr. 3.
Prereq: Sophomore classification or permission of instructor.
Specialized topics in history, topics vary each time offered.

HIST 496A: Advanced Topics in History: Europe
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Sophomore classification or permission of instructor.
Specialized topics in history, topics vary each time offered.

HIST 496B: Advanced Topics in History: U.S. and North America
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Sophomore classification or permission of instructor.
Specialized topics in history, topics vary each time offered.

HIST 496C: Advanced Topics in History: Global
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Sophomore classification or permission of instructor.
Specialized topics in history, topics vary each time offered.

HIST 498: Methods of Teaching History/Social Sciences
(Cross-listed with C I). (3-0) Cr. 3. F.S.
Prereq: Concurrent enrollment in HIST 480A; Admission to teacher education and 30 credits in subject-matter field
Concurrent enrollment in 480A; Admission to teacher education and 30 credits in subject-matter field. Theories and processes of teaching and learning secondary history/social sciences. Emphasis on development and enactment of current methods, assessments, and curriculum materials for providing appropriate learning experiences.

Courses primarily for graduate students, open to qualified undergraduates:

HIST 510: Proseminar in East Asian History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in East Asian history. Topics vary each time offered.

HIST 511: Proseminar in American History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 511A: Proseminar in American History: Colonial Period
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 511B: Proseminar in American History: Nineteenth Century
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 511C: Proseminar in American History: Twentieth Century
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 511D: Proseminar in American History: Environment
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 511E: Proseminar in American History: Social and Cultural
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 511F: Proseminar in American History: West
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 512: Proseminar in European History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in European history.

HIST 512A: Proseminar in European History, Ancient
(Cross-listed with CL ST). (3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in European history.

HIST 512B: Proseminar in European History: Medieval and Early Modern
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in European history.

HIST 512C: Proseminar in European History: Modern
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in European history.

HIST 513: Proseminar in Latin American History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in Latin American history. Topics vary each time offered.

HIST 530: Proseminar in Modern Russian/Soviet History
(3-0) Cr. 3. Repeatable.
Prereq: HIST 422
Readings in modern Russian history. Topics vary each time offered.

HIST 550: Proseminar in European Rural and Agricultural History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 550B: Proseminar in European Rural and Agricultural History: Twentieth Century Europe
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 552: Proseminar in American Rural and Agricultural History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 552A: Proseminar in American Rural and Agricultural History: American Agriculture
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 552B: Proseminar in American Rural and Agricultural History: Agrarian Reform Movements
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 552C: Proseminar in American Rural and Agricultural History: Midwestern Rural Society
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 552D: Proseminar in American Rural and Agricultural History: Women in Rural Life
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 575: Seminar in General History of Technology
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Permission of instructor
The history of technology with emphasis on the historical literature, differing interpretations of major problems, and problems identified for college-level teaching and for further scholarly research.

HIST 583: Historical Methods
(3-0) Cr. 3.
Study of evidence, theory, and methods.

HIST 583A: Historical Narrative
(3-0) Cr. 3.
Prereq: Permission of instructor.
Study of evidence, theory, and methods.

HIST 583B: Historical Methods: Statistical Evidence and Analysis
(3-0) Cr. 3.
Prereq: Permission of instructor.
Study of evidence, theory, and methods.

HIST 583C: Issues in Historiography
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Permission of instructor.
Study of evidence, theory, and methods.

HIST 585: Teaching Methods for the Modern Europe Survey
(2-2) Cr. 3. S.
Prereq: Graduate status or instructor approval.
Pedagogy and historiography of Europe, from the Protestant Reformation to the present. Pedagogical topics covered include general principles of survey-course construction, lecture technique, and textbook evaluation; historiographical topics will include the Reformation, the Enlightenment, the Industrial Revolution, the French Revolution, the rise of Nationalism, imperialism, the two World Wars, the Cold War and decolonization.

HIST 586: Proseminar in Women's History and Feminist Theory
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: Permission of instructor
Feminism as a movement and feminst theory from the early modern period to the present as it relates to the writing of women's history. Analysis of intepretations of European and U.S. women's history from patriarchal and postmodernist perspectives.

HIST 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

HIST 593: Seminar in American History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 593A: Seminar in American History: Colonial Period
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 593B: Seminar in American History: Nineteenth Century
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 593C: Seminar in American History: Twentieth Century
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 593D: Seminar in American History: Environmental
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 593F: Seminar in American History: West
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 594: Seminar in European History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 594A: Seminar in European History: Ancient
(Cross-listed with CL ST). (3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 594B: Seminar in European History: Medieval and Early Modern
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 594C: Seminar in European History: Modern
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 599: Creative Component
Cr. 1-6. Repeatable, maximum of 6 credits.

Courses for graduate students:

HIST 610: Seminar on American Rural Life
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Permission of instructor
Emphasis varies each time offered.

HIST 699: Research
Cr. 1-6. Repeatable.
Graduate student thesis research.

Honors (HON)

Courses primarily for undergraduates:

HON 121: First-Year Honors Seminar
(0-2) Cr. 1. F.
Prereq: Membership in the First-Year Honors Program
Orientation to Iowa State University and to the University Honors Program. Offered on a satisfactory-fail basis only.

HON 290: Special Problems
Cr. arr.
Prereq: Membership in and permission of the University Honors Program
Independent study on topics of an interdisciplinary nature. Intended primarily for freshmen and sophomores. Offered on a satisfactory-fail basis only.

HON 290H: Honors
Cr. 1-2. F.S.
Prereq: Membership in and permission of the University Honors Program
Independent study on topics of an interdisciplinary nature. Intended primarily for freshmen and sophomores. Offered on a satisfactory-fail basis only.

HON 290U: Undergraduate Research
Cr. arr. F.S.
Prereq: Membership in and permission of the University Honors Program
Independent study on topics of an interdisciplinary nature. Intended primarily for freshmen and sophomores. Offered on a satisfactory-fail basis only.

HON 302: Honors Leadership Seminar
(1-2) Cr. 2. F.
Prereq: Selection as a leader of a First-Year Honors Seminar
For students serving as leaders of First-Year Honors Seminars, under faculty supervision. Development of teaching and leadership skills within the context of an Honors education experience. Offered on a satisfactory-fail basis only.

HON 321: University Honors Seminars
Cr. 1-2. F.S.
Prereq: Membership in the University Honors Program
Interdisciplinary seminars on topics to be announced in advance. Offered on a satisfactory-fail basis only.

HON 322: University Honors Seminars
Cr. 1-2. F.S.
Prereq: Membership in the University Honors Program
Interdisciplinary seminars on topics to be announced in advance. Offered on a satisfactory-fail basis only.

HON 323: University Honors Seminars
Cr. 1-2. F.S.
Prereq: Membership in the University Honors Program
Interdisciplinary seminars on topics to be announced in advance. Offered on a satisfactory-fail basis only.

HON 324: University Honors Seminars
Cr. 1-2. F.S.
Prereq: Membership in the University Honors Program
Interdisciplinary seminars on topics to be announced in advance. Offered on a satisfactory-fail basis only.

HON 490: Independent Study
Cr. arr. Repeatable. F.S.
Prereq: Membership in and permission of the University Honors Program
Independent study on topics of an interdisciplinary nature. Intended primarily for juniors and seniors.

Horticulture (HORT)

Courses primarily for undergraduates:

HORT 110: Professional and Educational Development in Horticulture.
(1-0) Cr. 1. F.
Intended for first-year students and others new to the horticulture curriculum. Introduction to professional and educational development within horticulture. Focus is on university and career acclimation. Assessed service-learning component.

HORT 121: Home Horticulture
(2-0) Cr. 2. F.S.
Growing plants in and around the home including requirements for growing house plants; plant propagation; designing and maintaining flower, fruit, and vegetable gardens; lawn, tree, and shrub maintenance.

HORT 122: Hands-On Home Horticulture
(1-0) Cr. 1. F.S.
Demonstration and activities that illustrate principles of growing plants for the home garden. Topics include floral and landscape design, plant identification, propagation, selection, and management for indoor and outdoor gardens.

HORT 131: Floral Design
(0-2) Cr. 1. S.
Introduces basic geometric design of fresh arrangements, corsages, and holiday arrangements. Includes use of tools and supplies.

HORT 193: Topics in Horticulture
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193A: Topics in Horticulture: Greenhouse Crops
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193B: Topics in Horticulture: Nursery Crops
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193C: Topics in Horticulture: Turfgrass
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193D: Topics in Horticulture: Fruit Crops
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193E: Topics in Horticulture: Vegetable Crops
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193F: Topics in Horticulture: Cross-Commodity
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193G: Topics in Horticulture: Landscape Horticulture
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 221: Principles of Horticulture Science
(2-2) Cr. 3. F.S.
Prereq: Biol 211 or concurrent enrollment
Biological principles of growing horticultural crops including anatomy, reproduction, light, temperature, water, nutrition, and growth and development. Laboratory exercises emphasize environmental factors and permit detailed observation of plant growth.

HORT 225: Spanish for Horticulture
(3-0) Cr. 3. S.
Introduction to basic conversation and communication skills in Spanish, and cross-cultural skills for working with Spanish speakers in the Horticulture industry, emphasizing the use of vocabulary and expressions common in the workplace.

HORT 240: Trees, Shrubs, and Woody Vines for Landscaping
(3-0) Cr. 3. F.
Identification of trees, shrubs, and woody vines. Factors influencing the horticultural use of woody plants. Field trips outside of regular class time may be required.

HORT 276: Understanding Grape and Wine Science
(Cross-listed with FS HN). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: High school biology and chemistry.
A scientific introduction to viticulture (grape-growing) and enology (wine-making). Topics include grape species and varieties, viticulture practices, fruit quality, geography, history, principles of fermentation and aging, wine classification, appreciation, evaluation, storage and service, regulations, wine as food. No wine tasting.

HORT 281: Landscape Graphics
(0-4) Cr. 2. F.
Introduction to computer and hand rendering techniques of landscape graphics. Students will gain proficiency in plan view and elevation graphics. Intensive studio and computer based instruction.

HORT 282: Educating Youth Through Horticulture
(2-3) Cr. 3. Alt. S., offered even-numbered years.
Planning, developing, and implementing science-based educational programs in a garden setting. Through hands-on experiences students will learn about horticulture, learning theory, and the application of science principles as they pertain to educating youth. Assessed service-learning component.

HORT 283: Pesticide Application Certification
(Cross-listed with AGRON, ENT, FOR). (2-0) Cr. 2. S.
Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized.

HORT 321: Horticulture Physiology
(3-0) Cr. 3. F.
Prereq: HORT 221 or BIOL 211
Principles of plant physiology relating to growth and development of horticultural plants including plant water relations, membrane transport, photosynthesis, photomorphogenesis, respiration, and phytohormones. Emphasis on plant's responses to environmental factors (temperature, water, and light) including cellular and whole-plant physiology under stressful environments.

HORT 322: Plant Propagation
(2-2) Cr. 3. S.
Prereq: HORT 221 or BIOL 211
Fundamental principles underlying sexual and asexual propagation of plants; practice in reproducing plants by use of seeds, cuttings, layering, grafting and budding and tissue culture.

HORT 330: Herbaceous Ornamental Plants
(2-2) Cr. 3. F.
Prereq: HORT 221 or by permission of instructor
Identification, botanical characteristics, origins, propagation, uses and general culture of herbaceous annual and perennial plants for Midwestern gardens and landscapes.

HORT 331: Hydroponic Food Crop Production
(2-2) Cr. 3. F.
Prereq: HORT 221 or AGRON 114 or 3 credits in biological sciences
Principles and practices of hydroponic systems, crop production and culture, aquaponic systems, and new food crops for hydroponic systems will be discussed. Laboratories will focus on demonstration and participation in practices and procedures used in hydroponic food crop production. Assessed service-learning component.

HORT 332: Greenhouse Operation and Management
(3-3) Cr. 4. S.
Prereq: Hort 221
Operation and management of greenhouses and other controlled environment agriculture structures. Methods of monitoring and manipulating environmental, cultural, and management factors such as light, temperature, fertility, substrate, etc., to maximize production efficiency. Emphasis placed on the production of ornamental and food crops. Greenhouse analysis project required.

HORT 338: Seed Science and Technology
(Cross-listed with AGRON). (2-3) Cr. 3. F.
Prereq: AGRON 181 (or equivalent) or HORT 221; BIOL 212
Seed production, maturation, dormancy, vigor, deterioration, and related aspects of enhancement, conditioning, storage, and quality evaluation. Aspects of the seed industry and regulation of seed marketing.

HORT 341: Woody Plant Cultivars: Shade Trees, Ornamental Trees and Woody Shrubs
(2-0) Cr. 2. S.
Prereq: Hort 240 or L A 221 or L A 222
Cultivars of the most prevalent and economically important woody landscape plants will be taught. The importance of cultivars to the nursery and landscaping professions and suggestions for their proper usage will be discussed.

HORT 342: Landscape Plant Installation, Establishment, and Maintenance
(2-3) Cr. 3. F.
Prereq: Hort 240 or L A 221 or L A 222
Principles and practices involved with establishment and maintenance of managed landscapes. Laboratory work involves site evaluation, installation techniques, postplant care, and maintenance of established landscape plants.

HORT 351: Turfgrass Establishment and Management
(Cross-listed with AGRON). (3-0) Cr. 3. F.
Prereq: HORT 221 or AGRON 181 (or equivalent) or BIOL 211
Principles and practices of turfgrass propagation, establishment, and management. Specialized practices relative to professional lawn care, golf courses, athletic fields, highway roadsides, and seed and sod production. The biology and control of turfgrass pests.

HORT 351L: Turfgrass Establishment and Management Laboratory
(Cross-listed with AGRON). (0-3) Cr. 1. F.
Prereq: Credit or enrollment in HORT 351
Those enrolled in the horticulture curriculum are required to take 351L in conjunction with 351 except by permission of the instructor.

HORT 354: Soils and Plant Growth
(Cross-listed with AGRON). (3-0) Cr. 3. F.S.
Prereq: AGRON 182 or equivalent and BIOL 101
Effects of chemical, physical, and biological properties of soils on plant growth, with emphasis on nutritive elements, pH, organic matter maintenance, and rooting development.

HORT 354L: Soils and Plant Growth Laboratory
(Cross-listed with AGRON). (0-3) Cr. 1. F.S.
Prereq: Agron or Hort major with credit or enrollment in AGRON 354
Laboratory exercises in soil testing that assess a soil's ability to support nutritive requirements for plant growth.

HORT 376: Fundamentals of Field Production of Horticultural Food Crops
(3-0) Cr. 3. F.
Prereq: Hort 221 or Agron 114
An introduction to field production of fruit and vegetable crops and the theoretical and practical knowledge required for successfully producing them. Topics will include basic principles and practices of fruit and vegetable production, site selection, soil techniques, irrigation management, equipment and tools, integrated pest management, season extension strategies, postharvest handling and food safety, marketing, and basic business planning for fruit and vegetable enterprises. Additionally, this course will prepare students for HORT 461 and HORT 471, that are advanced level courses focusing on fruit and vegetable production.

HORT 380: Principles of Garden Composition
(2-0) Cr. 2. S.
Functional and aesthetic aspects of landscape planning as a basis for design decisions; emphasis on spatial design and plant selection. Includes site analysis, development process, and design principles.

HORT 381: Beginning Garden Composition Studio
(0-4) Cr. 2. S.
Prereq: HORT 281 and HORT 240 or HORT 330, concurrent enrollment in HORT 380
Introduction to landscape design process. Intensive studio-based projects implementing principles of landscape design, concept development, and graphic communication.

HORT 391: Horticultural Management Experience
Cr. 1. Repeatable. F.S.SS.
Prereq: HORT 221 or permission of instructor
A structured work experience for the student to gain insight into management operations associated with production and management of horticultural crops. A report of 10 or more pages describing the student's experience is required. One credit is given for each term the student is enrolled in the course. A maximum of two credits may be used toward the horticultural sciences course requirements, and two additional credits may be used toward the 128 credits required for graduation.

HORT 398: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of department resource and career center coordinator
Students must register for this course before commencing each work period.

HORT 421: Introduction to Plant Breeding
(Cross-listed with AGRON). (3-0) Cr. 3. F.
Prereq: GEN 320 or BIOL 313
Breeding methods used in the genetic improvement of self-pollinated, cross-pollinated and asexually reproducing agronomic and horticultural crops. Applications of biotechnology techniques in the development of improved cultivars.

HORT 424: Sustainable and Environmental Horticulture Systems
(Dual-listed with HORT 524). (Cross-listed with ENV S). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Inquiry into ethical issues and environmental consequences of horticultural cropping systems, production practices and managed landscapes. Emphasis on systems that are resource efficient, environmentally sound, socially acceptable, and profitable.

HORT 434: Fall Greenhouse Crop Production
(2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: HORT 332
Principles and practices of flowering and ornamental greenhouse crop production. Emphasis is placed on production of flowering potted plants, cut flowers, and foliage crops produced in greenhouses and other controlled environments. An overnight class field trip outside scheduled class time is required.

HORT 435: Spring Greenhouse Crop Production
(2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HORT 330 and HORT 332
Principles and practices of containerized greenhouse production of crops for gardens and outdoor use. Emphasis is placed on the production of seedling plugs and rooted cuttings, annual and perennial bedding plants, and native plants. An overnight class field trip outside scheduled class time is required.

HORT 442: Nursery Production and Garden Center Management
(2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: HORT 221
Nursery layout, design, and cultural practices important for growing and shipping field and container-grown nursery crops. Overview of garden center design and retailing and marketing strategies. Field trip(s) outside scheduled class time may be required.

HORT 444: Landscape Construction Management
(2-3) Cr. 3. F.
Principles and practices of residential landscape construction. Encompasses project management, landscape estimating and overview of common landscape materials. Laboratory work involves field trips and project installation.

HORT 445: Horticulture Management and Administration
(2-0) Cr. 2. F.
Prereq: HORT 221 and junior or senior classification
In-depth presentation and discussion of skills and strategies needed to manage a horticultural enterprise. Topics include motivating employees, managing meetings, conducting performance appraisals, dealing with conflict, and managing an increasingly diverse work force.

HORT 451: Professional Turfgrass Management
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: HORT 351
Turfgrass science including the study of (1) specific information on soil chemistry and soil modification as they relate to the development and maintenance of turfgrass areas, (2) specialized management practices used in athletic field care, professional lawn care, and golf course industries, and (3) construction methods for golf courses and sports fields.

HORT 452: Integrated Management of Diseases and Insect Pests of Turfgrasses
(Dual-listed with HORT 552). (Cross-listed with ENT, PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HORT 351
Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

HORT 453: Sports Turf Management
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: HORT 351
Management techniques for today's specialized athletic fields. The horticultural and budgetary aspects of football, soccer, baseball, and softball fields will be presented. Field trips and laboratory exercises will develop a practical understanding of actual principles in field development, construction, and management.

HORT 454: Turf & Landscape Irrigation
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Irrigation systems and principles for turf and landscape environments. Topics include design, installation, equipment, management, and trouble shooting of irrigation systems for golf, athletic fields, residential lawns and landscapes. Participation in practical exercises and local field trips to irrigation sites is required.

HORT 461: Fruit Crop Production and Management
(2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HORT 221
Principles and practices of small fruit, tree fruit, and nut culture and production. Morphology, physiology of growth and development, plant establishment, pest management, pruning, training, harvesting, storage, and marketing of commercial temperate fruit and nut crops. Emphasis on sustainable practices. Participation in practical exercises and local field trips is required.

HORT 471: Vegetable Production and Management
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: HORT 221
Principles of vegetable production with emphasis on sustainable production practices, market outlets, business aspects, and risk management. Topics will include crop classification and rotation; planting methods; crop climatic conditions, physiological growth & development; soil, water, and pest management; cover cropping; season extension strategies; harvest and postharvest management and marketing. Course involves visits to growers fields to observe/experience their production enterprise.

HORT 471L: Vegetable Production and Management Lab
(0-3) Cr. 1. Alt. S., offered even-numbered years.
Prereq: Junior or Senior status and concurrent enrollment in Hort 471 is required.
Hands-on training in the area of vegetable crop production. Students will have an opportunity to grow a variety of vegetables in a heated greenhouse and also conduct greenhouse and lab experiments. The lab also involves visits to vegetable production sites in Iowa to observe/experience and learn from growers and other agricultural professionals.

HORT 475: Urban Forestry
(Cross-listed with FOR). (2-3) Cr. 3. F.
Prereq: Junior or senior classification, 3 credits in biology
Discussion of establishment and management of woody perennials in community-owned urban greenspaces, consideration of urban site and soil characteristics, plant physiology, plant culture, urban forest valuation, inventory methods, species selection, and urban forest maintenance (health care and pest management).

HORT 481: Advanced Garden Composition
(0-4) Cr. 2. F.
Prereq: HORT 240 and HORT 330 and HORT 380 and HORT 381
Priority given to Landscape Design Installation and Management option students. Development of residential landscapes using design principles and the design process. Projects encompass site analysis, concept development, preliminary design, final design, and graphic presentation techniques. Techniques will include hand and computer rendering.

HORT 484: Organic Agricultural Theory and Practice
(Dual-listed with HORT 584). (Cross-listed with AGRON). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 9 cr. in biological or physical sciences
Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives.

HORT 490: Independent Study
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490A: Independent Study: Greenhouse Crops
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490B: Independent Study: Nursery Crops
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490C: Independent Study: Turfgrass
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490D: Independent Study: Fruit Crops
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490E: Independent Study: Vegetable Crops
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490F: Independent Study: Cross-Commodity
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490G: Independent Study: Landscape Horticulture
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490H: Independent Study: Honors
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490I: Independent Study: International Study
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490J: Independent Study: Entrepreneurship
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 491: Seed Science Internship Experience
(Cross-listed with AGRON). Cr. 1-2. Repeatable, maximum of 1 times. F.S.SS.
Prereq: Agron 338, advanced approval and participation of employer and instructor
A professional work experience and creative project for seed science secondary majors. The project requires the prior approval and participation of the employer and instructor. The student must submit a written report.

HORT 493: Workshop in Horticulture
Cr. arr. Repeatable.
Off campus. Offered as demand warrants. Workshops in horticulture.

HORT 494: Service Learning
Cr. arr. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission of instructor
Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling professional ethics and accomplishing student learning goals. Course expenses paid by student. A maximum of 4 credits of 494 may be used toward the Horticulture credits required for graduation. Assessed service-learning component.

HORT 494A: Service Learning: International
Cr. arr. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission of instructor
Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling professional ethics and accomplishing student learning goals. Course expenses paid by student. A maximum of 4 credits of 494 may be used toward the Horticulture credits required for graduation. Assessed service-learning component.

HORT 494B: Service Learning: Domestic
Cr. arr. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission of instructor
Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling professional ethics and accomplishing student learning goals. Course expenses paid by student. A maximum of 4 credits of 494 may be used toward the Horticulture credits required for graduation. Assessed service-learning component.

HORT 495: Horticulture Travel Course Preparation
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of instructor
Limited enrollment. Students enrolled in this course also intend to register for Hort 496 the following term. Topics include preparation for safe international travel, the horticultural/agricultural industries, climate, crops, economics, geography, history, marketing, soils, culture, traditions, and horticultural/agricultural development of the country to be visited. Students enroll in this course the term immediately before travel to the foreign country.

HORT 496: Horticulture Travel Course
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
Limited enrollment. Study and tour of production methods in major horticultural regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, cultures, and history of horticultural crops. Location and duration of tours will vary. Tour expenses paid by students.
Meets International Perspectives Requirement.

Courses primarily for graduate students, open to qualified undergraduates:

HORT 506: Crop Genetics
(Cross-listed with AGRON). Cr. 3. F.
Introduction to genetics of reproductive systems, recombination, segregation and linkage analysis, inbreeding, quantitative inheritance, fertility regulation, and polyploidy to prepare students for subsequent courses in crop improvement. Enrollment is restricted to off-campus MS in Plant Breeding students.

HORT 511: Integrated Management of Tropical Crops
(Cross-listed with ENT, PL P). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PL P 408 or PL P 416 or ENT 370 or ENT 376 or HORT 221
Applications of Integrated Crop Management principles (including plant pathology, entomology, and horticulture) to tropical cropping systems. Familiarization with a variety of tropical agroecosystems and Costa Rican culture is followed by 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects.
Meets International Perspectives Requirement.

HORT 524: Sustainable and Environmental Horticulture Systems
(Dual-listed with HORT 424). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Inquiry into ethical issues and environmental consequences of horticultural cropping systems, production practices and managed landscapes. Emphasis on systems that are resource efficient, environmentally sound, socially acceptable, and profitable.

HORT 530: Research Orientation
(1-3) Cr. 2. F.
Instruction in scientific methods and communication skills.

HORT 538: Seed Physiology and the Environment
(Cross-listed with AGRON). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: AGRON 316; CHEM 231 or CHEM 331
Physiological aspects of seed development, maturation, longevity, dormancy, and germination of agronomic and horticultural crops and their interactions with field and storage environments. Emphasis on current literature and advanced methodology.

HORT 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

HORT 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

HORT 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

HORT 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

HORT 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

HORT 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

HORT 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

HORT 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

HORT 543: Seed Physiology
(Cross-listed with STB). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
Brief introduction to plant physiology. Physiological aspects of seed development, maturation, longevity, dormancy and germination. Links between physiology and seed quality.

HORT 546: Strategies for Diversified Farming Systems
(Cross-listed with AGRON, SUSAG). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: SusAg 509
Project-focused engagement in food and farming systems using tools and perspectives drawn from multiple disciplines. Includes a field component.

HORT 551: Growth and Development of Perennial Grasses
(Cross-listed with AGRON). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: Junior or senior or graduate classification or permission of instructor
Selected topics on anatomy, morphology, and physiology relative to growth and development of perennial grasses. Emphasis on growth and development characteristics peculiar to grasses and variations of such characteristics under natural and managed conditions.

HORT 552: Integrated Management of Diseases and Insect Pests of Turfgrasses
(Dual-listed with HORT 452). (Cross-listed with ENT, PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HORT 351
Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

HORT 584: Organic Agricultural Theory and Practice
(Dual-listed with HORT 484). (Cross-listed with AGRON, SUSAG). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 9 cr. in biological or physical sciences
Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives.

HORT 590: Special Topics
Cr. arr. Repeatable.
Prereq: a major or minor in horticulture

HORT 593: Workshop in Horticulture
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593A: Workshop in Horticulture: Greenhouse Crops
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593B: Workshop in Horticulture: Nursery Crops
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593C: Workshop in Horticulture: Turfgrass
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593D: Workshop in Horticulture: Fruit Crops
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593E: Workshop in Horticulture: Vegetable Crops
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593F: Workshop in Horticulture: Cross-Commodity
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593G: Workshop in Horticulture: Landscape Horticulture
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

HORT 610: Graduate Seminar
Cr. 1. Repeatable. F.S.
Offered on a satisfactory-fail basis only.

HORT 690: Advanced Topics
Cr. arr. Repeatable.

HORT 696: Research Seminar
(Cross-listed with AGRON, BBMB, FOR, GDCB, PLBIO). Cr. 1. Repeatable.
Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

HORT 698: Horticulture Teaching Practicum
(1-0) Cr. 1. S.
Prereq: Graduate student classification
Discussions are intended to foster the development of graduate students as teaching assistants and future horticulture/plant science teachers. Topics include establishing a classroom presence, improving lectures, motivating students, dealing with difficult or disruptive students, and developing a teaching philosophy. Offered on a satisfactory-fail basis only.

HORT 699: Thesis and Dissertation Research
Cr. arr. Repeatable.

HORT 699A: Thesis and Dissertation Research: Greenhouse Crops
Cr. arr. Repeatable.

HORT 699B: Thesis and Dissertation Research: Nursery Crops
Cr. arr. Repeatable.

HORT 699C: Thesis and Dissertation Research: Turfgrass
Cr. arr. Repeatable.

HORT 699D: Thesis and Dissertation Research: Fruit Crops
Cr. arr. Repeatable.

HORT 699E: Thesis and Dissertation Research: Vegetable Crops
Cr. arr. Repeatable.

HORT 699F: Thesis and Dissertation Research: Cross-Commodity
Cr. arr. Repeatable.

HORT 699G: Thesis and Dissertation Research: Landscape Horticulture
Cr. arr. Repeatable.

HORT 699I: Thesis and Dissertation Research: Biotechnology
Cr. arr. Repeatable.

Hospitality Management (HSP M)

Courses primarily for undergraduates:

HSP M 101: Introduction to the Hospitality Industry
(3-0) Cr. 3. F.S.SS.
Introduction to the foodservice, lodging, and tourism components of the hospitality industry. Background information, current issues, and future challenges in various segments of the industry.

HSP M 189: Introduction to University Dining Services Management
(1-0) Cr. 1. Alt. S., offered even-numbered years.
Overview of management concepts and distinct features of university dining services.

HSP M 201: Introduction to Casino Management
(3-0) Cr. 3. F.
An overview of the gaming industry. History and development of gaming, casino operations, casino games, marketing of the core gaming products, and social and economic impacts of the gaming industry.

HSP M 230: Introduction to Hospitality Performance Analysis
(3-0) Cr. 3. F.S.
Introduction to Uniform Systems of Accounts for hospitality industry, profitability, income statements, budgeting, managing cash, accounts receivable and payable, costs control, pricing, and evaluation related to restaurant, lodging, and club industry. Preparation for a hospitality accounting certification exam.

HSP M 233: Hospitality Sanitation and Safety
(3-0) Cr. 3. F.S.
Sanitation and safety principles in hospitality operations. Issues impacting consumers and operators. Characteristics of food, supplies, and equipment as related to quality, sanitation and safety. Application of HACCP. Preparation for national foodservice sanitation certification examination.

HSP M 260: Global Tourism Management
(3-0) Cr. 3. F.S.
Overview of the global tourism industry: hospitality and related services, destination/ attractions, tourist behaviors, and destination marketing. Introduction to destination mix, socio-economic and cultural impacts of tourism, destination organizations, tourist motivations, destination image, marketing, promotions, tourism distribution system, and the future of tourism.
Meets International Perspectives Requirement.

HSP M 289: Contemporary Club Management
(Cross-listed with EVENT). (3-0) Cr. 3. F.S.
Prereq: HSP M 101
Organization and management of private clubs including city, country, and other recreational and social clubs. Field trip may be required.

HSP M 290: Independent Study
Cr. 1-2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Freshman or Sophomore classification. Permission of instructor, adviser, and department chair.
Independent study on topics of special interest to the student, facilitated by approved faculty member. Maximum of 9 credits combined of HSP M 290 and HSP M 490 can be applied to graduation.

HSP M 315: Hospitality Law
(3-0) Cr. 3. S.
Prereq: HSP M 101
Laws relating to ownership and operation of hospitality organizations. The duties and rights of both hospitality business operators and customers. Legal implications of various managerial decisions.

HSP M 320: Attractions and Amusement Park Administration
(Cross-listed with EVENT). (3-0) Cr. 3. S.
Prereq: HSP M 101 or permission of instructor
Examination of current issues in the attractions and amusement park industry. Emphasis will be placed on development and design along with the functional departments of modern amusement parks and themed attractions.

HSP M 333: Hospitality Operations Cost Controls
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in HSP M 380, HSP M 380L; 3 credits MATH
Introduction to revenue and cost systems in the hospitality industry. Application of principles related to procurement, production, and inventory controls.

HSP M 352: Lodging Operations Management I
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in HSP M 101, AESHM 287
Introduction to functional department activities and current issues of lodging organizations with emphasis on front office and housekeeping. Reservation activities and night audit exercises. Case studies.

HSP M 380: Quantity Food Production Management
(3-0) Cr. 3. F.S.
Prereq: HSP M 233 or 2 cr MICRO; FS HN 111 or FS HN 214; FS HN 115 or FS HN 215; at least junior classification; enrollment in HSP M 380L
Principles of and procedures used in quantity food production management including menu planning, food costing, work methods, food production systems, quality control, and service.

HSP M 380L: Quantity Food Production and Service Management Experience
(0-6) Cr. 2. F.S.
Prereq: HSP M 233 or 2 cr MICRO; FS HN 111 or FS HN 214; FS HN 115 or FS HN 215; at least junior classification; enrollment in HSP M 380
Application of quantity food production and service management principles and procedures in the program's foodservice operation.

HSP M 383: Introduction to Wine, Beer, and Spirits
(2-0) Cr. 2. F.S.
Prereq: Must be at least 21 years old
Introduction to history and methods of production for a variety of wines, beers, spirits, and other beverages. Beverage tasting and sensory analysis; product knowledge; service techniques; sales; and alcohol service related to the hospitality industry.

HSP M 383L: Introduction to Wine, Beer and Spirits Laboratory
(0-2) Cr. 1. F.S.
Prereq: HSP M 383 or concurrent enrollment. Must be at least 21 years old
The application of the management principles and procedures related to the sale and service of alcohol and specialty beverages served in the beverage and hospitality industry. Beverage tasting and sensory analysis of products commonly served in the beverage industry.

HSP M 391: Foodservice Systems Management I
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in HSP M 380, HSP M 380L
Principles and techniques related to basic management, leadership, and human resource management of foodservices in health care and other on-site foodservice settings. Food safety and sanitation for on-site foodservice operations. Credit for either HSP M 391 or AESHM 287 and AESHM 438 may count toward graduation. Not accepted for credit toward a major in Hospitality Management.

HSP M 392: Foodservice Systems Management II
(3-0) Cr. 3. S.
Prereq: HSP M 391
Introduction to cost control in foodservice departments: procedures for controlling food, labor, and other variable costs. Application of principles related to food product selection, specification, purchase, and storage in health care and other onsite operations. Credit for either HSP M 392 or HSP M 233 and HSP M 333 may count toward graduation. Not accepted for credit toward a major in Hospitality Management.

HSP M 393: Hospitality Management Industry Workshop
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: HSP M Junior or Senior Classification and Permission of Instructor.
Intensive 2 to 8 week workshop exploration. Topics vary each time offered. Maximum of 6 credits of HSPM 393 can be applied toward graduation.

HSP M 433: Hospitality Financial Management
(3-0) Cr. 3. S.
Prereq: HSP M 333; ACCT 284; ECON 101; credit or enrollment in STAT 101
Use of common financial statements, accounting ratios, and financial techniques to impact management decisions.

HSP M 437: Hospitality Information Technology
(3-0) Cr. 3. F.
Prereq: HSP M 352
Introduction to hospitality information technology. Property management and point-of-sales system interfaces: customer relationship management, selecting and purchasing computer systems, electronic distribution systems, internet and its related application systems, managing internal and external communication networks. Case studies.

HSP M 439: Advanced Hospitality Human Resource Management
(3-0) Cr. 3. F.
Prereq: AESHM 438
Emphasis on development of management personnel in hospitality organizations. Case studies.

HSP M 452: Lodging Operations Management II
(3-0) Cr. 3. S.
Prereq: HSP M 352; credit or enrollment in HSP M 333
Development of business plan and evaluation of business performance in a simulated environment. Operational decision making practices by applying concepts of management, operations, marketing, and finance for a computer-mediated environment.

HSP M 455: Introduction to Strategic Management in Foodservice and Lodging
(3-0) Cr. 3. S.
Prereq: AESHM 340; credit or enrollment in HSP M 433 and AESHM 438
Introduction to strategic management principles and practices with an application of human resources, operations, marketing, and financial management concepts. Case studies.

HSP M 487: Fine Dining Event Management
(Dual-listed with HSP M 587). (2-3) Cr. 3. F.
Prereq: HSP M 380, HSP M 380L
Exploration of the historical and cultural development of the world food table. Creative experiences with U.S. regional and international foods. Application of management and financial principles in food preparation and service in fine dining settings. Individual special problems.
Meets International Perspectives Requirement.

HSP M 489: Issues in Food Safety
(Cross-listed with AN S, FS HN, VDPAM). (1-0) Cr. 1. S.
Prereq: Credit or enrollment in FS HN 101 or FS HN 272 or HSP M 233; FS HN 419 or FS HN 420; FS HN 403
Capstone seminar for the food safety minor. Case discussions and independent projects about safety issues in the food system from a multidisciplinary perspective.

HSP M 490: Independent Study
Cr. arr. Repeatable.
Prereq: Sections B-E: Program approval; Section H: Full membership in Honors Program

HSP M 490B: Independent Study: Hospitality Management
Cr. arr. Repeatable.
Prereq: Sections B-E: Program approval
Independent Study in Hospitality Management.

HSP M 490D: Independent Study: Lodging Operations
Cr. arr. Repeatable.
Prereq: Sections B-E: Program approval; Section H: Full membership in Honors Program

HSP M 490E: Independent Study: Foodservice Operations
Cr. arr. Repeatable.
Prereq: Sections B-E: Program approval; Section H: Full membership in Honors Program

HSP M 490H: Independent Study: Honors
Cr. arr. Repeatable.
Prereq: Sections B-E: Program approval; Section H: Full membership in Honors Program

Courses primarily for graduate students, open to qualified undergraduates:

HSP M 505: Hospitality Management Scholarship and Applications
(0-1) Cr. 1. F.SS.
Focus on teaching and research scholarship involving the hospitality industry.

HSP M 506: Current Issues in Hospitality Management
(0-1) Cr. 1. Repeatable. S.SS.
Focus on current issues related to the hospitality industry.

HSP M 533: Financial Decision Making in Hospitality Organizations
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: HSP M 433
Concepts of financial management applied to strategic decision making.

HSP M 538: Human Resources Development in Hospitality Organizations
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: AESHM 438
Theories of human resources management. Practices and principles related to development of management personnel.

HSP M 540: Strategic Marketing
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: AESHM 340
Application of marketing principles in developing effective marketing strategies for hospitality, apparel, and retail organizations. Evaluation of multi-dimensional marketing functions in hospitality organizations.

HSP M 555: Strategic Management in Hospitality Organizations
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Courses in MKT, FIN, MGMT, and HSP M. Permission of instructor
Strategic management process as a planning and decision-making framework; integration of human resources, operations, marketing, and financial management concepts.

HSP M 587: Fine Dining Event Management
(Dual-listed with HSP M 487). (2-3) Cr. 3. F.
Prereq: HSP M 380, HSP M 380L
Exploration of the historical and cultural development of the world food table. Creative experiences with U.S. regional and international foods. Application of management and financial principles in food preparation and service in fine dining settings. Individual special problems.
Meets International Perspectives Requirement.

HSP M 590: Special Topics
Cr. arr. Repeatable, maximum of 3 credits.
Prereq: 9 credits in HRI at 400 level or above; application process
Topics in hospitality management.

HSP M 590B: Special Topics: Hospitality Management
Cr. arr. Repeatable, maximum of 3 credits.
Prereq: 9 credits in HSP M at 400 level or above; application process.

HSP M 590C: Special Topics: Tourism
Cr. arr. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: 9 credits in HSP M at 400 level or above; application process
Special topics in tourism.

HSP M 590D: Special Topics: Lodging Operations
Cr. arr. Repeatable, maximum of 3 credits.
Prereq: 9 credits in HSP M at 400 level or above; application process.

HSP M 590E: Special Topics: Commercial/Retail Foodservice Operations
Cr. arr. Repeatable, maximum of 3 credits.
Prereq: 9 credits in HSP M at 400 level or above; application process.

HSP M 590F: Special Topics: Onsite Foodservice Operations
Cr. arr. Repeatable, maximum of 3 credits.
Prereq: 9 credits in HSP M at 400 level or above; application process.

HSP M 599: Creative Component
Cr. arr.
Creative component as arranged with instructor.

Courses for graduate students:

HSP M 604: Professional Writing
(2-0) Cr. 2. S.SS.
Prereq: Enrollment in PhD program
Development of professional written communication with emphasis on abstracts, proposals, manuscripts, and technical reports.

HSP M 608: Administrative Problems
Cr. arr. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Permission of instructor; enrollment in PhD program
Advanced administrative problems; case studies in foodservice and lodging organizations.

HSP M 633: Advanced Hospitality Financial Management
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HSP M 433; Enrollment in PhD program
Theories and research in financial management with emphasis on financial performance and financing decisions.

HSP M 638: Advanced Human Resources Management in Hospitality Organizations
(3-0) Cr. 3. Alt. F., offered odd-numbered years.Alt. SS., offered even-numbered years.
Prereq: HSP M 538; Enrollment in PhD program
Research in human resources management with an emphasis on organization or unit administration.

HSP M 640: Seminar on Marketing Thoughts
(3-0) Cr. 3. Alt. S., offered even-numbered years.Alt. SS., offered even-numbered years.
Prereq: HSP M 540; STAT 401. Enrollment in PhD program
Conceptual and theoretical development of marketing strategies. Analytical and critical review of marketing research and industry practices.

HSP M 652: Advanced Lodging Operations
(3-0) Cr. 3. Alt. F., offered odd-numbered years.Alt. SS., offered even-numbered years.
Prereq: Enrollment in PhD program
Analysis and applications of concepts and theories of operations research for lodging operations.

HSP M 660: Research Seminar in Tourism Management
(3-0) Cr. 3. Alt. F., offered even-numbered years.Alt. SS., offered odd-numbered years.
Prereq: Enrollment in PhD program
Advanced graduate course on tourism and destination theories and research. Analysis and application fo theories, research findings, and research methods in tourism and destination management.

HSP M 680: Analysis of Research in Foodservice Operations
(3-0) Cr. 3. Alt. S., offered even-numbered years.Alt. SS., offered odd-numbered years.
Prereq: Enrollment in PhD program
Analysis and application of theories, research, and research methods in foodservice operations.

HSP M 690: Advanced Topics
Cr. arr. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Enrollment in PhD program, application process
Advanced study of current topics in hospitality management.

HSP M 690B: Advanced Topics: Hospitality Management
Cr. arr. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Enrollment in PhD program, application process
Advanced study of current topics in hospitality management.

HSP M 690C: Advanced Topics: Tourism
Cr. arr. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Enrollment in PhD program, application process
Advanced study of current topics in hospitality management.

HSP M 690D: Advanced Topics: Lodging Operations
Cr. arr. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Enrollment in PhD program, application process
Advanced study of current topics in hospitality management.

HSP M 690E: Advanced Topics: Commercial/Retail Foodservice Operations
Cr. arr. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Enrollment in PhD program, application process
Advanced study of current topics in hospitality management.

HSP M 690F: Advanced Topics: Onsite Foodservice Operations
Cr. arr. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Enrollment in PhD program, application process
Advanced study of current topics in hospitality management.

HSP M 699: Research
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in PhD program
Research.

Human Computer Interaction (HCI)

Courses primarily for graduate students, open to qualified undergraduates:

HCI 504: Evaluating Digital Learning Environments
(Cross-listed with C I). (3-0) Cr. 3. S.
Prereq: C I 501
Principles and procedures to plan, design, and conduct effective evaluation studies (formative, summative, usability) in different settings are studied. Opportunities to engage in real or simulated evaluation projects of substantial scope are provided. Create evaluation instruments, develop methods with which to evaluate a product or program, conduct try-outs or usability sessions, analyze the data, report the findings, and recommendations are some of the course activities.

HCI 507: Principles of 3D Character Animation
(Cross-listed with ARTIS). (0-6) Cr. 3.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of character animation. Prior knowledge of modeling, lighting, texturing and rendering with available software is assumed.

HCI 509: Computer/Video Game Design and Development
(Cross-listed with ARTIS). (0-6) Cr. 3. Repeatable, maximum of 12 credits.
Prereq: Permission of instructor
Independent project based creation and development of "frivolous and non-frivolous" computer games in a cross-disciplinary team. Projects require cross-disciplinary teams. Aspects of Indie development and computer/video game history will be discussed.

HCI 515: Statistical Natural Language Processing
(Cross-listed with ENGL, LING). (3-0) Cr. 3.
Prereq: STAT 330 or equivalent, recommended ENGL 219 or LING 219, or ENGL 511 or LING 511
Introduction to computational techniques involving human language and speech in applications such as information retrieval and extraction, automatic text categorization, word prediction, intelligent Web searching, spelling and grammar checking, speech recognition and synthesis, statistical machine translation, n-grams, POS-tagging, word-sense disambiguation, on-line lexicons and thesauri, markup languages, corpus analysis, and Python programming language.

HCI 520: Computational Analysis of English
(Cross-listed with ENGL, LING). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 510 or LING 510, and ENGL 511 or LING 511
Concepts and practices for analysis of English by computer with emphasis on the applications of computational analysis to problems in applied linguistics such as corpus analysis and recognition of learner language in computer-assisted learning and language assessment.

HCI 521: Cognitive Psychology of Human Computer Interaction
(Cross-listed with PSYCH). (3-0) Cr. 3.
Prereq: Graduate classification or instructor approval
Biological, behavioral, perceptual, cognitive and social issues relevant to human computer interactions.

HCI 522: Scientific Methods in Human Computer Interaction
(Cross-listed with PSYCH). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PSYCH 521 and STAT 101 or equivalent
Basics of hypothesis testing, experimental design, analysis and interpretation of data, and the ethical principles of human research as they apply to research in human computer interaction.

HCI 525: Optimization Methods for Complex Designs
(3-0) Cr. 3. F.
Prereq: M E 160, MATH 265
Optimization involves finding the 'best' according to specified criteria. Review of a range of optimization methods from traditional nonlinear to modern evolutionary methods such as Genetic algorithms. Examination of how these methods can be used to solve a wide variety of design problems across disciplines, including mechanical systems design, biomedical device design, biomedical imaging, and interaction with digital medical data. Students will gain knowledge of numerical optimization algorithms and sufficient understanding of the strengths and weaknesses of these algorithms to apply them appropriately in engineering design. Experience includes code writing and off-the-shelf routines. Numerous case-studies of real-world situations in which problems were modeled and solved using advanced optimization techniques.

HCI 558: Introduction to the 3D Visualization of Scientific Data
(Cross-listed with COM S, GEOL). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Graduate-student standing in the mathematical or natural sciences or engineering; basic programming knowledge
Introduction to visualizing scientific information with 3D computer graphics and their foundation in human perception. Overview of different visualization techniques and examples of 3D visualization projects from different disciplines (natural sciences, medicine, and engineering). Class project in interactive 3D visualization using the ParaView, Mayavi, TVTK, VTK or a similar system.

HCI 570: UX Lab Studies: Eyetracking & Other UX Tools
(1-0) Cr. 1.
Practical introduction to User Experience (UX) tools and how to use them for research: Designing a UX study; developing meaningful user tasks; how to plan a research study that integrates eyetracking measures, UX measures, behavioral measures, surveys, interviews and IRB applications; analyzing UX data; and presenting UX study results.

HCI 571: Augmented Reality
(3-0) Cr. 3.
Prereq: M E 557/CPR E 557/COM S 557, or equivalent computer graphics experience
Fundamental technologies enabling augmented reality (AR) application development. Assessment and integration of the hardware and software systems necessary for AR including, tracking, image processing and rendering. Programming skills in C++ and GPU-based optimization are developed to enable evaluation of interaction devices and modalities afforded by AR.

HCI 574: Computational Implementation and Prototyping in HCI
Cr. 3. S.
Fundamental concepts of software programming and the practical use of the Python programming language. Assignments include user interaction and interface design, information visualization, as well as other computational HCI tools. Intended for graduate students without prior background in software development. Requires programming during class lectures.

HCI 575: Computational Perception
(Cross-listed with COM S, CPR E). (3-0) Cr. 3. S.
Prereq: Graduate standing or permission of instructor
This class covers statistical and algorithmic methods for sensing, recognizing, and interpreting the activities of people by a computer. This semester we will focus on machine perception techniques that facilitate and augment human-computer interaction. The main goal of the class is to introduce computational perception on both theoretical and practical levels. Participation in small groups to design, implement, and evaluate a prototype of a human-computer interaction system that uses one or more of the techniques covered in the lectures.

HCI 580: Virtual Environments, Virtual Worlds, and Application
(Cross-listed with M E). (3-0) Cr. 3. F.
Prereq: Senior or Graduate status.
A systematic introduction to the underpinnings of Virtual Environments (VE), Virtual Worlds, advanced displays and immersive technologies; and an overview of some of the applications areas particularly virtual engineering.

HCI 585: Developmental Robotics
(Cross-listed with CPR E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: knowledge of C/C++ programming language.
An introduction to the emerging interdisciplinary field of Developmental Robotics, which crosses the boundaries between robotics, artificial intelligence, developmental psychology, and philosophy. The main goal of this field is to create autonomous robots that are more intelligent, more adaptable, and more useful than the robots of today, which can only function in very limited domains and situations.

HCI 587: Models and Theories in Human Computer Interaction
(3-0) Cr. 3.
Survey of the multidisciplinary models and theories that form the foundation of the science of Human Computer Interaction. Application of the scientific method to solve practical problems by using analyses or approaches from the behavioral and social sciences, and information and computer technology.

HCI 589: Design and Ethics
(Cross-listed with ARTGR). (3-0) Cr. 3. F.S.
Prereq: Graduate classification or permission of instructor.
Issues in ethics and decision-making as they relate to technology, design, design research, HCI, and the design industry.

HCI 590: Special Topics
Cr. arr. Repeatable.
Investigation of problems of special interest in human computer interaction.

HCI 591: Seminar in Human Computer Interaction
Cr. 1-3. Repeatable.

HCI 592: Entrepreneurship Workshop
(1-0) Cr. 1. F.
Students will be taken step-by-step through activities that must be undertaken when attempting to commercialize a technology or start their own company. Speakers will be brought in to introduce relevant topics, provide resources, answer questions, and provide working examples.

HCI 595: Visual Design of HCI
Cr. 3. SS.
Human interaction design as it applies to HCI. Aspects of audience analysis, design methodologies for creating concepts and solutions, techniques of concept prototyping, and the fundamentals of visual design such as color, type, symbolism, and grid structure. Class discussions, tutorials, and hands-on projects.

HCI 596: Emerging Practices in Human-Computer Interaction
Cr. 3. SS.
Prereq: HCI 521
Usability evaluation with emphasis on requirements gathering, rapid prototyping, evaluation, and communicating results through report writing along with emerging practices.

HCI 598: HCI Design, Implementation and Implications
Cr. 3. F.S.
Prereq: 21 credits in human computer interaction or permission of the instructor
Capstone course in HCI. Through a significant design project, students demonstrate their mastery of core courses in HCI. This course is the final course for students in the HCI Online MS program.

HCI 599: Creative Component
(3-0) Cr. 3.
Creative component for nonthesis option of Master of Science degree. Offered on a satisfactory-fail basis only.

Courses for graduate students:

HCI 603: Advanced Learning Environments Design
(Cross-listed with C I). (3-0) Cr. 3. S.
Prereq: C I 503
Exploration of advanced aspects of the instructional design process. Application of analysis, design, development and production, evaluation, implementation, and project management principles. Focus on the production and use of instructional technology with an emphasis on the instructional design consulting process. Theory and research in instructional technology provides the foundation for design decisions.

HCI 655: Organizational and Social Implications of Human Computer Interaction
(Cross-listed with MIS). (3-0) Cr. 3.
Prereq: Graduate Classification
Examine opportunities and implications of information technologies and human computer interaction on social and organizational systems. Explore ethical and social issues appurtenant to human computer interaction, both from a proscriptive and prescriptive perspective. Develop informed perspective on human computer interaction. Implications on research and development programs.

HCI 681: Cognitive Engineering
(Cross-listed with I E). (3-0) Cr. 3.
Prereq: I E 572 or I E 577 or PSYCH 516 or HCI/PSYCH 521 or equivalent
Provides an overview of human cognitive capabilities and limitations in the design of products, work places, and large systems. Contexts vary broadly and could range from simple use of mobile devices to an air-traffic control or nuclear plant command center. Course focuses on what we can infer about users' thoughts and feelings based on what we can measure about their performance and physiological state. Covers the challenge of designing automated systems.

HCI 697: HCI Internship
Cr. R. Repeatable.
Prereq: Permission of Director of Graduate Education, graduate classification

HCI 699: Research
Cr. arr. Repeatable.

Human Development and Family Studies (HD FS)

Courses primarily for undergraduates:

HD FS 102: Individual and Family Development, Health, and Well-being
(3-0) Cr. 3. F.S.SS.
Overview of life-span developmental tasks (physical, cognitive, language, social, emotional) examined from various theoretical perspectives. Discussion of topics related to family diversity, individual/family health and well-being and reciprocal relationships as affected by external factors.

HD FS 103: Professional Principles for Working with Children
(0.5-0) Cr. 0.5. F.S.
Introduction to professional principles and ethics, understanding of child abuse reporting, universal precautions. Completion of criminal background checks for ISU practica. Offered on a satisfactory-fail basis only. Only one of HD FS 103 or 105 may count toward graduation.

HD FS 105: Professional Principles for Working with Youth and Adults
(0.5-0) Cr. 0.5. F.S.
Introduction to professional principles and ethics, understanding of child, dependent adults and elder abuse reporting, working with aging adults, universal precautions. Offered on a satisfactory-fail basis only. Only one of HD FS 103 or 105 may count toward graduation.

HD FS 110: Freshman Learning Community Orientation
(1-0) Cr. 1. F.
Prereq: Membership in HD FS Learning Community
Introduction to the Department of Human Development and Family Studies including academic requirements and opportunities, strategies for transitioning to college, learning and study strategies, reading and reflection, and career awareness.

HD FS 111: New Transfer Student Seminar
(1-0) Cr. 1. F.S.
Introduction to HD FS curricula and faculty for students in CH FS, FCEDS or F C P. Department and University policies and procedures, degree audits, and registration. Exploration of campus resources and strategies for student success. Offered on a satisfactory-fail basis only.

HD FS 183: Personal Finance in Early Adulthood
(1-0) Cr. 1. F.S.SS.
Introduction to basic concepts and budgeting practices for management of resources and prevention of financial problems commonly associated with college, including credit and student loans. Offered on a satisfactory-fail basis only.

HD FS 208: Early Childhood Education Teacher Orientation
(Cross-listed with C I). Cr. 1. F.S.
Prereq: classification as ECE major
Overview of early childhood education (birth-grade 3) teacher licensure requirements. Program planning and university procedures. Required of all students majoring in early childhood education. Offered on a satisfactory-fail basis only.

HD FS 218: Professional Orientation and Service Learning
(2-0) Cr. 2. F.S.
Prereq: Credit or concurrent enrollment in HD FS 102. For child, adult and family services majors.
Ethics, professional development, and career exploration in child, adult and family services. Visits to and service learning with programs that serve children, adults and families with diverse needs. Participation in service learning project required. Offered on a satisfactory-fail basis only.

HD FS 223: Child Development and Health
(3-0) Cr. 3. F.S.
Typical and atypical development of children prenatal through middle childhood. Examination of healthy development and potential impact of health issues in children. Discussion of influence of the family and society on development.

HD FS 224: Development in Young Children: Birth through Age 8
(3-1) Cr. 3. F.S.
Prereq: HD FS 102 and HD FS 103
Learning, growth, and development (typical and atypical) of children from birth through age eight. Explores importance of family, programs, and a diverse society. Strategies for observing, recording, and interpreting children's cognitive, communication, motor, social, and emotional development. Practicum.

HD FS 226: Development and Guidance in Middle Childhood
(3-0) Cr. 3. F.
Prereq: HD FS 102 or PSYCH 230
Typical and atypical development from 5 to 12 years of age. Development in the contexts of family, school, and society. Guidance of children in family and group settings.

HD FS 227: Adolescent and Emerging Adulthood
(3-0) Cr. 3. F.S.
Prereq: HD FS 102 or PSYCH 230
Physical, cognitive, and socioemotional development of adolescents and young adults in the context of family, relationships, and culture.

HD FS 234: Adult Development
(Cross-listed with GERON). (3-0) Cr. 3. S.
Prereq: HD FS 102
Introductory exploration of the health, individual and social factors associated with adult development including young adulthood, middle age and older adulthood. Information is presented from a life-span developmental framework.

HD FS 239: Consumer Issues
(3-0) Cr. 3. F.S.
Introduction to factors affecting consumer decisions of individuals and families, including housing, healthcare, and personal finances. Emphasis on accessibility and affordability, community contexts for families; and consumer protection, legislation and regulation, and consumer fraud.
Meets U.S. Diversity Requirement

HD FS 240: Literature for Children
(3-0) Cr. 3. F.S.
Evaluation of literature for children, including an emphasis on diversity and inclusion; cultural competence. Roles of literature in the overall development of children. Literature selection and use in the home and educational settings.
Meets U.S. Diversity Requirement

HD FS 249: Parenting and Family Diversity Issues
(3-0) Cr. 3. F.S.
Parenting practices and family relationships across the lifespan. Practical knowledge and techniques about how to be an effective parent. Diverse families, discipline, and parent education programs.
Meets U.S. Diversity Requirement

HD FS 270: Family Communications and Relationships
(3-0) Cr. 3. F.S.Alt. SS., offered odd-numbered years.
Prereq: HD FS 102 or PSYCH 230
Family communication and its functions to develop, maintain, enrich and limit family relationships. Family theories related to communication and ethical considerations when working with families.
Meets U.S. Diversity Requirement

HD FS 276: Human Sexuality
(3-0) Cr. 3. F.S.SS.
Behavioral, biological, and psychological aspects of human sexuality within the social context of family, culture, and society. Role of sexuality in human development. Critical analysis of media and research. Communication and decision-making skills relating to sexuality issues and relationships.
Meets U.S. Diversity Requirement

HD FS 283: Personal and Family Finance
(3-0) Cr. 3. F.S.
Introduction to basic principles of personal and family finance. Budgeting, record keeping, checking and savings accounts, consumer credit, insurance, investments, and taxes.

HD FS 317: Field Experiences
Cr. 1-6. Repeatable. F.S.SS.
Prereq: Permission of instructor.
Consult department office for procedure. Supervised field experience in human development and family studies programs. Offered on a satisfactory-fail basis only.

HD FS 317B: Field Experiences: Human Development and Family Studies
Cr. 1-6. Repeatable. F.S.SS.
Prereq: 9 credits in HD FS.
Consult department office for procedure. Supervised field experience in human development and family studies programs. Offered on a satisfactory-fail basis only.

HD FS 317H: Field Experiences: Honors
Cr. 1-6. Repeatable. F.S.SS.
Prereq: 9 credits in HD FS
Consult department office for procedure. Supervised field experience in human development and family studies programs. Offered on a satisfactory-fail basis only.

HD FS 340: Assessment and Curricula: Ages Birth through 2 Years
(3-3) Cr. 4. F.S.
Prereq: HD FS 103; HD FS 224; admission to teacher education program
Assessment strategies for infants and toddlers, including those with special needs. Curricula, learning environments, teaching strategies, health and nutritional practices, and schedules that are developmentally, individually, and culturally appropriate. Using assessment to plan, implement, and evaluate activities to promote physical, motor, cognitive, communication, and social emotional development; practicum.

HD FS 341: Household Finance and Policy
(3-0) Cr. 3. F.
Prereq: 6 credits in social sciences
The social, economic, and governmental contexts of financial decision-making at the household level.

HD FS 342: Guidance and Group Management in Early Childhood
(2-2) Cr. 3. F.S.
Prereq: HD FS 103; HD FS 224
Guiding prosocial development, self-regulation, and task engagement of children birth to age 8. Focus is on promoting prosocial behaviors through supportive relationships and environments within diverse home, center, or school settings. Functional behavior assessment and ongoing progress monitoring for targeted and intensive interventions. Practicum.

HD FS 343: Assessment and Programming: Ages 3 through 6 Years
(3-3) Cr. 4. F.S.
Prereq: HD FS 103; HD FS 224; HD FS 240; admission to teacher education program
Assessment strategies for preschool and kindergarten children, including those with special needs. Learning environments, schedules, activities, nutritional practices, and teaching strategies that are developmentally, individually, and culturally appropriate. Using assessment to plan, implement, and evaluate activities to promote physical motor, cognitive, communication, and social emotional development; practicum.

HD FS 344: Programming for Children in Early Care and Education
(3-3) Cr. 4. F.S.
Prereq: HD FS 103; HD FS 224
Programming in inclusive child care centers and family child care homes, including those with special needs, aged birth through 8 years. Developing, implementing, and evaluating learning environments; activities and materials; behavioral guidance and classroom management practices; health and nutritional practices; and schedules to ensure developmental, individual, and cultural appropriateness. Monitoring children's development and behavior to promote physical, motor, cognitive, communication, and social emotional development. Learning to collaborate effectively with parents and staff. Practicum.

HD FS 345: Adapting Programming in Inclusive Settings
(3-0) Cr. 3. F.S.
Prereq: HD FS 224; SP ED 250
Adapting instruction, materials, and equipment to meet developmental needs of young children birth through age 8 with diverse learning needs and multiple disabilities in inclusive settings. Addressing individualized education programs; special health care needs, challenging behavior, and positioning and handling techniques.

HD FS 360: Housing and Services for Families and Children
(3-0) Cr. 3. F.
Prereq: 6 credits in social sciences
Approaches to and assessment of housing and services that assist those with special needs including those with disabilities, low-income, children at risk, single-parents, and the homeless. Emphasis on community settings; e.g., residential facilities, group housing, shelters and transitional housing.
Meets U.S. Diversity Requirement

HD FS 367: Abuse and Illness in Families
(3-0) Cr. 3. F.S.Alt. SS., offered even-numbered years.
Prereq: HD FS 102 or PSYCH 230
Causes and consequences of family stressors including physical, sexual, and emotional abuse; substance abuse; and mental and physical illness across the life span. Interplay between victims, offenders, and the treatment system.

HD FS 369: Research Methods in Human Development and Family Studies
(3-1) Cr. 3. F.S.
Prereq: HD FS 102 or PSYCH 230; 9 hours in HD FS; junior or senior status.
Understanding and evaluating research. Use of primary and secondary data to identify and study problems related to human development and family issues. An introduction to statistical concepts and data analysis. Computer laboratory experience.

HD FS 373: Death as a Part of Living
(Cross-listed with GERON). (3-0) Cr. 3. F.S.Alt. SS., offered even-numbered years.
Prereq: HD FS 102
Consideration of death in the life span of the individual and the family with opportunity for exploration of personal and societal attitudes.

HD FS 377: Aging and the Family
(Cross-listed with GERON). (3-0) Cr. 3. F.Alt. SS., offered odd-numbered years.
Prereq: HD FS 102
Interchanges of the aged and their families. Emphasis on role changes, social interaction, and independence as influenced by health, finances, life styles, and community development.
Meets U.S. Diversity Requirement

HD FS 378: Retirement Planning and Employee Benefits
(Cross-listed with ECON, GERON). (3-0) Cr. 3. S.
Prereq: 3 credits in Principles of Economics and 3 credits in Human Development and Family Studies
Economic well-being in the context of demographic change, the present and future of Social Security, family retirement needs analysis, investment strategies and characteristics of retirement plans, helping others to work towards financial security, family economic issues for retired persons. Overview of employee and retirement benefits.
Meets U.S. Diversity Requirement

HD FS 383: Fundamentals of Financial Planning
(3-0) Cr. 3. F.
Prereq: HD FS 283
Fundamental principles of the financial planning process, client/planner interactions, time value of money applications as well as analyses of ethics review, financial statements, cash flow and debt management, education planning, retirement planning, tax planning, and estate planning needs of families.

HD FS 395: Children, Families, and Public Policy
(3-0) Cr. 3. F.S.Alt. SS., offered odd-numbered years.
Prereq: HD FS 369 or equivalent
Public policy and politics as they affect children and families. Examination of how individuals and groups influence policy. Investigation of current issues and programs influencing the well-being and welfare of children and families.

HD FS 416: Human Development and Family Studies Seminar
Cr. arr. Repeatable. F.S.SS.
Prereq: 8 credits in human development and family studies
Intensive study of a selected topic in human development and family studies.

HD FS 417: Supervised Student Teaching
Cr. 8. Repeatable.
Prereq: Reservation required

HD FS 417C: Supervised Student Teaching: Early Childhood Special Education Programs.
Cr. 8. Repeatable. F.S.
Prereq: GPA 2.5, full admission to teacher education program, HD FS 455; HD FS 456.
Teaching experience with preschool children with disabilities.

HD FS 418: Professional Practice Reflection/Discussion
Cr. 0.5-2. Repeatable. F.S.
Discussion of professional practice experience. Offered on a satisfactory-fail basis only.

HD FS 418A: Professional Practice Reflection/Discussion: Teaching
(0.5-0) Cr. 0.5. F.S.
Prereq: Taken concurrently with HD FS 417
Discussion of HD FS 417 student teaching field experience. Offered on a satisfactory-fail basis only.

HD FS 418B: Professional Practice Reflection/Discussion: Internships
(2-0) Cr. 2. F.S.
Prereq: Junior classification
Process and development of skills necessary for professional preparation and practice including career planning, resume writing, and interviewing. Strategies for successful career management. Offered on a satisfactory-fail basis only.

HD FS 449: Program Evaluation and Proposal Writing
(3-0) Cr. 3. F.S.
Prereq: HD FS 369
Theory and practice of program evaluation and proposal writing in human services including needs assessment, outcome development and measurement, and proposal components. Assessment of programs' success in meeting goals.

HD FS 455: Curricula for Ages 3 through 6 Years
(3-3) Cr. 4. F.S.
Prereq: HD FS 343, HD FS 345, SP ED 355 and SP ED 455
Program models and methods leading to development and organization of appropriate curricula in preschool and kindergarten programs for young children with diverse learning needs. Government regulations and professional standards for child programming. Teaming with parents, colleagues, and paraprofessionals to plan, implement, and evaluate developmentally and culturally appropriate individualized education plans in inclusive settings; practicum.

HD FS 456: Working with Families in Early Intervention
(3-0) Cr. 3. F.S.
Prereq: Current background check; HD FS 340 or HD FS 344; or permission of instructor
Applying family systems theory and family centered principles in early intervention. Understanding the impact of disability on families and young children. Utilizing strategies for delivering family-centered interventions and service coordination in home-based and natural environments. Building trusting relationships, teaming with families and interdisciplinary colleagues to create, implement, and evaluate Individualized Family Service Plans (IFSPs) for children birth to age three. Understanding foundations of theory and policy and empowering families through effective supports and services. Experiences with families.

HD FS 463: Environments for the Aging
(Dual-listed with HD FS 563). (Cross-listed with ARTID, GERON). (3-0) Cr. 3. S.
Prereq: HD FS 360 or 3 credits in housing, architecture, interior design, rehabilitation, psychology, or human development and family studies or permission of instructor
Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (on-line course offering via Distance Education).
Meets U.S. Diversity Requirement

HD FS 479: Family Interaction Dynamics
(3-0) Cr. 3. F.S.
Prereq: HD FS 102 or equivalent; HD FS 369 or equivalent; 9 hours in social sciences; junior or senior status
Analysis of research related to family interaction processes across the family life span. Emphasis on relationship dynamics and cultural differences.

HD FS 482: Family Savings and Investments
(3-0) Cr. 3. F.
Prereq: HD FS 283
Management of family financial resources; emphasis on savings and the investment planning process; issues facing financial planners who manage family assets. Identification of investment options including common stocks, fixed income securities, convertible securities, and related choices.

HD FS 484: Estate Planning for Families
(3-0) Cr. 3. S.
Prereq: HD FS 283
Study of estate planning focusing on efficient conservation and transfer of wealth, consistent with client's goals. Legal, tax, financial and non-financial aspects of estate planning process; trusts, wills, probate, advanced directives, charitable giving, wealth transfers and related taxes.

HD FS 485: Capstone: Family Financial Planning
(3-0) Cr. 3. S.
Prereq: HD FS 283, HD FS 341, HD FS 378, HD FS 383, HD FS 482, FIN 361
Development and refinement of competencies required by personal financial planners to work with individuals and families in meeting financial objectives. Utilization of skills obtained in financial planning emphasis to complete one or more financial planning narratives.

HD FS 486: Administration of Human Services Programs
(3-0) Cr. 3. F.S.
Prereq: Junior classification; 6 credits in HD FS at 300 level and above
Examination of purpose, policies, staffing, operations, and clientele of organizations serving children, adults and families with diverse needs. Management/leadership principles and techniques. Introduction to financial management. Administrators/supervisors roles in employee management as well as development of client-oriented programs, fundraising, goal setting, strategic planning, and advocacy.

HD FS 489: Financial Counseling
(Dual-listed with HD FS 589). (2-0) Cr. 2. F.
Prereq: HD FS 283 for 489, graduate classification for 589
Personal, social/psychological and legal climates affecting family financial decisions. A life cycle approach to financial decision making. Development of financial counseling and planning skills to assist families and individuals to become self-sufficient in family financial management.

HD FS 489L: Financial Counseling Laboratory
(Dual-listed with HD FS 589L). (0-2) Cr. 1. Repeatable, maximum of 2 credits. F.S.
Prereq: HD FS 283 for 489L, graduate classification for 589L
Practical experience in remedial, preventative, and productive approaches to both financial and housing counseling in one-on-one and/or group settings.

HD FS 490: Independent Study
Cr. arr. Repeatable.
Prereq: 6 credits in human development and family studies
Consult department office for procedure.

HD FS 490H: Independent Study: Honors
Cr. arr. Repeatable.
Prereq: 6 credits in human development and family studies
Consult department office for procedure.

HD FS 491: Internship
Cr. 4-9. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: HD FS 418B; permission of instructor; senior classification; minimum 2.0 GPA; reservation required one semester before placement
Supervised work experience related to the student's curriculum. Offered on a satisfactory-fail basis only.

HD FS 493: Workshop
(Dual-listed with HD FS 593). Cr. arr. Repeatable. F.S.SS.
Prereq: Senior classification
Workshop in HD FS.

HD FS 499: Research
Cr. arr. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Consult department office for procedures.
Supervised research experience.

Courses primarily for graduate students, open to qualified undergraduates:

HD FS 501: Graduate Studies, Research, and Ethics in HD FS
(2-0) Cr. 2. F.
Prereq: Admission to HD FS Graduate program
Overview of graduate study, research, ethics, and professional development in the field of human development and family studies. Curriculum, programs of study, portfolios, faculty research interests, dissemination of research, career planning, and teaching discussed.

HD FS 502: Professional Development in Human Development and Family Studies
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: graduate classification; HD FS 501
Overview of professional skills, portfolio building, preparation for academic and nonacademic jobs, leadership fundamentals and project management training, time management, work balance issues, and professional ethics. Opportunities for graduate students to work on their professional development tailored to individual needs of students. Develop an individual professional portfolio.

HD FS 503: Quantitative Research Methods
(4-0) Cr. 4. F.
Prereq: Permission of instructor
Concepts, methods, and strategies for research in human development and family studies. Topics include the nature of scientific research, measurement, types of research in human development and family studies, validity of research designs, methods of data gathering, and strategies for and issues in the study of change.

HD FS 504: Qualitative Research Methods
(3-0) Cr. 3. F.
Prereq: 9 credits of social sciences or permission of instructor
Introduction to qualitative research methodology. Application of fieldwork methods, analysis, interpretation, and writing through individual qualitative research projects.

HD FS 505: Application of Quantitative Research Methods
(3-0) Cr. 3. S.
Prereq: HD FS 503 or permission of instructor
Practical applications of quantitative research methods, including an introduction to secondary data analysis, correlation and regression analysis, regression diagnostics; reporting results.

HD FS 510: Theories of Human Development
(3-0) Cr. 3. F.SS.
Prereq: 9 credits of social sciences or permission of instructor
Theoretical approaches and current research in child, adolescent, and adult development. Individual life span perspectives. Implications for research, policy and practice. (Summer course offering is on-line).

HD FS 511: Family Theory
(3-0) Cr. 3. S.
Prereq: 9 credits in social sciences or permission of instructor
Theoretical approaches and current research in family development. Review the nature and value of theory to the study of the family and evaluate the use of theory in empirical research. Implications for research, policy and practice.

HD FS 530: Perspectives in Gerontology
(Cross-listed with GERON). (3-0) Cr. 3. F.
Overview of current aging issues including theory and research, critical social and political issues in aging, the interdisciplinary focus of gerontology, career opportunities, and aging in the future. (on-line course offering via Distance Education).

HD FS 534: Adult Development
(Cross-listed with GERON). (3-0) Cr. 3. S.
Exploration of the biological, psychological and social factors associated with aging. Although the focus is on the later years, information is presented from a life-span developmental framework. Empirical studies are reviewed and their strengths, limitations and implications for normative and optimal functioning are discussed. (on-line course offering via Distance Education).

HD FS 538: Developmental Disabilities
(Cross-listed with PSYCH). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 9 credits in human development and family studies or psychology or permission of instructor
Theories, research, and current issues regarding the intersection of development and disabilities. Investigation of interventions with individuals and families. (on-line course offering via Distance Education).

HD FS 541: Housing and Real Estate in Family Financial Planning
(Cross-listed with FFP). (3-0) Cr. 3. Alt. SS., offered even-numbered years.
The role of housing and real estate in the family financial planning process, including taxation, mortgages, financial calculations, legal concerns, and ethical issues related to home ownership and real estate investments. Emphasis on emerging issues in the context of housing and real estate. (on-line course offering via Distance Education).

HD FS 545: Economics, Public Policy, and Aging
(Cross-listed with GERON). (3-0) Cr. 3. F.
Policy development in the context of the economic status of the older adult population. Retirement planning and the retirement decisions; social security and public transfer programs; intra-family transfers to/from the aged; private pensions; financing medical care; prospects and issues for the future.

HD FS 555: Current Issues and Research in Early Childhood Services
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 9 credits in social sciences or permission of instructor
Analysis of contemporary and historical early childhood/early intervention/early childhood special education model programs and services. Examination of relationships among service systems and implementation, program quality, teacher effectiveness, and outcomes for children with and without disabilities. (on-line course offering via Distance Education).

HD FS 563: Environments for the Aging
(Dual-listed with HD FS 463). (Cross-listed with ARTID, GERON). (3-0) Cr. 3. S.
Prereq: HD FS 360 or 3 credits in housing, architecture, interior design, rehabilitation, psychology, or human development and family studies or permission of instructor
Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (on-line course offering via Distance Education).
Meets U.S. Diversity Requirement

HD FS 566: Family Policy
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in social sciences or permission of instructor
An introduction to policy for family researchers and practitioners. Examination of relevant policies through a family lens via discussion of theory and student interests in current and enduring family policies and programs. Descriptions of work roles in family policy and the interaction of family researchers and policymakers.

HD FS 567: Family Stress, Abuse, and Illness
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 9 credits in social sciences or permission of instructor
Explores research related to family stress within romantic, parent-child, and sibling relationships. Examines contemporary theory and research on the nature, causes, and consequences of family stressors. These stressors include, but are not limited to economic distress; physical and emotional abuse; substance abuse; and mental and physical illness across the life span. (on-line course offering via Distance Education).

HD FS 568: Individual and Family Assessment
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HD FS 510 or permission of instructor
Use of interviews, observational assessments, direct tests with individuals and families for research and intervention. Opportunities to practice assessments.

HD FS 575: Cross-cultural Perspectives about Families and Children
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in social sciences or permission of instructor
Review of current research regarding family diversity including an examination of cultural and structural influences on the development and well-being of families and children. Discussion of the impact on human rights and social justice. (on-line course offering via Distance Education).

HD FS 577: Aging in the Family Setting
(Cross-listed with GERON). (3-0) Cr. 3. S.
Prereq: 9 credits in social sciences or permission of instructor
Theories and research related to personal and family adjustments in later life affecting older persons and their intergenerational relationships. Related issues including demographics also are examined through the use of current literature. (on-line course offering via Distance Education).

HD FS 579: Family Well-being Across the Lifespan
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 9 credits in social sciences or permission of instructor
Review of current research to provide a theoretical and practical understanding of the economic, social, and psychological factors that influence interpersonal relationships and individual well-being within the institution of the family system. Economic and policy effects considered. (on-line course offering via Distance Education).

HD FS 581: International Study in Human Development and Family Studies
Cr. 1-12. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission by application
Limited enrollment. Supervised international study experiences in Human Development and Family Studies. Countries vary.

HD FS 581A: International Study in HD FS: Practicum
Cr. 1-12. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission by application
Limited enrollment. Supervised international study experiences in Human Development and Family Studies. Countries vary.

HD FS 581B: International Study in HD FS: Exchange
Cr. 1-12. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission by application
Limited enrollment. Supervised international study experiences in Human Development and Family Studies. Countries vary.

HD FS 581C: International Study in HD FS: Group Study
Cr. 1-12. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission by application
Limited enrollment. Supervised international study experiences in Human Development and Family Studies. Countries vary.

HD FS 583: Investing for the Family's Future
(Cross-listed with FFP). (3-0) Cr. 3. F.
Prereq: HD FS 483
Evaluation of investment markets for the household. Analysis of how families choose where to put their savings. Emphasis is on using the family's overall financial and economic goals to help inform investment choices. (on-line course offering via Distance Education).

HD FS 584: Program Evaluation and Research Methods in Gerontology
(Cross-listed with GERON). (3-0) Cr. 3. S.
Overview of program evaluation, research methods, and grant writing in gerontology. Includes application of quantitative and qualitative methods in professional settings. (on-line course offering via Distance Education).

HD FS 585: Program Evaluation
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 6 credits in graduate level social sciences or permission of instructor
Theoretical and practical issues related to design and implementation of program evaluation in social sciences. Includes theory, design, implementation, analysis and report writing to assist programs to be successful in meeting program goals.

HD FS 588: Family Economics
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 6 credits in sociology or economics
Analysis of family income, wealth, and economic well-being. Emphasis on effects of family behavior and public policies on the adequacy and security of income across the family life cycle. Implications of resource allocation within the family for adult and child well-being.

HD FS 589: Financial Counseling
(Dual-listed with HD FS 489). (2-0) Cr. 2. F.
Prereq: HD FS 283 for 489, graduate classification for 589
Personal, social/psychological and legal climates affecting family financial decisions. A life cycle approach to financial decision making. Development of financial counseling and planning skills to assist families and individuals to become self-sufficient in family financial management.

HD FS 589L: Financial Counseling Laboratory
(Dual-listed with HD FS 489L). (0-2) Cr. 1. Repeatable, maximum of 2 credits. F.S.
Prereq: HD FS 283 for 489L, graduate classification for 589L
Practical experience in remedial, preventative, and productive approaches to both financial and housing counseling in one-on-one and/or group settings.

HD FS 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Consult department office on procedure for filing a written plan of study.

HD FS 590I: Special Topics: Human Development and Family Studies
Cr. arr. Repeatable.
Prereq: Permission of instructor
Consult department office on procedure for filing a written plan of study.

HD FS 591: Internship
Cr. arr. Repeatable. F.S.SS.
Prereq: 10 graduate credits
Supervised experience in an area of human development and family studies.

HD FS 591I: Internship: Human Development and Family Studies
Cr. arr. Repeatable. F.S.SS.
Prereq: 10 graduate credits
Supervised experience in an area of human development and family studies.

HD FS 593: Workshop
(Dual-listed with HD FS 493). Cr. arr. Repeatable. F.S.SS.
Prereq: Senior classification
Workshop in HD FS.

HD FS 594: Professional Seminar in Gerontology
(Cross-listed with GERON). (3-0) Cr. 3. SS.
An integrative experience for gerontology students designed to be taken near the end of the degree program. By applying knowledge gained in earlier coursework, students will strengthen skills in ethical decision-making behavior, applying these skills in gerontology-related areas such as advocacy, professionalism, family and workplace issues. Students from a variety of professions will bring their unique perspectives to bear on topics of common interest. (on-line course offering via Distance Education).

HD FS 599: Creative Component
Cr. arr. F.S.SS.
Prereq: 9 graduate credits in HD FS
Nonthesis students creative component (e.g., a special report, capstone course, integrated field experience, annotated bibliography, research project, design, or other creative endeavor). A minimum of five credits of independent work is required on the programs of study (POS). Creative component format determined cooperation with the POS committee.

Courses for graduate students:

HD FS 603: Advanced Quantitative Methods
(3-0) Cr. 3. F.
Prereq: HD FS 503, HD FS 505; STAT 402 or STAT 404 or permission of instructor
Methodological and analytical issues in research in human development and family studies. Advanced research design and measurement, selection of statistical techniques, and issues in the interpretation of findings.

HD FS 604: Advanced Qualitative Methods
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HD FS 504 or permission of instructor
Research methodologies including phenomenology, grounded theory, ethnography, and case studies. Methods of data collection and analysis procedures. Issues of ethics and interpretation of findings. (on-line course offering via Distance Education).

HD FS 605: Multi-level Modeling
(Cross-listed with PSYCH). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HD FS 503 and HD FS 505 or STAT 404 or permission of instructor
Rationale for and interpretation of random coefficient models. Strategies for the analysis of multi-level and panel data including models for random intercepts, random slopes, and growth curves.

HD FS 606: Advanced Structural Equation and Longitudinal Modeling
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HD FS 603 or STAT 404 or permission of instructor
Rationale for and interpretation of advanced structural equation modeling for the analysis of longitudinal data. Emphasis will be placed on developing a working familiarity with some of the common statistical procedures, coupled with their application through the use of statistical software.

HD FS 607: Mixed Methods
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HD FS 503, HD FS 504,HD FS 505, or permission of instructor
Foundations of mixed methods research, controversies, and philosophical concerns. Rationale for and interpretation of mixed methods designs. Research design, sampling, data collection, data analysis, results, and interpretation. (on-line course offering via Distance Education).

HD FS 608: Grant Writing for Research
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: HD FS 503, HD FS 505, and HD FS 504 or permission of instructor
Understand how to identify funding sources as well as the fundamental components of a federal research grant proposal such as the abstract or summary, background and significance, specific aims/goals and objectives, project design and methods, sustainability, assessment, broader impacts, dissemination, budget, budget justification, and cover letter.

HD FS 616: Seminar
Cr. arr.
May be repeated. F.S.SS.

HD FS 631: Child Health and Development
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: HD FS 510 or permission of instructor
Young children's cognitive, physical, communication, and social-emotional health and development will be examined. Both typical and atypical trajectories will be explored. Research on current trends in the field will be emphasized.(on-line course offering via Distance Education).

HD FS 632: Behavioral Interventions in Early Childhood
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HD FS 510 or permission of instructor
Issues related to behavioral development and needs of children ages 3-8. Design and implementation of group and individual behavioral interventions. Discussion of coaching strategies to improve intervention implementation. (on-line course offering via Distance Education).

HD FS 633: Infant Mental Health
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HD FS 510 or permission of instructor
Examination of the individual, interpersonal, and familial factors that influence infant (birth through age 3) mental health. Analysis of the risk and protective factors that influence these systems and their potential effects on social-emotional development. Current issues relating to effective programs for improving parent-infant interactions and additional supports available to families.(on-line course offering via Distance Education).

HD FS 634: Adolescent and Emerging Adult Health and Development
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HD FS 510 or permission of instructor
Theory and research on biopsychosocial, cognitive, physical and sexual health and development from early adolescence to emerging adulthood. Contexts of development including families, peers, schools, neighborhoods, romantic relationships, economics and public policies are considered.(on-line course offering via Distance Education).

HD FS 635: Adult Development, Aging, and Health
(Cross-listed with GERON). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: HD FS 510 or permission of instructor
Review of the impact of the growing older adult population as well as individual development and aging on individuals, families, and society. Exploration of theoretical perspectives applied to adult development and aging and distinction of normative and non-normative changes in adulthood. Discussion of methods to assess development across adulthood and consideration of the role of individual and environmental factors impacting efforts to optimize adult development.(on-line course offering via Distance Education).

HD FS 640: Biomarkers and Family Research
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HD FS 510 or permission of instructor.
Research on the biological underpinnings of human development and the biobehavioral health of the family. Exposure to interdisciplinary research and practice on biomarkers in the family, with particular emphasis on health-and well being-related measures. Application of biomarker collection, measurement, analysis and dissemination.

HD FS 690: Advanced Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor and enrollment in Ph.D. program

HD FS 690I: Advanced Topics: Human Development and Family Studies
Cr. arr. Repeatable.
Prereq: Permission of instructor and enrollment in Ph.D. program

HD FS 691: Internship
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor
Supervised practice and experience in the following specified areas. Offered on a satisfactory-fail basis only.

HD FS 691A: Internship: College Teaching
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor
Supervised practice and experience in college-level teaching. Offered on a satisfactory-fail basis only.

HD FS 691B: Internship: Research
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor
Supervised practice and experience in conducting research. Offered on a satisfactory-fail basis only.

HD FS 691D: Internship: Professional Experience
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor
Supervised practice and experience in relevant professional experiences. Offered on a satisfactory-fail basis only.

HD FS 699: Research
Cr. arr. Repeatable.
Offered on a satisfactory-fail basis only.

HD FS 699I: Research: Human Development and Family Studies
Cr. arr. Repeatable.
Offered on a satisfactory-fail basis only.

Human Sciences (H SCI)

Courses primarily for undergraduates:

H SCI 110: Orientation and Human Sciences Career Exploration
(2-0) Cr. 2. F.S.
Orientation and adjustment to the university and college; review of policies and procedures; academic resources; and course selection and planning. Comprehensive approach to career development; intensive self-analysis; and in-depth examination of majors in Human Sciences. Required for all students declared as an Undecided major in the College of Human Sciences.

H SCI 150: Dialogues on Diversity
(1-0) Cr. 1. F.S.
An exploration of diversity within the context of the Iowa State University community through understanding human relations issues.
Meets U.S. Diversity Requirement

H SCI 490: Independent Study
Cr. 1-4.

H SCI 490E: Entrepreneurship
Cr. 1-4.

Immunobiology (IMBIO)

Courses for graduate students:

IMBIO 602: Current Topics Workshop in Immunology
(1-0) Cr. 1. Repeatable. F.
Lectures provided by off-campus experts. Students are required to participate in discussion sessions with lecturers.

IMBIO 604: Seminar in Immunobiology
(1-0) Cr. 1. Repeatable. S.
Student and faculty presentation.

IMBIO 661: Comparative Immunology and Infectious Disease
(Cross-listed with V PTH). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Graduate level Immunology or permission of instructor.
Discuss and define similarities and differences of varied host responses to infectious challenge. Learning will focus on comparative aspects of the host response and the unique aspects of immunity from different organisms, while highlighting molecular and mechanistic similarities of pathogen recognition, response and resolution.

IMBIO 690: Special Topics
Cr. arr. Repeatable.
Advanced study of specific topics in specialized field of immunobiology.

IMBIO 697: Graduate Research Rotation
Cr. arr. Repeatable.
Graduate research projects performed under the supervision of selected faculty members in the Interdepartmental Immunobiology major.

IMBIO 699: Research
Cr. arr. Repeatable.

Industrial Design (IND D)

Courses primarily for undergraduates:

IND D 201: Industrial Design Studio I
(0-12) Cr. 6. F.
Prereq: Admission to the industrial design program, enrollment in IND D 231.
Product scale form development and visual communication.

IND D 202: Industrial Design Studio II
(0-12) Cr. 6. S.
Prereq: IND D 201
Principles of structure and function in products.

IND D 231: Introduction to Industrial Design
(3-0) Cr. 3. F.
Prereq: DSN S 102 and DSN S 131, enrollment in 201; admission to the industrial design program through department review or permission of instructor.
The history, definition, scope, and basic principles of industrial design. Overview of technical, artistic, and sociological context of the profession.

IND D 232: Creative Thinking for Industrial Design
(3-0) Cr. 3. S.
Prereq: IND D 231
Exploration of strategies, methods, and processes associated with creative thinking skills and problem solving. Discussion of the nature of creativity and its implications in different contexts that cross content boundaries.

IND D 260: Engineering: Getting from Thought to Thing
(Cross-listed with ENGR). (3-0) Cr. 3. F.S.
What is engineering, technology and their roles in society? Investigation of engineering methods through case studies of everyday objects. Explore questions about the impact of technology in society. Apply engineering methods to design and failure analysis.

IND D 270: Survey of How Things Work
(Cross-listed with ENGR). (3-0) Cr. 3. F.S.
Removing mysteries surrounding science and technology. Identify key concepts from applied science and technology to obtain better understanding on how things work. Review and explain the principles behind the technologies which define our modern way of life. A survey of broad range of technology could include: cell phones, GPS, radio, television, computers, ultrasound, microwave ovens, automobile, bioengineering and other industrial and consumer technologies. Common day technology examples illustrating scientific knowledge and applications.

IND D 301: Industrial Design Studio III
(0-12) Cr. 6. F.
Prereq: IND D 202
Systematic design methodology and integration of creative thinking techniques.

IND D 302: Industrial Design Studio IV
(0-12) Cr. 6. F.S.
Prereq: IND D 301 or permission of instructor
Exploration of commercial factors in industrial design.

IND D 332: Design Research Methods
(3-0) Cr. 3. F.
Prereq: IND D 231 or permission of instructor.
Survey of qualitative and quantitative methods with an emphasis on contextual user-centered research. Integration of user data collection, visualization, and synthesis as a source for design. Experience of a small-scale research practice related to industrial design.

IND D 334: Materials and Processes for Industrial Design
(3-0) Cr. 3. S.
Prereq: IND D 201 and IND D 231.
Introduction to materials and manufacturing methods for mass production and distribution of products.

IND D 341: Computer Aided Industrial Design I
(0-6) Cr. 3. F.S.
Prereq: IND D 301
Emphasis on the computer as an industrial design and visualization tool.

IND D 351: Applied Human Factors Lab
(0-1) Cr. 1. F.
Prereq: IND D 231 and enrollment in ARTID 251
Theory and application of human factors issues in the industrial design field, specifically their impact on the relationship of the user, the product, and the product systems.

IND D 387: History of Industrial Design I
(3-0) Cr. 3. F.
Prereq: 30 credits earned at ISU
Historical perspective of industrial objects starting at the Industrial Revolution 1830 to 1960. Discussion of social, political, cultural and technological context for industrial design.
Meets U.S. Diversity Requirement

IND D 388: History of Industrial Design II
(3-0) Cr. 3. S.
Prereq: 30 credits earned at ISU.
Historical perspective of industrial objects 1960 to present. Discussion of social, political, cultural and technological context for industrial design.

IND D 397: Industrial Design Internship
(0-12) Cr. 6. F.S.SS.
Prereq: IND D 202, 18 credits in industrial design, permission of instructor.
Professional industrial design, off-campus experience.

IND D 401: Industrial Design Studio
(0-12) Cr. 6. F.S.
Prereq: IND D 301 or permission of instructor
Advanced topics focused on industrial design applications. Topics vary each time offered.

IND D 490: Special Topics
Cr. arr. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Advanced topics focused on industrial design applications. Topics vary each time offered. A. Theory, Criticism, Methodology B. Experimental Techniques C. Three Dimensional Design D. Distributed Collaboration.

IND D 490A: Special Topics: Theory, Criticism, Methodology
Cr. arr. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Advanced topics focused on industrial design applications. Topics vary each time offered.

IND D 490B: Special Topics: Experimental Techniques
Cr. arr. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Advanced topics focused on industrial design applications. Topics vary each time offered.

IND D 490C: Special Topics: Three-Dimensional Design
Cr. arr. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Advanced topics focused on industrial design applications. Topics vary each time offered.

IND D 490D: Special Topics: Distributed Collaboration
Cr. arr. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Advanced topics focused on industrial design applications. Topics vary each time offered.

IND D 495: Study Abroad Option
(0-12) Cr. 6. F.S.SS.
Prereq: IND D 202 and permission of instructor
International study abroad program. Visits to design studios, showrooms, museums and manufacturing facilities.

IND D 499: Senior Project
(0-12) Cr. 6. S.
Prereq: IND D 495 or IND D 507 and senior standing
Advanced practice in specialized area of industrial design. Topics vary.

Courses primarily for graduate students, open to qualified undergraduates:

IND D 501: Industrial Design Studio Intensive I
(0-12) Cr. 6. F.
Prereq: Admission into the Graduate Intensive Track or graduate standing in the industrial design program.
Basic concepts and techniques for industrial design. Emphasis on form development, structure, function and communication.

IND D 502: Industrial Design Studio Intensive II
(0-12) Cr. 6. S.
Prereq: Admission into the Graduate Intensive Track or graduate standing in the industrial design program.
Advanced concepts and techniques for industrial design. Emphasis on systematic design methodology and commercial factors, and visual and verbal communication of design problems and solutions.

IND D 503: Industrial Design Studio I
(0-12) Cr. 6. F.
Prereq: Admission to the industrial design graduate program or completion of Graduate Intensive Track.
Advanced, project-based application of industrial design concepts and techniques.

IND D 504: Industrial Design Studio II
(0-12) Cr. 6. S.
Prereq: IND D 502.
Advanced, project based application of industrial design concepts and techniques, with an emphasis on service and system design, and its implications for the community.

IND D 507: Industrial Design Practicum
(0-12) Cr. 6. F.S.
Prereq: Evidence of satisfactory experience in area of specialization; admitted by application and written permission of instructor only.
Studio project focused on topics generated with external partners. Topics vary.

IND D 511: Colloquium
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Admission into the Graduate Intensive Track or graduate standing in the industrial design program.
Presentation and discussion of creative activity carried out in various design disciplines and their relationship to industrial design. Seminar sessions focusing on exemplary pieces of design research undertaken by faculty and graduate students in the design field.

IND D 532: Design Thinking
(3-0) Cr. 3. S.
Prereq: Admission into the Graduate Intensive Track or graduate standing in the industrial design program, or permission of instructor.
Exploration of problem-solving methods for systems, products, and processes across all contexts. Strategies for problem-solution co-evolution process, with a focus on collaborative and interdisciplinary design to investigate real-world problems and opportunities.

IND D 534: Product Realization for Industrial Design
(3-0) Cr. 3. S.
Prereq: Admission into the Graduate Intensive Track or graduate standing in the industrial design program.
Introduction to materials and manufacturing methods for products. Exploration of emerging materials and new applications.

IND D 540: Visual Communication for Industrial Design
(0-6) Cr. 3. F.
Prereq: Admission into the Graduate Intensive Track or graduate standing in the industrial design program.
Exploration of multiple visual communication techniques used in industrial design and product development.

IND D 541: Computer Aided Industrial Design
(0-6) Cr. 3. F.S.
Prereq: Completion of industrial design studio or permission of instructor.
Exploration of the computer as an industrial design and visualization tool. Advanced concepts in computer to machine interface for manufacture.

IND D 543: Portfolio and Professional Practice
(1-4) Cr. 3. F.S.
Prereq: Advanced standing in the industrial design program.
Discussion of industrial design practice and career planning. Development and preparation of personal promotional materials for a range of media.

IND D 551: Human Factors
(3-0) Cr. 3. S.
Prereq: IND D 532
Human factors issues and the study of relationships between the user, the product, and the human body and its physical functions. Investigations of bio-mechanics, anthropometry, instrumental displays and control, and their measurement as they relate to the design process.

IND D 590: Special Topics
(1-4) Cr. 3. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Advanced topics focused on industrial design applications. Topics include theory, criticism, methodology, experimental techniques, three dimensional design, distributed collaboration.

IND D 592: Special Projects
Cr. arr. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Planned projects in topics related to theory, criticism, methodology, experimental techniques, three dimensional design, distributed collaboration.

IND D 595: Study Abroad Option
(0-12) Cr. 6. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
International study abroad program. Visits to design studios, showrooms, museums and manufacturing facilities.

IND D 597: Internship
(0-12) Cr. 6. Repeatable. F.S.SS.
Prereq: Completion of Industrial design studio or permission of instructor.
Professional industrial design, off-campus experience.

Courses for graduate students:

IND D 601: Graduate Project I
(0-12) Cr. 6. F.
Prereq: IND D 632
Advanced creative component in specialized area of focus within industrial design. Culminates in a development plan and supporting documentary.

IND D 602: Graduate Project II
(0-12) Cr. 6. S.
Prereq: IND D 601
Advanced creative component in specialized area of focus within industrial design. Culminates in a physical or digital artifact and supporting documentation.

IND D 631: Design Research Methods
(3-0) Cr. 3. F.
Prereq: Admission into the Graduate Intensive Track, graduate standing in the industrial design program, or permission of instructor.
Cross-disciplinary research methods to examine the impact of industrial design on humans, environments, and social contexts. Examination and critique of current research methods employed in the field, and application of a selection of these methods to a variety of research questions.

IND D 632: Thesis Preparation
(3-0) Cr. 3. S.
Prereq: IND D 631
Exploration and formulation of graduate thesis or project topics, with proposed studies and investigations. Introduction to structuring a design research prospectus and university requirements for graduation. Determine Faculty Committee and Program of Study and file forms with Graduate College.

IND D 699: Thesis
(0-12) Cr. 6. Repeatable. F.S.SS.
Prereq: IND D 632
Advanced research component in specialized area of focus within industrial design. Culminates in a thesis document.

Industrial Engineering (I E)

Courses primarily for undergraduates:

I E 101: Industrial Engineering Profession
Cr. R. F.S.
(1-0) Introduce students to the industrial engineering profession, its scope, industrial engineering tools, and future trends.

I E 148: Information Engineering
(2-2) Cr. 3. F.S.
Prereq: Credit or enrollment in MATH 143
Development of information solutions for engineering problems. Fundamentals of the software development process. Engineering computations and the human/computer interface. Data models and database development. Program connectivity and network applications.

I E 222: Design & Analysis Methods for System Improvements
(3-0) Cr. 3. S.
Prereq: I E 248; credit or enrollment in I E 271.
Study of system improvement methods and strategies. Specific areas of lean system improvements include continuous improvement, setup reduction, workplace organization, inventory and waste minimization. Methods and strategies to analyze and quantify the impact of changes.

I E 248: Engineering System Design, Manufacturing Processes and Specifications
(2-2) Cr. 3. F.
Prereq: MATH 166 and PHYS 221. Credit or enrollment in I E 101 and MAT E 273.
Introduction to metrology, engineering drawings and specifications. Engineering methods for designing and improving systems. Theory, applications, and quality issues related to machining processes.

I E 271: Applied Ergonomics and Work Design
(3-0) Cr. 3. S.
Prereq: PHYS 221
Basic concepts of ergonomics and work design. Their impact on worker and work place productivity, and cost. Investigations of work physiology, biomechanics, anthropometry, work methods, and their measurement as they relate to the design of human-machine systems.

I E 305: Engineering Economic Analysis
(3-0) Cr. 3. F.S.SS.
Prereq: MATH 166
Economic analysis of engineering decisions under uncertainty. Financial engineering basics including time value of money, cash flow estimation, and asset evaluation. Make versus buy decisions. Comparison of project alternatives accounting for taxation, depreciation, inflation, and risk.

I E 312: Optimization
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in MATH 267.
Concepts, optimization and analysis techniques, and applications of operations research. Formulation of mathematical models for systems, concepts, and methods of improving search, linear programming and sensitivity analysis, network models, and integer programming.

I E 341: Production Systems
(3-0) Cr. 3. F.
Prereq: STAT 231; credit or enrollment in I E 312
Introduction of key concepts in the design and analysis of production systems. Topics include inventory control, forecasting, material requirement planning, project planning and scheduling, operations scheduling, and other production systems such as Just-In-Time (JIT), warehousing, and global supply chains.

I E 348: Solidification Processes
(Cross-listed with MAT E). (2-2) Cr. 3. S.
Prereq: I E 248 and MAT E 273, or MAT E 215
Theory and applications related to metal casting, welding, polymer processing, powder metallurgy, and composites manufacturing, and related rapid manufacturing processes.

I E 361: Statistical Quality Assurance
(Cross-listed with STAT). (2-2) Cr. 3. F.S.
Prereq: STAT 231, STAT 301, STAT 326 or STAT 401
Statistical methods for process improvement. Simple quality assurance principles and tools. Measurement system precision and accuracy assessment. Control charts. Process capability assessment. Experimental design and analysis for process improvement. Significant external project in process improvement.

I E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

I E 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

I E 403: Introduction to Sustainable Production Systems
(Dual-listed with I E 503). (3-0) Cr. 3.
Prereq: Credit or enrollment I E 341
Quantitative introduction of sustainability concepts in production planning and inventory control. Review of material recovery (recycling) and product/component recovery (remanufacturing) from productivity perspectives. Sustainability rubrics ranging from design and process to systems. Application to multi-echelon networks subject to forward/backward flow of material and information. Closed-loop supply chains. Comparative study of sustainable vs. traditional models for local and global production systems.

I E 405: Advanced Engineering Economy for Complex Engineering Projects
(Dual-listed with I E 505). (3-0) Cr. 3.
Prereq: MATH 265, MATH 267, STAT 231 and I E 305, or permission by instructor
Overview of engineering economic valuation and complex engineering projects. Stochastic dynamic programming for project valuation. Modeling and analysis of confounding factors of engineering projects. Integration and synthesis of valuation methodologies to complex projects. Applications to power plants, transmission networks, and satellites.

I E 413: Stochastic Modeling, Analysis and Simulation
(4-0) Cr. 4. F.
Prereq: MATH 267, STAT 231
Development and analysis of simulation models using a simulation language. Application to various areas of manufacturing and service systems such as assembly, material handling, and customer queues. Utilizing model output to make important business decisions. Fitting of data to statistical distributions. Introduction to Markov processes and other queuing models.

I E 432: Industrial Automation
(2-3) Cr. 3. S.
Prereq: Phys 222
Overview of electrical circuit theory and its relationship to industrial control systems. Theory and application of transducers in the form of sensors and actuators, with applications in manufacturing, distribution and mechanical systems. Programmable Logic Controllers (PLC), their programming and use for automation solutions. Introduction of automated identification systems such as Radio Frequency Identification (RFID) and Bar Coding technologies.

I E 441: Industrial Engineering Design
(1-6) Cr. 3. F.S.
Prereq: I E 248, I E 271, I E 361; credit or enrollment in I E 341, I E 413, and I E 448
A large, open-ended design project related to an enterprise. Application of engineering design principles including problem definition, analysis, synthesis, and evaluation.

I E 446: Geometric Variability in Manufacturing
(Dual-listed with I E 546). (3-0) Cr. 3.
Prereq: I E 348, or MAT E 216, or M E 324
Assessment, accommodation, and control of geometric variability in manufacturing processes, specifically composites, metalcasting, welding, machining, and powder metallurgy. Techniques include the design of the component, tooling and process plan. The use of contact and noncontact measurement methods to assess variation.

I E 447: Biomedical Design and Manufacturing
(Dual-listed with I E 547). (3-0) Cr. 3.
Prereq: Students with two semesters or less before graduation
Exploration of biology, materials, body mechanics, manufacturing, quality control, and ethics and the intersection of these subjects as they relate to biomedical manufacturing.

I E 448: Manufacturing Systems Engineering
(3-0) Cr. 3. S.
Prereq: I E 248, I E 305
Fixturing and tooling requirements for manufacturing process planning, geometric dimensioning and tolerancing, computer aided inspection, cellular and flexible manufacturing, and facility layout. Lean manufacturing principles and controlled flow production.

I E 449: Computer Aided Design and Manufacturing
(Dual-listed with I E 549). (3-0) Cr. 3.
Prereq: Prereq: I E 248 or similar manufacturing engineering course, MATH 265.
Representation and interpretation of curves, surfaces and solids. Parametric curves and surfaces and solid modeling. Use of CAD software and CAD/CAM integration. Computer numerical control, CNC programming languages, and process planning.

I E 450: Technical Sales for Engineers I
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in I E 305.
Sales process methodology, techniques for building professional relationships, sales automation software, prospecting and account development, market analysis and segmentation, responding to RFQ's and RFP's in written and verbal form. Developing technical value propositions and competitive positioning, evaluating organizational decision processes and people, technical marketing strategies, sales closing strategies.

I E 451: Technical Sales for Engineers II
(3-0) Cr. 3. S.
Prereq: I E 450
Case studies and experiential lessons on the development and application of technical sales strategies. Specific topics include developing pricing and distribution strategies, managing a sales staff and channel, developing sales teams and global sales plans, bid and negotiation strategies, time management skills, and implementing sales automation technologies.

I E 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, AER E, B M E, CPR E, E E, ENGR, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

I E 467: Multidisciplinary Engineering Design II
(Cross-listed with AER E, CPR E, E E, ENGR, M E, MAT E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: Student must be within two semesters of graduation or receive permission of instructor.
Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

I E 468: Large-Scale Complex Engineered Systems (LSCES)
(Dual-listed with I E 568). (Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: senior standing in College of Engineering or permission of AerE 468 instructor
Introduction to the theoretical foundation and methods associated with the design for large-scale complex engineered systems, including objective function formation, design reliability, value-driven design, product robustness, utility theory, economic factors for the formation of a value function and complexity science as a means of detecting unintended consequences in the product behavior.

I E 481: e-Commerce Systems Engineering
(Dual-listed with I E 581). (3-0) Cr. 3.
Prereq: I E 148
Design, analysis, and implementation of e-commerce systems. Information infrastructure, enterprise models, enterprise processes, enterprise views. Data structures and algorithms used in e-commerce systems, SQL, exchange protocols, client/server model, web-based views.

I E 483: Knowledge Discovery and Data Mining
(Dual-listed with I E 583). (3-0) Cr. 3.
Prereq: I E 148, I E 312, and STAT 231
Introduction to data warehouses and knowledge discovery. Techniques for data mining, including probabilistic and statistical methods, genetic algorithms and neural networks, visualization techniques, and mathematical programming. Advanced topics include web-mining and mining of multimedia data. Case studies from both manufacturing and service industries. A computing project is required.

I E 490: Independent Study
Cr. 1-5. Repeatable.
Prereq: Senior classification, permission of instructor
Independent study and work in the areas of industrial engineering design, practice, or research.

I E 490H: Independent Study: Honors
Cr. 1-5. Repeatable.
Prereq: Senior classification, permission of instructor
Independent study and work in the areas of industrial engineering design, practice, or research.

Courses primarily for graduate students, open to qualified undergraduates:

I E 501: M.S. Research Basics and Communications
Cr. R. Repeatable.
Prereq: Enrollment in M.S. or M.Eng. program in Industrial Engineering.
Principles and practices for research tasks at the M.S. level including proposal writing, presentations, paper preparation, and project management. Offered on a satisfactory-fail basis only.

I E 502: M.S. Research Conduct
Cr. R. Repeatable.
Prereq: Enrollment in M.S. program in Industrial Engineering.
Responsible conduct of research at the M.S. level, including ethical issues in peer review, conflicts of interest, mentoring, human subjects and live animals, data management, and collaboration. Offered on a satisfactory-fail basis only.

I E 503: Introduction to Sustainable Production Systems
(Dual-listed with I E 403). (3-0) Cr. 3.
Prereq: Credit or enrollment I E 341
Quantitative introduction of sustainability concepts in production planning and inventory control. Review of material recovery (recycling) and product/component recovery (remanufacturing) from productivity perspectives. Sustainability rubrics ranging from design and process to systems. Application to multi-echelon networks subject to forward/backward flow of material and information. Closed-loop supply chains. Comparative study of sustainable vs. traditional models for local and global production systems.

I E 505: Advanced Engineering Economy for Complex Engineering Projects
(Dual-listed with I E 405). (3-0) Cr. 3.
Prereq: MATH 265, MATH 267, STAT 231 and I E 305, or permission by instructor
Overview of engineering economic valuation and complex engineering projects. Stochastic dynamic programming for project valuation. Modeling and analysis of confounding factors of engineering projects. Integration and synthesis of valuation methodologies to complex projects. Applications to power plants, transmission networks, and satellites.

I E 508: Design and Analysis of Allocation Mechanisms
(3-0) Cr. 3.
Prereq: I E 312 or MATH 307
Market-based allocation mechanisms from quantitative economic systems perspective. Pricing and costing models designed and analyzed with respect to decentralized decision processes, information requirements, and coordination. Financial Engineering Techniques. Case studies and examples from industries such as regulated utilities, semiconductor manufacturers, and financial engineering services.

I E 510: Network Analysis
(3-0) Cr. 3.
Prereq: I E 312
Formulation and solution of deterministic network flow problems including shortest path, minimum cost flow, and maximum flow. Network and graph formulations of combinatorial problems including assignment, matching, and spanning trees. Introduction to deterministic and stochastic dynamic programming.

I E 513: Analysis of Stochastic Systems
(3-0) Cr. 3.
Prereq: STAT 231
Introduction to modeling and analysis of manufacturing and service systems subject to uncertainty. Topics include the Poisson process, renewal processes, Markov chains, and Brownian motion. Applications to inventory systems, production system design, production scheduling, reliability, and capacity planning.

I E 514: Production Scheduling
(3-0) Cr. 3.
Prereq: I E 312, I E 341
Introduction to the theory of machine shop systems. Complexity results for various systems such as job, flow and open shops. Applications of linear programming, integer programming, network analysis. Enumerative methods for machine sequencing. Introduction to stochastic scheduling.

I E 519: Simulation Modeling and Analysis
(3-0) Cr. 3.
Prereq: COM S 311, STAT 401
Event scheduling, process interaction, and continuous modeling techniques. Probability and statistics related to simulation parameters including run length, inference, design of experiments, variance reduction, and stopping rules. Aspects of simulation languages.

I E 531: Quality Control and Engineering Statistics
(Cross-listed with STAT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 401; STAT 342 or STAT 447
Statistical methods and theory applicable to problems of industrial process monitoring and improvement. Statistical issues in industrial measurement; Shewhart, CUSUM, and other control charts; feedback control; process characterization studies; estimation of product and process characteristics; acceptance sampling, continuous sampling and sequential sampling; economic and decision theoretic arguments in industrial statistics.

I E 533: Reliability
(Cross-listed with STAT). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 342 or STAT 432 or STAT 447
Probabilistic modeling and inference in engineering reliability; lifetime models, product limit estimator, probability plotting, maximum likelihood estimation for censored data, Bayesian methods in reliability, system reliability models, competing risk analysis, acceleration models and analysis of accelerated test data; analysis of recurrence data; planning studies to obtain reliability data.

I E 534: Linear Programming
(3-0) Cr. 3.
Prereq: I E 312
Formulation of optimization problems as mathematical models, including linear programming, integer programming concepts, multi-objective optimization, and bilevel optimization. Introduction to classic optimization algorithms, including Simplex, cutting plane, and branch-and-bound. Basic concepts of duality theory and sensitivity analysis. Using computer solvers (Matlab and Gusek) to obtain optimal solutions to optimization models.

I E 537: Reliability and Safety Engineering
(3-0) Cr. 3.
Prereq: STAT 231 or STAT 401
Mathematical basics for dealing with reliability data, theory, and analysis. Bayesian reliability analysis. Engineering ethics in safety evaluations. Case studies of accidents in large technological systems. Fault and event tree analysis.

I E 541: Inventory Control and Production Planning
(3-0) Cr. 3.
Prereq: I E 341
Economic Order Quantity, dynamic lot sizing, newsboy, base stock, and (Q,r) models. Material Requirements Planning, Just-In-Time (JIT), variability in production systems, push and pull production systems, aggregate and workforce planning, and capacity management. Supply Chain Contracts.

I E 543: Wind Energy Manufacturing
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Undergraduate engineering degree or permission of instructor.
Materials, processes and systems required to produce the major components (blades, towers, nacelles) of megawatt scale wind turbines. Transportation, manufacturing siting and procurement decisions as it relates to these large components in an expanding industry.

I E 545: Rapid Prototyping and Manufacturing
(3-0) Cr. 3.
Prereq: Prereq: I E 248 or similar manufacturing engineering course, MATH 265. Undergraduates at Senior Standing if given permission by instructor.
Introduction to rapid prototyping processes and other rapid manufacturing methodologies. Operating principles and characteristics of current and developing rapid prototyping processes. Use of rapid prototypes in product design, development, and service. Selection of rapid prototyping systems based on rapid methodologies used in manufacturing processes and rapid tooling approaches.

I E 546: Geometric Variability in Manufacturing
(Dual-listed with I E 446). (3-0) Cr. 3.
Prereq: I E 348, or MAT E 216, or M E 324
Assessment, accommodation, and control of geometric variability in manufacturing processes, specifically composites, metalcasting, welding, machining, and powder metallurgy. Techniques include the design of the component, tooling and process plan. The use of contact and noncontact measurement methods to assess variation.

I E 547: Biomedical Design and Manufacturing
(Dual-listed with I E 447). (3-0) Cr. 3.
Prereq: Students with two semesters or less before graduation
Exploration of biology, materials, body mechanics, manufacturing, quality control, and ethics and the intersection of these subjects as they relate to biomedical manufacturing.

I E 549: Computer Aided Design and Manufacturing
(Dual-listed with I E 449). (3-0) Cr. 3.
Prereq: Prereq: I E 248 or similar manufacturing engineering course, MATH 265.
Representation and interpretation of curves, surfaces and solids. Parametric curves and surfaces and solid modeling. Use of CAD software and CAD/CAM integration. Computer numerical control, CNC programming languages, and process planning.

I E 560: Engineering Risk Analysis
(3-0) Cr. 3.
Prereq: Coursework in basic probability and statistics
Overview of probabilistic risk analysis and modeling risks. Topics include probability, influence diagrams, subjective probability assessment, fault tree analysis, risk perception, risk communication, intelligent adversary, and financial risk analysis. Application of probabilistic risk analysis to business investments, engineering systems, critical infrastructure, defense and security, cybersecurity, and health systems.

I E 561: Continuous Quality Improvement of Process
(3-0) Cr. 3.
Prereq: I E 361
Methods for continuous quality improvement in process analysis. The systems analysis for process improvement model based on W. Edwards Deming. Quality function deployment methods. Case studies of applications to manufacturing and other heavy industries. Use of process analysis computerized programs and tools for design analysis.

I E 563: Engineering and Systems Management
(3-0) Cr. 3.
Prereq: Course in probability and statistics.
Introduction to engineering management concepts and examples relevant to the engineering manager today. Topics include decision trees and associated probabilities; personnel issues and challenges; working with management, client and the project team; personality types; and documents/forms that are useful for the engineering manager. Case studies, and a group project required.

I E 564: Decision Analysis in System Design
(3-0) Cr. 3.
Prereq: Course in probability and statistics.
Application of decision theory principles and tools to evaluate alternative complex engineering systems based on technical design requirements. Systems engineering methods are presented, with applications in aerospace, energy, and manufacturing domains. Methods for identifying and mitigating risk and uncertainty are presented.

I E 565: Systems Engineering and Analysis
(Cross-listed with AER E, E E). (3-0) Cr. 3.
Prereq: Coursework in basic statistics
Introduction to organized multidisciplinary approach to designing and developing systems. Concepts, principles, and practice of systems engineering as applied to large integrated systems. Life cycle costing, scheduling, risk management, functional analysis, conceptual and detail design, test and evaluation, and systems engineering planning and organization. Not available for degrees in industrial engineering.

I E 566: Applied Systems Engineering
(3-0) Cr. 3.
Prereq: I E 565
Design for reliability, maintainability, usability, supportability, producibility, disposability, and life cycle costs in the context of the systems engineering process. Students will be required to apply the principles of systems engineering to a project including proposal, program plan, systems engineering management plan, and test and evaluation plan. Not available for degrees in industrial engineering.

I E 568: Large-Scale Complex Engineered Systems (LSCES)
(Dual-listed with I E 468). (Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: senior standing in College of Engineering or permission of AerE 468 instructor
Introduction to the theoretical foundation and methods associated with the design for large-scale complex engineered systems, including objective function formation, design reliability, value-driven design, product robustness, utility theory, economic factors for the formation of a value function and complexity science as a means of detecting unintended consequences in the product behavior.

I E 570: Systems Engineering and Project Management
(3-0) Cr. 3.
Prereq: Coursework in basic statistics
Systems view of projects and the processes by which they are implemented. Focuses on qualitative and quantitative tools and techniques of project management. Topics will include organizational structure types; project selection methodologies; simulation and optimization; and earned value management. Case studies will be included, and a group project required.

I E 571: Occupational Biomechanics
(3-0) Cr. 3.
Prereq: E M 274, STAT 231
Anatomical, physiological, and biomechanical bases of physical ergonomics. Anthropometry, body mechanics, strength of biomaterials, human motor control. Use of bioinstrumentation, passive industrial surveillance techniques and active risk assessment techniques. Acute injury and cumulative trauma disorders. Static and dynamic biomechanical modeling. Emphasis on low back, shoulder and hand/wrist biomechanics.

I E 572: Design and Evaluation of Human-Computer Interaction
(3-0) Cr. 3.
Prereq: I E 577 or instructor's permission
Human factors methods applied to interface requirements, design, prototyping, and evaluation. Concepts related to understanding user characteristics, design principles, usability analysis, methods and techniques for design and evaluation of the interface. The evaluation and design of the information presentation characteristics of a wide variety of interfaces: web sites (e-commerce), mobile applications, and information presentation systems (cockpits, instrumentation, etc.).

I E 576: Human Factors in Product Design
(3-0) Cr. 3.
Prereq: I E 572 or I E 577
Investigation of the human interface to consumer and industrial systems and products, providing a basis for their design and evaluation. Discussions of human factors in the product design process: modeling the human during product use; usability; human factors methods in product design evaluation; user-device interface; safety, warnings, and instructions for products; considerations for human factors in the design of products for international use.

I E 577: Human Factors
(3-0) Cr. 3.
Prereq: I E 271 or graduate classification
Physical and psychological factors affecting human performance in systems. Signal detection theory, human reliability modeling, information theory, and performance shaping applied to safety, reliability, productivity, stress reduction, training, and human/equipment interface design. Laboratory assignments related to system design and operation.

I E 581: e-Commerce Systems Engineering
(Dual-listed with I E 481). (3-0) Cr. 3.
Prereq: I E 148
Design, analysis, and implementation of e-commerce systems. Information infrastructure, enterprise models, enterprise processes, enterprise views. Data structures and algorithms used in e-commerce systems, SQL, exchange protocols, client/server model, web-based views.

I E 582: Enterprise Modeling and Integration
(3-0) Cr. 3.
Prereq: 3 credits in information technology or information systems
The design and analysis of enterprise models to support information engineering of enterprise-wide systems. Representation of system behavior and structure including process modeling, information modeling, and conceptual modeling. Applications in enterprise application integration, enterprise resource planning systems, product data management systems, and manufacturing execution systems.

I E 583: Knowledge Discovery and Data Mining
(Dual-listed with I E 483). (3-0) Cr. 3.
Prereq: I E 148, I E 312, and STAT 231
Introduction to data warehouses and knowledge discovery. Techniques for data mining, including probabilistic and statistical methods, genetic algorithms and neural networks, visualization techniques, and mathematical programming. Advanced topics include web-mining and mining of multimedia data. Case studies from both manufacturing and service industries. A computing project is required.

I E 585: Requirements and Architecture Engineering
(3-0) Cr. 3.
Prereq: 3 credits in information technology or information systems
Principles and practices for requirements engineering as part of the product development process with emphasis on software systems engineering. Problem definition, problem analysis, requirements analysis, requirements elicitation, validation, specifications. Case studies using requirements engineering methods and techniques.

I E 588: Information Systems for Manufacturing
(3-0) Cr. 3.
Prereq: I E 148, I E 448
Design and implementation of systems for the collection, maintenance, and usage of information needed for manufacturing operations, such as process control, quality, process definition, production definitions, inventory, and plant maintenance. Topics include interfacing with multiple data sources, methods to utilize the information to improve the process, system architectures, and maintaining adequate and accurate data for entities internal and external to the enterprise to achieve best manufacturing practices.

I E 590: Special Topics
Cr. 1-3. Repeatable.
Advanced study of a research topic in the field of industrial engineering.

Courses for graduate students:

I E 601: Ph.D. Research Basics and Communications
Cr. R. Repeatable.
Prereq: Enrollment in Ph.D. program in Industrial Engineering.
Principles and practices for conducting research at the Ph.D. level, including problem definition, proposal writing, presentations, conference proceedings, paper preparation, and project management. Offered on a satisfactory-fail basis only.

I E 602: Ph.D. Research Conduct
Cr. R. Repeatable.
Prereq: Enrollment in Ph.D. program in Industrial Engineering
Responsible conduct of research at the Ph.D. level, including ethical issues in peer review, conflicts of interest, mentoring, human subjects and live animals, data management, and collaboration. Offered on a satisfactory-fail basis only.

I E 613: Stochastic Production Systems
(3-0) Cr. 3.
Prereq: I E 513
Modeling techniques to evaluate performance and address issues in design, control, and operation of systems. Markov models of single-stage make-to-order and make-to-stock systems. Approximations for non-Markovian systems. Impact of variability on flow lines. Open and closed queuing networks.

I E 631: Nonlinear Programming
(3-0) Cr. 3.
Prereq: I E 534
Develop nonlinear models, convex sets and functions, optimality conditions, Lagrangian duality, unconstrained minimization techniques. Constrained minimization techniques covering penalty and barrier functions, sequential quadratic programming, the reduced gradient method, nonlinear control concepts.

I E 632: Integer Programming
(3-0) Cr. 3.
Prereq: I E 534
Integer programming including cutting planes, branch and bound, and Lagrangian relaxation. Introduction to complexity issues and search-based heuristics.

I E 633: Stochastic Programming
(3-0) Cr. 3.
Prereq: I E 513 or STAT 447, I E 534 or equivalent
Mathematical programming with uncertain parameters; modeling risk within optimization; multi-stage recourse and probabilistically constrained models; solution and approximation algorithms including Benders decomposition and progressive hedging; and applications to planning, allocation and design problems.

I E 634: Computational Optimization
(3-0) Cr. 3.
Prereq: I E 534 or equivalent.
Theory, algorithm, and computer implementation of optimization models. Simplex, Benders decomposition, computational complexity, mixed integer linear program, linear program with complementarity constraints, inverse optimization, bilevel discrete optimization. CPLEX, Matlab, and Tomlab will be used for computer implementation.

I E 642: Simultaneous Engineering in Manufacturing Systems
(3-0) Cr. 3.
Prereq: I E 549 or M E 415
Current engineering methods for the product life cycle process. Feature-based design, computer-aided process planning, and data-driven product engineering.

I E 671: Research Practicum in Human Factors and Ergonomics
(3-0) Cr. 3. Repeatable.
Prereq: I E 571 or I E 577 or IE 572
Research topic development, literature evaluation, experimental design, use of bioinstrumentation, data collection, basic data interpretation, statistical analysis, manuscript preparation.

I E 681: Cognitive Engineering
(Cross-listed with HCI). (3-0) Cr. 3.
Prereq: I E 572 or I E 577 or PSYCH 516 or HCI/PSYCH 521 or equivalent
Provides an overview of human cognitive capabilities and limitations in the design of products, work places, and large systems. Contexts vary broadly and could range from simple use of mobile devices to an air-traffic control or nuclear plant command center. Course focuses on what we can infer about users' thoughts and feelings based on what we can measure about their performance and physiological state. Covers the challenge of designing automated systems.

I E 690: Advanced Topics
Cr. 1-3. Repeatable.
Prereq: Permission of the instructor
Advanced topics related to Ph.D. research in industrial engineering under the direction of the instructor.

I E 697: Engineering Internship
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of department
One Fall OR Spring semester combined with one summer, maximum per academic year. Excludes Fall/Spring combination. Professional work period. Offered satisfactory/fail basis only. (With Instructor Permission). Offered on a satisfactory-fail basis only.

I E 699: Research
Cr. arr. Repeatable.

Information Assurance (INFAS)

Courses primarily for undergraduates:

INFAS 131: Introduction to Computer Security Literacy
(Cross-listed with CPR E). (1-0) Cr. 1.
Basic concepts of practical computer and Internet security: passwords, firewalls, antivirus software, malware, social networking, surfing the Internet, phishing, and wireless networks. This class is intended for students with little or no background in information technology or security. Basic knowledge of word processing required. Offered on a satisfactory-fail basis only.

INFAS 332: Cyber Defense Competition
(Cross-listed with CPR E). (0-2) Cr. 1. Repeatable. S.
Participation in cyber defense competition driven by scenario-based network design. Includes computer system setup, risk assessment and implementation of security systems, as well as defense of computer and network systems against trained attackers. Team based. Offered on a satisfactory-fail basis only.

INFAS 430: Network Protocols and Security
(Dual-listed with INFAS 530). (Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: CPR E 381 or equivalent
Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

Courses primarily for graduate students, open to qualified undergraduates:

INFAS 530: Network Protocols and Security
(Dual-listed with INFAS 430). (Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: CPR E 381 or equivalent
Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

INFAS 531: Information System Security
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530 or COM S 586 or MIS 535
Computer, software, and data security: basic cryptography, security policies, multilevel security models, attack and protection mechanisms, legal and ethical issues.

INFAS 532: Information Warfare
(Cross-listed with CPR E). (3-0) Cr. 3. S.
Prereq: CPR E 531
Computer system and network security: implementation, configuration, testing of security software and hardware, network monitoring. Authentication, firewalls, vulnerabilities, exploits, countermeasures. Study and use of attack tools. Ethics in information assurance. Emphasis on laboratory experiments.

INFAS 533: Cryptography
(Cross-listed with CPR E, MATH). (3-0) Cr. 3. S.
Prereq: MATH 301 or CPR E 310 or COM S 330
Basic concepts of secure communication, DES and AES, public-key cryptosystems, elliptic curves, hash algorithms, digital signatures, applications. Relevant material on number theory and finite fields.

INFAS 534: Legal and Ethical Issues in Information Assurance
(Cross-listed with CPR E, POL S). (3-0) Cr. 3. S.
Prereq: Graduate classification; CPR E 531 or INFAS 531
Legal and ethical issues in computer security. State and local codes and regulations. Privacy issues.

INFAS 535: Steganography and Digital Image Forensics
(Cross-listed with CPR E, MATH). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E E 524 or MATH 317 or MATH 407 or COM S 330
Basic principles of covert communication, steganalysis, and forensic analysis for digital images. Steganographic security and capacity, matrix embedding, blind attacks, image forensic detection and device identification techniques. Related material on coding theory, statistics, image processing, pattern recognition.

INFAS 536: Computer and Network Forensics
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530
Fundamentals of computer and network forensics, forensic duplication and analysis, network surveillance, intrusion detection and response, incident response, anonymity and pseudonymity, privacy-protection techniques, cyber law, computer security policies and guidelines, court testimony and report writing, and case studies. Emphasis on hands-on experiments.

INFAS 538: Reverse Engineering and Security Testing
(Cross-listed with CPR E). (2-3) Cr. 3. S.
Prereq: COM S 321 or CPR E 381, COM S 352 or CPR E 308
Techniques and tools for understanding the behavior of software/hardware systems based on reverse engineering. Flaw hypothesis, black, grey, and white box testing as well as other methods for testing the security of software systems. Discussion of counter-reverse engineering techniques.

INFAS 592: Seminar in Information Assurance
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Projects or seminar in Information Assurance.

Courses for graduate students:

INFAS 632: Information Assurance Capstone Design
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: INFAS 531, INFAS 532, INFAS 534
Capstone design course which integrates the security design process. Design of a security policy. Creation of a security plan. Implementation of the security plan. The students will attack each other's secure environments in an effort to defeat the security systems. Students evaluate the security plans and the performance of the plans. Social, political and ethics issues. Student self-evaluation, journaling, final written report.

INFAS 634: Current Research Problems in Cyber Security
(3-0) Cr. 0. Repeatable. F.S.
Prereq: CPR E 530, CPR E 531, permission of instructor.
Discussion of national cybersecurity/information systems security problems. Students will learn how to apply research techniques, think clearly about these issues, formulate and analyze potential solutions, and communicate their results. Working in small groups under the mentorship of technical clients from government and industry, each student will formulate, carry out, and present original research on current cybersecurity/information assurance problems of interest to the nation. This course will be run in a synchronized distance fashion, coordinating some activities with our partner schools and our technical clients.

INFAS 697: Information Assurance Summer Internship
Cr. R.
Prereq: Permission of department, graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

Integrated Studio Arts (ARTIS)

Courses primarily for undergraduates:

ARTIS 201: Creative Visual Thinking
(0-6) Cr. 3. F.S.
Exploration of the nature of visual perception in relation to issues of visual communication, problem solving, envisioning information, and visual thinking. Studio assignments to be digitized and sent to instructor electronically for evaluation and critique.

ARTIS 202: Studio Fundamentals: Wood
(0-8) Cr. 2. F.S.
Prereq: Open to all students; sophomore level and above. Required of all ISA BFA majors
Half-semester course. Introduction to wood's physical properties, its potential as an expressive medium, and basic wood working hand tools and techniques.

ARTIS 203: Studio Fundamentals: Jewelry/Metalsmithing
(0-8) Cr. 2. F.S.
Prereq: Open to all students; sophomore level and above. Required of all ISA BFA majors
Half semester course. Introduction to basic jewelry/metals design and fabrication. Forming, texturing, and joining techniques (soldering/riveting) will be explored and applied to two projects.

ARTIS 204: Studio Fundamentals: Ceramics
(0-8) Cr. 2. F.S.
Prereq: Open to all students, sophomore level and above. Required of all ISA BFA majors
Half-semester course providing an introduction to ceramic techniques including hand-building, high fire and low fire glaze applications and expressive approaches that will be applied to two projects. The emphasis is on creative communication through ceramics.

ARTIS 206: Studio Fundamentals: Printmaking
(0-8) Cr. 2. F.S.
Prereq: Open to all students, sophomore level and above. Required of all ISA BFA majors.
Introduction to relief, monoprint, lithographic and intaglio printing as methods for visual communication and expression.

ARTIS 208: Color
(0-6) Cr. 3. F.S.
Prereq: Open to all students, sophomore level and above. Required for all ISA BFA majors.
Introduction to Color Theory and applications. Exploration of additive and subtractive color systems using various media as methods for visual communication and expression.

ARTIS 210: Studio Fundamentals: Photo
(0-8) Cr. 2. F.S.
Prereq: Open to all students, sophomore level and above. Required of all ISA BFA majors.
Introduction to film camera operation and traditional black and white darkroom methods for visual communication and creative expression. Film cameras required for class but may be checked out for short periods during semester.

ARTIS 212: Studio Fundamentals: Computers
(0-8) Cr. 2. F.S.
Prereq: Open to all students, sophomore level and above. Required of all ISA BFA majors.
Half-semester course. Introduction to digital media tools and concepts through the use of Adobe PhotoShop and Illustrator to create two dimensional and time-based artworks.

ARTIS 213: Studio Fundamentals: Painting
(0-8) Cr. 2. F.S.
Prereq: Open to all students, sophomore level and above. Required of all ISA BFA majors.
Half-semester course. Introduction to preparation of painting grounds, color mixing, manipulation of paint and pictorial space as methods for visual communication and expression.

ARTIS 214: Studio Fundamentals: Textiles
(0-8) Cr. 2. F.S.
Prereq: Open to all students, sophomore level and above. Required of all ISA BFA majors.
Half semester course. Introduction to two-dimensional and three-dimensional textile techniques used for visual communication and expression.

ARTIS 227: Introduction to Creative Digital Photography
(0-6) Cr. 3.
Prereq: DSN S 102, DSN S 131 and DSN S 183 or permission of instructor.
This course will include the functions and operations of the digital camera, scanning and other image input devices, digital image manipulation, software usage and support, color management and printing, presentation of images, compositional dynamics and the development of "seeing" as a medium of design, expression, and communication. Students should have access to a good or high quality digital camera with the ability to separately adjust shutter speed, f/stop and exposure, a laptop with updated Adobe Photoshop software, and enough digital storage for all class assignments.

ARTIS 227H: Introduction to Creative Digital Photography: Honors
(0-6) Cr. 3-4.
Prereq: DSN S 102, DSN S 131 and DSN S 183
This course will include the functions and operations of the digital camera, scanning and other image input devices, digital image manipulation, software usage and support, color management and printing, presentation of images, compositional dynamics and the development of "seeing" as a medium of design, expression, and communication. Students should have access to a good or high quality digital camera with the ability to separately adjust shutter speed, f/stop and exposure, a laptop with updated Adobe Photoshop software, and enough digital storage for all class assignments.

ARTIS 229: Introduction to Darkroom Photography
(0-6) Cr. 3.
Prereq: DSN S 102, DSN S 131 and DSN S 183 or permission of instructor
Photography as a creative medium of art, design, expression and communication. Camera techniques and black and white wet lab processing taught. Alternative processes explored as time permits. 35 mm camera with manual exposure controls is required.

ARTIS 229H: Introduction to Darkroom Photography, Honors
(0-6) Cr. 3-4.
Prereq: DSN S 102, DSN S 131 and DSN S 183 or permission of instructor
Photography as a creative medium of art,design, expression and communication. Camera techniques and black and white wet lab processing taught. Alternative processes explored as time permits. 35 mm camera with manual exposure controls is required.

ARTIS 230: Drawing II
(0-6) Cr. 3. F.S.
Prereq: DSN S 102, DSN S 183 and DSN S 131
A continuation of DSN S 131 (Design Representation). Further development of perceptual drawing skills from a variety of subject matter. Continued practice with drawing materials and techniques with emphasis on tonal and color media.

ARTIS 233: Watercolor Painting
(0-6) Cr. 3.
Prereq: ARTIS 230
Fundamentals of painting using water-based media applied to observation-based painting. Subject matter may include working from actual or two-dimensional references of still life, landscape, architectural space, and the human form.

ARTIS 233H: Watercolor Painting: Honors
(0-6) Cr. 3-4.
Prereq: ARTIS 230
Fundamentals of painting using water-based media applied to observation-based painting. Subject matter may include working from actual or two-dimensional references of still life, landscape, architectural space, and the human form.

ARTIS 238: Painting I
(0-6) Cr. 3. F.S.
Prereq: ARTIS 230
Fundamentals of painting using acrylic and oil media applied to observation-based painting. Subject matter may include working from actual or two-dimensional references of still life, landscape, and the human form.

ARTIS 238H: Painting I: Honors
(0-6) Cr. 3-4. F.S.
Prereq: ARTIS 230
Fundamentals of painting using acrylic and oil media applied to observation-based painting. Subject matter may include working from actual or two-dimensional references of still life, landscape, and the human form.

ARTIS 305: Collage, Assemblage, and Found Object
(Dual-listed with ARTIS 505). (0-6) Cr. 3. Repeatable.
Prereq: 6 credits of 200 level studio or permission of instructor
Using techniques of the collage and assemblage, this course will explore the significance of recycling, sustainable methods of art making, and thrift-store culture as medium and subject matter for artists. Through selected readings, slide presentations, and studio activities, we will address the environmental cause and effect of materials and methods, consumption and waste, and one's personal responsibility as stewards for the planet we share. Emphasis will be on conceptual development.

ARTIS 308: Computer Modeling, Rendering and Virtual Photography
(0-6) Cr. 3.
Prereq: ARTIS 230 or permission of instructor
Introduction to 3D modeling using computer and available software. Modeling, texturing, lighting, and rendering with respect to 3D object and still scene creation.

ARTIS 308H: Computer Modeling, Rendering and Virtual Photography,:Honors
(0-6) Cr. 3-4.
Prereq: ARTIS 230 or permission of instructor
Introduction to 3D modeling using computer and available software. Modeling, texturing, lighting, and rendering with respect to 3D object and still scene creation.

ARTIS 310: Sources and Methods of Visual Design
(1-4) Cr. 3.
Study and application of methods used by contemporary artists for the purpose of generating ideas for new work. Field trip.

ARTIS 311: Contemporary Issues in Studio Art
Cr. 3.
Exploration of issues and directions in current art. Readings, discussions, and studio research projects to build an experimental and applied knowledge base for understanding each student's place in the contemporary art world.

ARTIS 319: Studio Furniture
(3-0) Cr. 3. F.
Overview of American studio furniture since 1940 including noted makers, important examples, and diverse approaches. Discussion of workmanship and the principles of furniture design. Field trip.

ARTIS 320: Introduction to Furniture Design
(0-6) Cr. 3.
Prereq: ARTIS 202 or permission of instructor.
Design and production of basic furniture forms in wood. Introduction to power tools. Develop an individual design process including an understanding of scale and proportion. Develop a deeper understanding of wood and the social and environmental implications of choices in regards to materials and processes used in furniture production.

ARTIS 320H: Introduction to Furniture Design: Honors
(0-6) Cr. 3-4.
Prereq: ARTIS 202 or permission of instructor.
Design and production of basic furniture forms in wood. Introduction to power tools. Develop an individual design process including an understanding of scale and proportion. Develop a deeper understanding of wood and the social and environmental implications of choices in regards to materials and processes used in furniture production.

ARTIS 322: Intermediate Ceramics Studio
(0-6) Cr. 3.
Prereq: ARTIS 204
Investigation of expressive forms and techniques in ceramics; introduction to throwing on the wheel, to exploration of utilitarian and sculptural approaches in the medium, and to glaze-making research and electric kiln firing.

ARTIS 322H: Intermediate Ceramics Studio: Honors
(0-6) Cr. 3-4.
Prereq: ARTIS 204
Investigation of expressive forms and techniques in ceramics; introduction to throwing on the wheel, to exploration of utilitarian and sculptural approaches in the medium, and to glaze-making research and electric kiln firing.

ARTIS 323: Scientific Illustration Principles and Techniques
(Cross-listed with BPM I). (0-6) Cr. 3. Repeatable.
Prereq: 6 credits in art and design and 3 credits in biological sciences
Studio basics and professional techniques in black & white, continuous tone, and color. Emphasis on tools, materials, and rendering.

ARTIS 324: Jewelry/Metalsmithing II
(0-6) Cr. 3.
Prereq: ARTIS 203 or permission of instructor
Continued study of traditional and contemporary metalsmithing fabrication techniques applicable to jewelry and object construction, including container forms. Emphasis on design, modeling and rendering techniques and progressive skill development. Basic stone setting and lost wax casting introduced.

ARTIS 324H: Jewelry/Metalsmithing II: Honors
(0-6) Cr. 3-4.
Prereq: ARTIS 203 or permission of instructor
Continued study of traditional and contemporary metalsmithing fabrication techniques applicable to jewelry and object construction, including container forms. Emphasis on design, modeling and rendering techniques and progressive skill development. Basic stone setting and lost wax casting introduced.

ARTIS 325: Integrated Studio Arts Seminar
(2-0) Cr. 2. Repeatable, maximum of 6 credits.
Prereq: Open to ISA BFA majors
Contemporary issues in studio arts explored through lectures, presentations and critiques.

ARTIS 326: Illustration and Illustration Software
(Cross-listed with BPM I). (0-6) Cr. 3. Repeatable.
Prereq: ARTIS 323
Application of painting, drawing, and image making techniques to communication. Development of technical abilities using illustration software. Digital and print production techniques.

ARTIS 327: Illustration as Communication
(Cross-listed with BPM I). (0-6) Cr. 3.
Prereq: ARTIS 326
Studio problems in illustration emphasizing composition and communication. Problem solving methodologies.

ARTIS 329: Creative Photography
(0-6) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ARTIS 210 or ARTIS 229 or permission of instructor
Continuation and expansion of concepts and processes from introductory photography. The class begins with advanced film camera techniques and experimentation with medium format cameras. It then moves into digital and color photography while also addressing output and presentation. Emphasis will be on the use of photography for visual communication and creative expression.

ARTIS 329H: Creative Photography, Honors
(0-6) Cr. 3-4. Repeatable, maximum of 6 credits.
Prereq: ARTIS 210 or ARTIS 229 or permission of instructor
Continuation and expansion of concepts and processes from introductory photography. The class begins with advanced film camera techniques and experimentation with medium format cameras. It then moves into digital and color photography while also addressing output and presentation. Emphasis will be on the use of photography for visual communication and creative expression.

ARTIS 330: Drawing III: Life Drawing
(0-6) Cr. 3. Repeatable.
Prereq: ARTIS 230
Drawing from the human figure.

ARTIS 330H: Drawing III: Life Drawing, Honors
(0-6) Cr. 3-4. Repeatable.
Prereq: ARTIS 230
Drawing from the human figure.

ARTIS 331: Alternative materials for Artist/Designer
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 200 level ISA studio courses, or permission of instructor
Exploration of alternative materials (primarily non-metallics, both natural and manufactured) applicable to the design and creation of small designed objects and adornment. Students will learn additive and reductive processes, experiment with found object inclusion, rubber mold-making, and resin casting. A series of finished pieces will result. Open to all majors in the College of Design.

ARTIS 335: Three-Dimensional Studio
(Cross-listed with ARCH). (1-4) Cr. 3. Repeatable, maximum of 6 credits.
This course deals with three dimensional problems in visual invention, organization, and expression emphasizing creative manipulation of tools, materials, and techniques as means for three dimensional thinking. Projects cover the additive (modeling), subtractive (carving), substitutional (casting) as well as constructive techniques.

ARTIS 337: Application of Scientific Illustration Techniques
(Cross-listed with BPM I). (0-6) Cr. 3. Repeatable, maximum of 6 credits. S.
Prereq: ARTIS 327
Rendering techniques applied to different types of biological and scientific subjects emphasizing communication. The use of traditional and digital media. Term project required.

ARTIS 338: Painting II
(0-6) Cr. 3. Repeatable.
Prereq: ARTIS 238 or ARTIS 213 and ARTIS 230
Painting using acrylic and oil media; composition and expression.

ARTIS 338H: Painting II: Honors
(0-6) Cr. 3-4. Repeatable.
Prereq: ARTIS 238 or ARTIS 213 and ARTIS 230
Painting using acrylic and oil media; composition and expression.

ARTIS 345: Woven Textile Structures
(0-6) Cr. 3. Repeatable.
Prereq: ARTIS 214 or permission of instructor
Introduction to woven textile construction using commercial and hand-dyed yarns. Emphasis on technical development of weaving as a means for personal expression as well as an understanding of its role within the applied arts.

ARTIS 345H: Woven Textile Structures, Honors
(0-6) Cr. 3-4. Repeatable.
Prereq: ARTIS 214 or permission of instructor
Introduction to woven textile construction using commercial and hand-dyed yarns. Emphasis on technical development of weaving as a means for personal expression as well as an understanding of its role within the applied arts.

ARTIS 346: Textile Surface Design
(0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 214 or permission of instructor
Exploration of hand-dyeing and discharge methods on fabric to create complex surfaces. A variety of surface embellishment techniques will be introduced. Emphasis on technical skill development and research, as well as creative use of textile surface design techniques for artistic expression.

ARTIS 346H: Textile Surface Design: Honors
(0-6) Cr. 3-4. Repeatable.
Prereq: ARTIS 214 or permission of instructor.
Exploration of hand-dyeing and discharge methods on fabric to create complex surfaces. A variety of surface embellishment techniques will be introduced. Emphasis on technical skill development and research, as well as creative use of textile surface design techniques for artistic expression.

ARTIS 347: Printed Textile Design
(0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 214 or permission of instructor
Textile hand-printing methods on fabric including block, stencil and screen-printing using dyes, discharging agents and pigments. Digital printing on fabric will be introduced. Experimental printing methods will also be explored. Emphasis on research and development of surface design techniques as a means for personal expression.

ARTIS 347H: Printed Textile Design: Honors
(0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 214 or permission of instructor
Textile hand-printing methods on fabric including block, stencil and screen-printing using dyes, discharging agents and pigments. Digital printing on fabric will be introduced. Experimental printing methods will also be explored. Emphasis on research and development of surface design techniques as a means for personal expression.

ARTIS 356: Relief Printmaking: Digital/Traditional
(Dual-listed with ARTIS 556). (0-6) Cr. 3-4. Repeatable, maximum of 6 credits. F.S.
Prereq: ARTIS 206 and ARTIS 230
In-depth exploration of digital or traditional design and block cutting processes (computer/laser cutter/CNC router or drawing/chisels). Use relief printmaking to create a unified body of prints from those blocks. Emphasis is on experimental and creative use of printmaking with study of contemporary trends.

ARTIS 356H: Relief Printmaking: Digital/Traditional, Honors
(0-6) Cr. 3-4. Repeatable, maximum of 6 credits. F.S.
Prereq: ARTIS 206 and ARTIS 230
Explore the techniques and aesthetic qualities of black and white and color relief printmaking with woodcuts, computer/laser cutter/CNC router blocks, or photopolymer plates. Emphasis is on experimental and creative use of printmaking with study of contemporary trends.

ARTIS 357: Intaglio and Monotype Printmaking: Digital / Traditional
(Dual-listed with ARTIS 557). (0-6) Cr. 3-4. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 206 and 230
Explore the techniques and aesthetic qualities of black and white and color intaglio printmaking primarily through etching, aquatint, laser-cut plates and collagraph processes. Students will generate imagery through traditional drawing, collage and digital processes. Unique, one-of-a-kind black and white and color prints from Plexiglas will also be introduced. Emphasis is on experimental and creative use of printmaking for artistic expression.

ARTIS 357H: Intaglio and Monotype Printmaking: Digital / Traditional, Honors
(Dual-listed with ARTIS 557H). (0-6) Cr. 3-4. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 206 and ARTIS 230
Explore the techniques and aesthetic qualities of black and white and color intaglio printmaking primarily through etching, aquatint, laser-cut plates and collagraph processes. Students will generate imagery through traditional drawing, collage and digital processes. Unique, one-of-a-kind black and white and color prints from Plexiglas will also be introduced. Emphasis is on experimental and creative use of printmaking for artistic expression.

ARTIS 358: Lithography: Digital / Traditional
(Dual-listed with ARTIS 558). (0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 206 and credit or enrollment in ARTIS 230
Examine the techniques and aesthetic qualities of lithography primarily through hand-drawn and photographic plates. Students may generate imagery through traditional drawing, collage or digital processes. Emphasis is on experimental and creative use of printmaking for artistic expression. For those taking the course for a second semester, focus is on stone lithography and increased work with color.

ARTIS 358H: Lithography: Digital / Traditional, Honors
(0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 206 and credit or enrollment in ARTIS 230
Examine the techniques and aesthetic qualities of lithography primarily through hand-drawn and photographic plates. Students may generate imagery through traditional drawing, collage or digital processes. Emphasis is on experimental and creative use of printmaking for artistic expression. For those taking the course for a second semester, focus is on stone lithography and increased work with color.

ARTIS 360: Sustainable Design and Fabrication of Furniture
(0-6) Cr. 3. F.S.
An introduction to issues of design and fabrication of furniture focusing on sustainability. Exploration of the effect of consumers on design and how this affects our environment and our global society.

ARTIS 362: Artists, Designers and Sustainable Development
(0-6) Cr. 3. S.
Prereq: Junior level standing in the University
The artist/designer's role in sustainable development with a focus on cultural understanding of the collaborating communities. Class discussion, visual exercises, and the creation of creative collaborative service-learning projects such as product design, habitat design, and visual arts projects. Preorientation for travel to Ghana in ARTIS 363. Meets International Perspectives Requirement.

ARTIS 363: Studio Abroad: Ghana
(0-6) Cr. 3. SS.
Prereq: ARTIS 362
Traveling studio to Ghana, West Africa; an experiential tour of arts and history combined with design focused collaborative service-learning projects. Projects may include product development, design consultation, sustainable building design, and learning and teaching of visual arts. Student teams will develop projects in partnership with Ghanaians. Meets International Perspectives Requirement.

ARTIS 399: BFA Professional Practice
(2-0) Cr. 2. S.
Prereq: Junior classification in ISA BFA curriculum.
Introduction to professional practices including development of portfolio (visual and written components). Lecture and presentation topics include applying to graduate school, internships, applying for jobs, grants/funding opportunities, professional networking, exhibition opportunities, and best practices for studio artists. Half-semester course. Required of all ISA majors.

ARTIS 407: Principles of 3D Character Animation
(Dual-listed with ARTIS 507). (0-6) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of character animation. Prior knowledge of modeling, lighting, texturing and rendering with available software is assumed.

ARTIS 407H: Principles of 3D Character Animation: Honors
(Dual-listed with ARTIS 507H). (0-6) Cr. 3-4. Repeatable, maximum of 9 credits.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of character animation. Prior knowledge of modeling, lighting, texturing and rendering with available software is assumed.

ARTIS 408: Principles of 3D Animation
(0-6) Cr. 3. Repeatable.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of animation. Prior knowledge of modeling, lighting, texturing, animation and rendering with computer and available software is assumed.

ARTIS 408H: Principles of 3D Animation: Honors
(0-6) Cr. 3-4. Repeatable.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of animation. Prior knowledge of modeling, lighting, texturing, animation and rendering with computer and available software is assumed.

ARTIS 409: Computer/Video Game Design and Development
(Dual-listed with ARTIS 509). (0-6) Cr. 3. Repeatable, maximum of 12 credits.
Prereq: Permission of instructor. Programming emphasis: COM S 227, COM S 228, COM S 229 or equivalent in engineering; art or graphics emphasis: ARTIS 230 and ARTIS 308; writing emphasis: an English course in creative writing or writing screen plays; business or marketing students: Junior classification
Independent project based creation and development of "frivolous and non-frivolous" computer games in a cross-disciplinary team. Projects require cross-disciplinary teams. Aspects of Indie development and computer/video game history will be discussed.

ARTIS 420: Advanced Furniture Design
(Dual-listed with ARTIS 520). (0-6) Cr. 3-4. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 320
Design and creation of more complex furniture forms with consideration of precedents and innovative techniques and approaches. Continued development of a unique personal approach to the design and making of furniture. Refine your sensitivity to wood and understand the social and environmental implications of various materials used in furniture design and production.

ARTIS 420H: Advanced Furniture Design: Honors
(Dual-listed with ARTIS 520H). (0-6) Cr. 3-4. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 320
Design and creation of more complex furniture forms with consideration of precedents and innovative techniques and approaches. Continued development of a unique personal approach to the design and making of furniture. Refine your sensitivity to wood and understand the social and environmental implications of various materials used in furniture design and production.

ARTIS 422: Ceramics Studio
(Dual-listed with ARTIS 522). (0-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 322 for enrollment in ARTIS 422; graduate standing or permission of instructor for enrollment in ARTIS 522
Creation of a body of work in personal ceramic forms and unique surface treatments. Gas Kiln firings, research into contemporary ceramic artists and development of a body of increasingly skilled work are emphasized. Students are expected to be capable of independent studio work and take responsibility for kiln firings.

ARTIS 422H: Ceramics Studio: Honors
(0-6) Cr. 3-4. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 322 for enrollment in ARTIS 422; graduate standing or permission of instructor for enrollment in ARTIS 522
Creation of a body of work in personal ceramic forms and unique surface treatments. Gas Kiln firings, research into contemporary ceramic artists and development of a body of increasingly skilled work are emphasized. Students are expected to be capable of independent studio work and take responsibility for kiln firings.

ARTIS 424: Jewelry/Metalsmithing III
(Dual-listed with ARTIS 524). (0-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 324 or permission of instructor
Emphasis on metal fabrication and hollow construction techniques applicable to jewelry, functional objects and sculptural art forms. Processes introduced include raising, forming, and anticlastic shell forming techniques. Introduction to mechanisms and tool making. Advanced students are encouraged to integrate alternative materials and technologies. A focus is placed on independent research, professional engagement and portfolio development.

ARTIS 424H: Jewelry/Metalsmithing III: Honors
(Dual-listed with ARTIS 524H). (0-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 324 or permission of instructor
Emphasis on metal fabrication and hollow construction techniques applicable to jewelry, functional objects and sculptural art forms. Processes introduced include raising, forming, and anticlastic shell forming techniques. Introduction to mechanisms and tool making. Advanced students are encouraged to integrate alternative materials and technologies. A focus is placed on independent research, professional engagement and portfolio development.

ARTIS 429: Advanced Photography
(Dual-listed with ARTIS 529). (0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 329
Independent, advanced work in traditional alternative and/or digital photographic processes. Emphasis is on development of a unified body of work and research into contemporary photographers and aesthetic concern.

ARTIS 429H: Advanced Photography: Honors
(0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 329
Independent, advanced work in traditional alternative and/or digital photographic processes. Emphasis is on development of a unified body of work and research into contemporary photographers and aesthetic concern.

ARTIS 430: Drawing IV
(Dual-listed with ARTIS 530). (0-6) Cr. 3. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 330
Figurative and/or non-figurative drawing with advanced work in media, composition, and theory.

ARTIS 430H: Drawing IV: Honors
(0-6) Cr. 3-4. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 330
Figurative and/or non-figurative drawing with advanced work in media, composition, and theory.

ARTIS 432: Sequential Narrative Drawing
(Dual-listed with ARTIS 532). (0-6) Cr. 3. S.
Prereq: For ARTIS 432: DSN S 131, plus ARTIS 230, ARTIS 330, or instructor permission. For ARTIS 532, Graduate classification or instructor permission.
Studio course in drawing focusing on the fundamentals of communicating a narrative through sequential images in a variety of applications. Emphasis will be placed on visual research, ideation, concept art and process sketching.

ARTIS 438: Painting III
(Dual-listed with ARTIS 538). (0-6) Cr. 3. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 338
Figurative and non-figurative painting with advanced work in media, composition, and theory.

ARTIS 438H: Painting III: Honors
(0-6) Cr. 3-4. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 338
Figurative and non-figurative painting with advanced work in media, composition, and theory.

ARTIS 447: Printed Textile Design
(Dual-listed with ARTIS 547). (0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 347 or permission of instructor.
Exploration of hand-printing methods on fabric including block, stencil, and screen-printing using dyes, discharging agents, and pigments. Individualized research and development of surface design techniques as means for personal expression.

ARTIS 448: Digital Textile Design
(Dual-listed with ARTIS 548). (0-6) Cr. 3. Repeatable. F.S.
Prereq: Junior classification in either College of Design or Apparel, Merchandising, Design
This hands-on studio course will allow students to explore digital printing technology and its application to textile design for those working within industry as well as independent studio practitioners. Digital design development includes pattern repeats and photo manipulation to create unique textile designs for fashion, interior and fine art applications.

ARTIS 458: Advanced Printmaking
(0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 356, ARTIS 357, or ARTIS 358, and permission of instructor
Independent, advanced work in printmaking processes. Emphasis is on development of a unified body of work and research into contemporary artists.

ARTIS 458H: Advanced Printmaking: Honors
(0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 356, ARTIS 357, or ARTIS 358, and permission of instructor
Independent, advanced work in printmaking processes. Emphasis is on development of a unified body of work and research into contemporary artists.

ARTIS 473: Video Art
(Dual-listed with ARTIS 573). (0-6) Cr. 3.
Prereq: ARTIS 212 or permission of instructor for enrollment in ARTIS 473; graduate standing or permission of instructor for enrollment in ARTIS 573
Usage of professional video editing software and application of best practices for video production and post-production to realize original artworks. Creation of narrative and non-narrative videos and site specific video installations. Prominent examples in the history of video art provide context for the coursework. Non-repeatable for graduate students.

ARTIS 475: Interactive Art
(0-6) Cr. 3.
Prereq: ARTIS 212 or Permission of Instructor.
Create software and integrate the sensors required to create interactive artworks, video games, and installations. Prominent examples in the history of interactive art provides context for the coursework.

ARTIS 482: Selected Topics in Studio Art
(Dual-listed with ARTIS 582). Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Special issues related to studio art. Topics vary each time offered.

ARTIS 490: Independent Study
Cr. 1-6. Repeatable. F.S.SS.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed craft design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490B: Independent Study: Ceramics
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490C: Independent Study: Computer Art and Design
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490D: Independent Study: Drawing
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490E: Independent Study: Textiles
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490F: Independent Study: Illustration
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490G: Independent Study: Metals
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490H: Independent Study: Honors
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490I: Independent Study: Painting
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490J: Independent Study: Photography
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490K: Independent Study: Printmaking
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490L: Independent Study: Furniture
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490M: Independent Study: Mixed Media
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 491: Post Baccalaureate Capstone Course
Cr. 1. F.S.
Prereq: Enrollment in Post Baccalaureate Program.
Exhibition of artwork completed in the Post Baccalaureate program, required for fulfillment of certificate. Offered on a satisfactory-fail basis only.

ARTIS 493: Workshop
Cr. 1-3. Repeatable. SS.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493B: Workshop: Ceramics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493C: Workshop: Computer Art and Design
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493D: Workshop: Drawing
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493E: Workshop: Textiles
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493F: Workshop: Illustration
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493G: Workshop: Metals
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493H: Workshop: Honors
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493I: Workshop: Painting
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493J: Workshop: Photography
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493K: Workshop: Printmaking
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493L: Workshop: Furniture
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493M: Workshop: Mixed Media
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 494: Integrated Studio Arts in Europe Seminar
(1-0) Cr. 1.
Prereq: Permission of instructor and planned enrollment in ARTIS 495
Cultural and historical aspects of art and design in Western Europe in preparation for study abroad. Area of study varies each time offered. Offered on a satisfactory-fail basis only. Offered on a satisfactory-fail basis only.
Meets International Perspectives Requirement.

ARTIS 495: Integrated Studio Arts in Europe
(Dual-listed with ARTIS 595). Cr. 3.
Prereq: Graduate classification, ARTIS 494 or equivalent, permission of instructor
International study abroad program in western Europe. Visits to design studios, art museums, and educational facilities. Related activities depending on specific area of study which may vary each time offered.
Meets International Perspectives Requirement.

ARTIS 496: Art and Design Field Study
Cr. R. Repeatable.
Prereq: Concurrent enrollment in an art and design studio or integrated studio arts course and permission of instructor
Study and tours of museums, galleries, artist and/or designer studios and other areas of interest within art and design. Offered on a satisfactory-fail basis only.

ARTIS 497: Studio Internship
Cr. 1-6. Repeatable, maximum of 6 credits.
Prereq: Advanced classification in a department curriculum
Written approval of supervising instructor and department chair on required form in advance of semester of enrollment. Supervised experience with a cooperating artist or studio. Offered on a satisfactory-fail basis only.

ARTIS 499: BFA Exhibition
(1-0) Cr. 1. S.
Prereq: ARTIS 399 and senior classification in the ISA BFA Curriculum.
Capstone experience for the BFA degree, including the refinement of a final portfolio (visual and written components). Guest lecturers cover range of topics relevant to the professional practice of art and design. Course culminates in the planning, design and installation of the BFA group exhibition in a formal gallery setting. Half-semester course. Required of all ISA majors.

Courses primarily for graduate students, open to qualified undergraduates:

ARTIS 505: Collage, Assemblage, and Found Object
(Dual-listed with ARTIS 305). (0-6) Cr. 3. Repeatable.
Prereq: 6 credits of 200 level studio or permission of instructor
Using techniques of the collage and assemblage, this course will explore the significance of recycling, sustainable methods of art making, and thrift-store culture as medium and subject matter for artists. Through selected readings, slide presentations, and studio activities, we will address the environmental cause and effect of materials and methods, consumption and waste, and one's personal responsibility as stewards for the planet we share. Emphasis will be on conceptual development.

ARTIS 507: Principles of 3D Character Animation
(Dual-listed with ARTIS 407). (0-6) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of character animation. Prior knowledge of modeling, lighting, texturing and rendering with available software is assumed.

ARTIS 507H: Principles of 3D Character Animation: Honors
(Dual-listed with ARTIS 407H). (0-6) Cr. 3-4. Repeatable, maximum of 9 credits.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of character animation. Prior knowledge of modeling, lighting, texturing and rendering with available software is assumed.

ARTIS 508: Computer Aided Animation and Visualization
(0-6) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ARTIS 408 or graduate classification and permission of instructor
Further investigations begun in ARTIS 408. Attention given to the workflow and management of creating animation and visualizations.

ARTIS 509: Computer/Video Game Design and Development
(Dual-listed with ARTIS 409). (0-6) Cr. 3. Repeatable, maximum of 12 credits.
Prereq: Permission of instructor. Programming emphasis: COM S 227, COM S 228, COM S 229 or equivalent in engineering; art or graphics emphasis: ARTIS 230 and ARTIS 308; writing emphasis: an English course in creative writing or writing screen plays; business or marketing students: Junior classification
Independent project based creation and development of "frivolous and non-frivolous" computer games in a cross-disciplinary team. Projects require cross-disciplinary teams. Aspects of Indie development and computer/video game history will be discussed.

ARTIS 511: Seminar in Teaching
(3-0) Cr. 3.
Prereq: Graduate classification
Readings and discussion of university level design education issues, studio/classroom observation, development of a teaching philosophy, lesson planning and presentation.

ARTIS 520: Advanced Furniture Design
(Dual-listed with ARTIS 420). (0-6) Cr. 3-4. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 320
Design and creation of more complex furniture forms with consideration of precedents and innovative techniques and approaches. Continued development of a unique personal approach to the design and making of furniture. Refine your sensitivity to wood and understand the social and environmental implications of various materials used in furniture design and production.

ARTIS 520H: Advanced Furniture Design: Honors
(Dual-listed with ARTIS 420H). (0-6) Cr. 3-4. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 320
Design and creation of more complex furniture forms with consideration of precedents and innovative techniques and approaches. Continued development of a unique personal approach to the design and making of furniture. Refine your sensitivity to wood and understand the social and environmental implications of various materials used in furniture design and production.

ARTIS 522: Ceramics Studio
(Dual-listed with ARTIS 422). (0-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 322 for enrollment in ARTIS 422; graduate standing or permission of instructor for enrollment in ARTIS 522
Creation of a body of work in personal ceramic forms and unique surface treatments. Gas Kiln firings, research into contemporary ceramic artists and development of a body of increasingly skilled work are emphasized. Students are expected to be capable of independent studio work and take responsibility for kiln firings.

ARTIS 524: Jewelry/Metalsmithing III
(Dual-listed with ARTIS 424). (0-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 324 or permission of instructor
Emphasis on metal fabrication and hollow construction techniques applicable to jewelry, functional objects and sculptural art forms. Processes introduced include raising, forming, and anticlastic shell forming techniques. Introduction to mechanisms and tool making. Advanced students are encouraged to integrate alternative materials and technologies. A focus is placed on independent research, professional engagement and portfolio development.

ARTIS 524H: Jewelry/Metalsmithing III: Honors
(Dual-listed with ARTIS 424H). (0-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 324 or permission of instructor
Emphasis on metal fabrication and hollow construction techniques applicable to jewelry, functional objects and sculptural art forms. Processes introduced include raising, forming, and anticlastic shell forming techniques. Introduction to mechanisms and tool making. Advanced students are encouraged to integrate alternative materials and technologies. A focus is placed on independent research, professional engagement and portfolio development.

ARTIS 529: Advanced Photography
(Dual-listed with ARTIS 429). (0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 329
Independent, advanced work in traditional alternative and/or digital photographic processes. Emphasis is on development of a unified body of work and research into contemporary photographers and aesthetic concern.

ARTIS 530: Drawing IV
(Dual-listed with ARTIS 430). (0-6) Cr. 3. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 330
Figurative and/or non-figurative drawing with advanced work in media, composition, and theory.

ARTIS 532: Sequential Narrative Drawing
(Dual-listed with ARTIS 432). (0-6) Cr. 3. S.
Prereq: For ARTIS 432: DSN S 131, plus ARTIS 230, ARTIS 330, or instructor permission. For ARTIS 532, Graduate classification or instructor permission.
Studio course in drawing focusing on the fundamentals of communicating a narrative through sequential images in a variety of applications. Emphasis will be placed on visual research, ideation, concept art and process sketching.

ARTIS 538: Painting III
(Dual-listed with ARTIS 438). (0-6) Cr. 3. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 338
Figurative and non-figurative painting with advanced work in media, composition, and theory.

ARTIS 547: Printed Textile Design
(Dual-listed with ARTIS 447). (0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 347 or permission of instructor.
Exploration of hand-printing methods on fabric including block, stencil, and screen-printing using dyes, discharging agents, and pigments. Individualized research and development of surface design techniques as means for personal expression.

ARTIS 548: Digital Textile Design
(Dual-listed with ARTIS 448). (0-6) Cr. 3. Repeatable. F.S.
Prereq: Junior classification in either College of Design or Apparel, Merchandising, Design
This hands-on studio course will allow students to explore digital printing technology and its application to textile design for those working within industry as well as independent studio practitioners. Digital design development includes pattern repeats and photo manipulation to create unique textile designs for fashion, interior and fine art applications.

ARTIS 556: Relief Printmaking: Digital/Traditional
(Dual-listed with ARTIS 356). (0-6) Cr. 3-4. Repeatable, maximum of 6 credits. F.S.
Prereq: ARTIS 206 and ARTIS 230
In-depth exploration of digital or traditional design and block cutting processes (computer/laser cutter/CNC router or drawing/chisels). Use relief printmaking to create a unified body of prints from those blocks. Emphasis is on experimental and creative use of printmaking with study of contemporary trends.

ARTIS 557: Intaglio and Monotype Printmaking: Digital / Traditional
(Dual-listed with ARTIS 357). (0-6) Cr. 3-4. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 206 and 230
Explore the techniques and aesthetic qualities of black and white and color intaglio printmaking primarily through etching, aquatint, laser-cut plates and collagraph processes. Students will generate imagery through traditional drawing, collage and digital processes. Unique, one-of-a-kind black and white and color prints from Plexiglas will also be introduced. Emphasis is on experimental and creative use of printmaking for artistic expression.

ARTIS 557H: Intaglio and Monotype Printmaking: Digital / Traditional, Honors
(Dual-listed with ARTIS 357H). (0-6) Cr. 3-4. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 206 and ARTIS 230
Explore the techniques and aesthetic qualities of black and white and color intaglio printmaking primarily through etching, aquatint, laser-cut plates and collagraph processes. Students will generate imagery through traditional drawing, collage and digital processes. Unique, one-of-a-kind black and white and color prints from Plexiglas will also be introduced. Emphasis is on experimental and creative use of printmaking for artistic expression.

ARTIS 558: Lithography: Digital / Traditional
(Dual-listed with ARTIS 358). (0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 206 and credit or enrollment in ARTIS 230
Examine the techniques and aesthetic qualities of lithography primarily through hand-drawn and photographic plates. Students may generate imagery through traditional drawing, collage or digital processes. Emphasis is on experimental and creative use of printmaking for artistic expression. For those taking the course for a second semester, focus is on stone lithography and increased work with color.

ARTIS 558H: Lithography: Digital / Traditional, Honors
(Dual-listed with ARTIS 358H). (0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 206 and credit or enrollment in ARTIS 230
Examine the techniques and aesthetic qualities of lithography primarily through hand-drawn and photographic plates. Students may generate imagery through traditional drawing, collage or digital processes. Emphasis is on experimental and creative use of printmaking for artistic expression. For those taking the course for a second semester, focus is on stone lithography and increased work with color.

ARTIS 571A: Critique Seminar: Grants, Residencies, Exhibitions
(2-0) Cr. 2.
Prereq: Admission into graduate program in the College of Design
Ongoing critiques and dialog about progress of studio projects. Graduate students will learn to articulate their ideas from concept to creation. Emphasis will be on the examination of professional practices of artists.

ARTIS 571B: Critique Seminar: Entrepreneurialism
(2-0) Cr. 2.
Prereq: Admission into graduate program in the College of Design
Ongoing critiques and dialog about progress of studio projects. Graduate students will learn to articulate their ideas from concept to creation. Emphasis will be on the examination of creative business opportunities related to students' areas of interest.

ARTIS 571C: Critique Seminar: Critique and Creative Process
(2-0) Cr. 2. Repeatable, maximum of 4 credits.
Prereq: Admission into graduate program in the College of Design
Ongoing weekly critiques and dialog about sources, methods, and progress of studio projects. Graduate students will learn to articulate their ideas from concept to creation. The interaction of students at different levels in a broad spectrum of studio courses will reveal commonalities and connections between all of the visual arts, accelerating individual creative development.

ARTIS 573: Video Art
(Dual-listed with ARTIS 473). (0-6) Cr. 3.
Prereq: ARTIS 212 or permission of instructor for enrollment in ARTIS 473; graduate standing or permission of instructor for enrollment in ARTIS 573
Usage of professional video editing software and application of best practices for video production and post-production to realize original artworks. Creation of narrative and non-narrative videos and site specific video installations. Prominent examples in the history of video art provide context for the coursework. Non-repeatable for graduate students.

ARTIS 582: Selected Topics in Studio Art
(Dual-listed with ARTIS 482). Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Special issues related to studio art. Topics vary each time offered.

ARTIS 590: Special Topics

Cr. arr. F.S.SS.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590B: Special Topics: Ceramics

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590C: Special Topics: Computer Art and Design

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590D: Special Topics: Drawing

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590E: Special Topics: Textiles

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590F: Special Topics: Illustration

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590G: Special Topics: Metals

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590I: Special Topics: Painting

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590J: Special Topics: Photography

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590K: Special Topics: Printmaking

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590L: Special Topics: Furniture

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590M: Special Topics: Mixed Media

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 593: Workshop

Cr. 1-3. Repeatable. SS.

Prereq: Graduate classification and permission of instructor

Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593B: Workshop: Ceramics

Cr. 1-3. Repeatable.

Prereq: Graduate classification and permission of instructor

Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593C: Workshop: Computer Art and Design
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593D: Workshop: Drawing
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593E: Workshop: Textiles
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593F: Workshop: Illustration
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593G: Workshop: Metals
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593I: Workshop: Painting
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593J: Workshop: Photography
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593K: Workshop: Printmaking
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593L: Workshop: Furniture
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593M: Workshop: Mixed Media
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 595: Integrated Studio Arts in Europe
(Dual-listed with ARTIS 495). Cr. 3.
Prereq: Graduate classification, ARTIS 494 or equivalent, permission of instructor
International study abroad program in western Europe. Visits to design studios, art museums, and educational facilities. Related activities depending on specific area of study which may vary each time offered. Meets International Perspectives Requirement.

Courses for graduate students:

ARTIS 605: Research Methods
(3-0) Cr. 3.
Prereq: Permission of instructor
Research strategies related to fine art and technology. Application of selected methods to specific issues.

ARTIS 607: Intermedia
(0-6) Cr. 3. F.S.
Prereq: Graduate classification and permission of instructor.
Exploration and application of media with various materials, methods and ideas.

ARTIS 697: Studio Internship
Cr. arr.
Prereq: Graduate classification and approval of POS committee
Supervised off-campus learning experience with a prominent artist, designer, or firm.

ARTIS 698: Current Issues in Studio Arts
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.
Prereq: Graduate classification and permission of instructor.
Selected issues in contemporary studio arts. Topics and readings vary each time offered.

ARTIS 699: Research
Cr. arr. Repeatable.
Research in Integrated Studio Arts.

ARTIS 699A: Research: Thesis
Cr. arr. Repeatable.
Research thesis.

ARTIS 699B: Research: Thesis-exhibition
Cr. arr. Repeatable.
Research exhibition.

Interdisciplinary Graduate Studies (IGS)

Courses primarily for graduate students, open to qualified undergraduates:

IGS 520: Orientation in Community Development
(1-0) Cr. 1.
Introduction to the Community Development program. Focus on on-line delivery methods, graduate level research and writing, technology skills.

IGS 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

IGS 699: Thesis Research
Cr. arr. Repeatable.

Interior Design (ARTID)

Courses primarily for undergraduates:

ARTID 250: Fundamentals of Interior Design
(2-0) Cr. 2. F.
The profession, issues, and the role of interior design.

ARTID 251: Human Factors in Design
(3-0) Cr. 3. F.
Overview of issues related to the human/built environment interface: introduction to health and safety factors, ergonomics, anthropometrics, sensory perception, psycho-behavioral response, physical performance, cultural factors and universal design. Emphasis on application of human factor methods to the analysis, solution, and evaluation of design problems.

ARTID 255: Forces That Shape Interior Space
(3-0) Cr. 3. F.S.
A survey of variables influencing the nature and function of "interior" environments. Review of professional, geo-political, utilitarian, social-cultural, economic, humanistic, historical, technological, and other factors as generators of form and space.

ARTID 259: Sophomore Field Study
Cr. R.
Prereq: Enrollment in interior design studio course
Study and tours of areas of interest within the interior design profession such as manufacturers, design studios, showrooms and museums. Offered on a satisfactory-fail basis only.

ARTID 261: Graphic Communication for Interior Design I
(2-4) Cr. 3. F.
Prereq: Admission to the interior design program through program review and enrollment in ARTID 265
Perspective drawing, design sketching, and presentation drawings. Introduction to technical drawing conventions, and design drawings. Emphasis on drawing layout, line quality, and lettering. Use of various rendering media and techniques on 2D and 3D drawings. Overview of presentation techniques, both visual and verbal.

ARTID 263: Graphic Communication for Interior Design II
(2-4) Cr. 3. S.
Prereq: ARTID 261, enrollment in ARTID 267
Computer visualization techniques and applications; projects employing computer graphic methods.

ARTID 265: Interior Design Studio I
(1-6) Cr. 4. F.
Prereq: Credit or enrollment in ARTID 250 and ARTID 261; admission to the interior design program through program review
Enhanced creative interior design problem solving. Emphasis on research, spatial composition theories and graphic ideation and communication as applied to the interior design of small scale environments. Modeling and manual visualization techniques.

ARTID 267: Interior Design Studio II
(1-6) Cr. 4. S.
Prereq: ARTID 265
Human factors issues including ergonomics, human behavior and the requirements of special groups. Color theories related to interior spaces. Residential interior design and medium scale projects. Detail drawings, and expansion of visualization techniques.

ARTID 350: Interior Finish Materials and Systems
(3-0) Cr. 3. S.
Prereq: Completion of the College of Design Core.
Exploration of concepts, materials, and assemblies associated with development of planar interior elements including floors, walls, ceiling, windows, and finishes. Fiber, plastic, sheet metal, and other surfacing materials. Attention to related human factors, testing, detailing, specifications writing and end-use application.

ARTID 351: Interior Health and Safety Systems
(3-0) Cr. 3. S.
Prereq: Completion of the College of Design Core.
Exploration of interior design concepts, materials, and assemblies as they contribute to the user, health, safety and general well-being. Wood, steel, masonry, and glass assemblies. Attention to related human factors, testing, codes, detailing, specifications writing and end-use application.

ARTID 352: Interior Environmental Control Systems
(3-0) Cr. 3. S.
Prereq: Completion of the College of Design Core.
Exploration of concepts, materials, assemblies associated with building service systems. Overview of electrical, lighting, acoustical, HVAC, plumbing and other non-structural building features. Attention to related human factors, testing, codes, detailing, specifications writing and end-use application.

ARTID 353: Interior Building Systems and Details
(3-0) Cr. 3. F.
Prereq: Completion of the College of Design Core.
Exploration of building construction concepts, materials, and assemblies and their influence on interior design. Attention to human factors, codes, detailing, and other interior design issues related to buildings.

ARTID 355: Interior Design History/Theory/Criticism I
(3-0) Cr. 3. S.
Theoretical approaches to evaluation of interior finishes, furnishings, and decorative arts in relation to parallel developments in art and architecture, from a critical, historical and multicultural perspective. Focus on pre-1850.

ARTID 356: Interior Design History/Theory/Criticism II
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in ARTID 355 or permission of instructor
Advanced theoretical approaches to evaluation of interior finishes, furnishings, and decorative arts in relation to parallel developments in art and architecture from a critical, historical, and multicultural perspective. Focus on mid-nineteenth and twentieth century.

ARTID 357: Made in Italy
(2-0) Cr. 2. F.
Prereq: Participation in Study Abroad Rome program
An investigation of the 20th century roots of modern Italian design and its contemporary form. Lectures and seminar presentations highlight major Italian designers and internationally significant design in the 20th century. Focus is on innovative design that exhibits a synthesis of formal and social functions.
Meets International Perspectives Requirement.

ARTID 359: Junior Field Study
Cr. R. F.
Prereq: Enrollment in third year interior design studio course
Study and tours of areas of interest within the interior design profession such as manufacturers, design studios, showrooms, and museums. Offered on a satisfactory-fail basis only.

ARTID 360: Sophomore Interior Design Internship Seminar
(1-0) Cr. 1. S.
Prereq: Sophomore classification in interior design program.
Procedural and ethical concerns relating to interior design internship. Preparation of documents for internship search. Formulation of personal internship and career goals.

ARTID 361: Junior Interior Design Internship Seminar
(1-0) Cr. 1. S.
Prereq: junior classification in interior design program.
Procedural and ethical concerns relating to interior design internship. Refinement of placement credentials and personal goals. Internship search process and agreements.

ARTID 365: Interior Design Studio III
(1-6) Cr. 4. F.
Prereq: ARTID 263, ARTID 267, and enrollment in ARTID 359
Refined methods of problem identification design programming and problem solving, including theoretically-based concept development and refinement. Emphasis and compliance with codes and standards. Produce small and large scale projects. Alternative manual and computer-based visualization methods. Teamwork. Multi-cultural, study abroad option.

ARTID 367: Interior Design Studio IV
(1-6) Cr. 4-5. S.
Prereq: ARTID 365
Emphasis on three-dimensional spatial development in large scale, multiple scale unit institutional projects. Inclusion of extensive design documentation. Expansion of alternative manual and computer-based visualization methods. Teamwork.

ARTID 367H: Interior Design Studio IV: Honors
(1-6) Cr. 4-5. S.
Prereq: ARTID 365
Emphasis on three-dimensional spatial development in large scale, multiple scale unit institutional projects. Inclusion of extensive design documentation. Expansion of alternative manual and computer-based visualization methods. Teamwork.

ARTID 459: Senior Field Study
Cr. R.
Prereq: Enrollment in fourth year interior design studio course
Study and tours of areas of interest within the interior design profession such as manufacturers, design studios, showrooms and museums. Offered on a satisfactory-fail basis only.

ARTID 460: Interior Design Internship
Cr. 3. SS.
Prereq: ARTID 350, 360, and 365
Professional interior design off-campus experience.

ARTID 461: Interior Design Professional Practices
(2-0) Cr. 2. S.
Prereq: ARTID 460
Organization and general management of the interior design office: agreements, business procedures, and professional ethics. Professional interior design issues and concerns.

ARTID 461H: Interior Design Professional Practices: Honors
(2-0) Cr. 2. S.
Prereq: ARTID 460
Organization and general management of the interior design office: agreements, business procedures, and professional ethics. Professional interior design issues and concerns.

ARTID 463: Environments for the Aging
(Dual-listed with ARTID 563). (Cross-listed with GERON, HD FS). (3-0) Cr. 3. S.
Prereq: HD FS 360 or 3 credits in housing, architecture, interior design, rehabilitation, psychology, or human development and family studies or permission of instructor
Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (on-line course offering via Distance Education).
Meets U.S. Diversity Requirement

ARTID 465: Interior Design Studio V
(Dual-listed with ARTID 565). (1-6) Cr. 4. F.
Prereq: ARTID 460, or permission of instructor, and enrollment in ARTID 459
Design research and refined problem solving methods including functional analysis, programming and detailing.

ARTID 467: Interior Design Studio VI
(Dual-listed with ARTID 567). (1-6) Cr. 4. S.
Prereq: ARTID 465
Refinement of technical, analytical and theoretical problem-solving methods and comprehensive design documentation. In-depth development of interior design projects. Current issues in interior design.

ARTID 468: Interior Design in an Urban Setting
(1-4) Cr. 3. S.
Prereq: Enrollment or credit in third year studio courses
Study of selected interior design projects and designers practicing in an urban setting. Studio project examining issues related to interior design in an urban context.

ARTID 468H: Interior Design in an Urban Setting: Honors
(1-4) Cr. 3-4. S.
Prereq: Enrollment or credit in third year studio courses
Study of selected interior design projects and designers practicing in an urban setting. Studio project examining issues related to interior design in an urban context.

ARTID 490: Independent Study
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related interior design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTID 490H: Independent Study, Honors
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related interior design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTID 493: Workshop
Cr. 1-3. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: Evidence of satisfactory experience in area of specialization
Intensive 2 to 4 week studio exploration. Topics vary each time offered.

Courses primarily for graduate students, open to qualified undergraduates:

ARTID 551: Design Humanics
(3-0) Cr. 3. Repeatable, maximum of 15 credits. F.S.
Prereq: Instructor permission
An exploration of human nature as broadly defined and as applied to design of the built environment. Consideration of human characteristics, responses and performance, at varying scales, as sources of design insight. Topics vary each time offered.

ARTID 551A: Design Humanics: Sensory Perception & Ergonomic Factors
(3-0) Cr. 3. Repeatable, maximum of 9 credits. F.S.
Prereq: Instructor permission
Human factors related to the nature, performance and accommodation of the individuals and small groups, including sensation and perception, physical requirements, anthropometrics, safety and other issues connecting human needs and built environmental responses. Topics vary each time offered.

ARTID 551B: Design Humanics: Emotional, Behavioral & Contextual Factors
(3-0) Cr. 3. Repeatable, maximum of 9 credits. F.S.
Prereq: Instructor permission
Human factors issues related to the nature, performance and accommodation of medium to large groups and settings. Emphasis on psychological, sociological, cultural, interpersonal safety, and related human needs and built environmental responses. Topics vary each time offered.

ARTID 552: Design Methods: Design Methods
(2-0) Cr. 2. Repeatable, maximum of 10 credits. F.S.
Prereq: Permission of instructor
Survey of methodologies and methodological tools for varied end uses and drawn from wide ranging sources. Emphasis on their organization and application to design of the human environment. Topics vary each time offered.

ARTID 552A: Design Methods: Investigation Analysis
(2-0) Cr. 2. Repeatable, maximum of 10 credits. F.S.
Prereq: Permission of instructor
Methods of design research, analysis, programming and theory formulation.

ARTID 552B: Design Methods: Synthesis
(2-0) Cr. 2. Repeatable, maximum of 10 credits. F.S.
Prereq: Permission of instructor
Methods of synthesizing design concepts and solutions.

ARTID 552C: Design Methods: Communication
(2-0) Cr. 2. Repeatable, maximum of 10 credits. F.S.
Prereq: Permission of instructor
Methods of managing, translating, communicating and otherwise utilizing text, image, abstract and other forms of information.

ARTID 552D: Design Methods: Procedural Alternatives
(2-0) Cr. 2. Repeatable, maximum of 10 credits. F.S.
Prereq: Permission of instructor
New and specialized methodological trends, including subject or setting-specific methods.

ARTID 554: Interior Design Teaching Practicum
Cr. 3. Repeatable. F.S.SS.
Prereq: ARTID 668 and permission of instructor
Supervised practical application of interior design theory, materials, and practice to the educational process.

ARTID 559: Graduate Interior Design Field Study
Cr. 1-3. Repeatable.
Prereq: Graduate enrollment or permission of instructor
Study and tours of places of interior design-related interest such as manufacturers, design studios, related professional offices, showrooms, museums, and historical sites.

ARTID 560: Interior Design Internship
Cr. 3. F.S.SS.
Prereq: Permission of instructor.
Professional interior design off-campus experience.

ARTID 563: Environments for the Aging
(Dual-listed with ARTID 463). (Cross-listed with GERON, HD FS). (3-0) Cr. 3. S.
Prereq: HD FS 360 or 3 credits in housing, architecture, interior design, rehabilitation, psychology, or human development and family studies or permission of instructor
Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (on-line course offering via Distance Education).
Meets U.S. Diversity Requirement

ARTID 565: Interior Design Studio V
(Dual-listed with ARTID 465). (1-6) Cr. 4. F.
Prereq: ARTID 460, or permission of instructor, and enrollment in ARTID 459
Design research and refined problem solving methods including functional analysis, programming and detailing.

ARTID 567: Interior Design Studio VI
(Dual-listed with ARTID 467). (1-6) Cr. 4. S.
Prereq: ARTID 465
Refinement of technical, analytical and theoretical problem-solving methods and comprehensive design documentation. In-depth development of interior design projects. Current issues in interior design.

ARTID 568: Experimental Interior Design
(0-8) Cr. 4. Repeatable, maximum of 16 credits. F.S.
Prereq: Graduate classification and permission of instructor
Application of alternative design methods and sources of insight to the solution of human environmental design problems. Focus on the identification, formulation, refinement and application of theory to the design process. Emphasis on the pursuit of new discovery and innovative problem solving. Approaches, settings and scales vary each time offered.

ARTID 569: Advanced Studies in Interior Design
Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or permission of instructor
Examination of special issues with emphasis on their translation into design application.

ARTID 569A: Advanced Studies in Interior Design: Design Theory
Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or permission of instructor
Examination of special issues with emphasis on their translation into design application.

ARTID 569B: Advanced Studies in Interior Design: Advanced Color
Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or permission of instructor
Examination of special issues with emphasis on their translation into design application.

ARTID 569C: Advanced Studies in Interior Design: Sustainable Design
Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or permission of instructor
Examination of special issues with emphasis on their translation into design application.

ARTID 569D: Advanced Studies in Interior Design: Variable Topics
Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or permission of instructor
Examination of special issues with emphasis on their translation into design application.

ARTID 590: Special Topics
Cr. arr.
Prereq: Bachelor's degree in interior design, or evidence of satisfactory equivalency in specialized area. Written approval of instructor and department chair on required form in advance of semester of enrollment

ARTID 593: Workshop
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification; evidence of satisfactory experience in area of specialization
Intensive 2 to 4 week studio exploration. Topics vary each time offered.

ARTID 598: Research Forum
(1-0) Cr. 1-3. Repeatable, maximum of 9 times. F.S.
Prereq: Concurrent enrollment in ARTID 565, ARTID 567, ARTID 568, ARTID ARTID 665, or ARTID 668, and permission of instructor
Presentation and discussion of cross-disciplinary design research theory, methods, and application. Focus on the investigation, application, and communication of types of design research.

ARTID 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

ARTID 660: Research Methods
(3-0) Cr. 3. S.
Prereq: Permission of instructor
Research strategies related to design. Application of selected methods to specific issues. Open to non-majors.

ARTID 668: Advanced Experimental Interior Design
(0-8) Cr. 4. Repeatable, maximum of 16 credits. F.S.
Prereq: Graduate classification and permission of instructor.
Application of alternative design methods and sources of insight to the solution of human environmental design problems. Focus on the identification, formulation, refinement and application of theory to the design process. Emphasis on the pursuit of new discovery and innovative problem solving. Approaches, settings and scales vary each time offered.

ARTID 690: Advanced Topics
Cr. arr. Repeatable.
Prereq: M.F.A classification, permission of instructor

ARTID 697: Design Practicum
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Approval of POS committee
Applied, off campus, professional interior design-related experience.

ARTID 699: Research
Cr. arr. Repeatable.

ARTID 699A: Thesis
Cr. arr. Repeatable.

ARTID 699B: Thesis-Exhibition
Cr. arr. Repeatable.

ARTID A560: Interior Design Internship
Cr. 3. F.S.SS.
Prereq: Permission of instructor.
Professional interior design off-campus experience.

International Studies (INTST)

Courses primarily for undergraduates:

INTST 235: Introduction to International Studies
(3-0) Cr. 3. F.SS.
Overview of international studies, emphasizing cultural, geographic, economic, and political characteristics of major world areas and nations.
Meets International Perspectives Requirement.

INTST 295: International Experience Abroad
Cr. 1-8. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 12 college-level credits
Supervised instruction in an international setting, augmented by practical living experience.
Meets International Perspectives Requirement.

INTST 350: Topics in International Studies
Cr. 2-4.

Meets International Perspectives Requirement.

INTST 395: Interdisciplinary Study Abroad
Cr. 1-4. Repeatable.
Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 395A: Interdisciplinary Study Abroad: Pre-Departure Seminar
Cr. 1-4. Repeatable.
Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 395B: Interdisciplinary Study Abroad: Humanities
Cr. 1-4. Repeatable.
Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 395C: Interdisciplinary Study Abroad: Communications
Cr. 1-4. Repeatable.
Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 395D: Interdisciplinary Study Abroad: Mathematics and Natural Science
Cr. 1-4. Repeatable.
Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 395E: Interdisciplinary Study Abroad: Social Sciences
Cr. 1-4. Repeatable.
Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 430: Seminar in International Studies
(3-0) Cr. 3. S.
Prereq: INTST 235, junior classification or higher
Capstone seminar in international studies focused on economic development, women's issues, war and ethnic conflict, population, the environment, globalization, human rights, international trade and business and other issues. Students develop a project on a subject linked to their area of professional interest or academic specialization.
Meets International Perspectives Requirement.

INTST 446: International Issues and Challenges in Sustainable Development
(Cross-listed with AGRON, GLOBE). Cr. 3. F.S.
Prereq: 3-credit biology course, Sophomore or higher classification, permission of Instructor
Interdisciplinary study and analysis of agricultural systems, sustainable management, and impact on plants and animal biodiversity. International field experience in evaluating different agricultural systems and impact on biodiversity may be required. A program fee is charged to students for international study abroad.
Meets International Perspectives Requirement.

INTST 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: Permission of International Studies director and faculty supervisor
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered or to integrate areas of study appropriate to special problems with international foci. No more than 3 credits of IntSt 490 may be used in the International Studies major or minor.

INTST 491: Experiences Abroad: Learning to Think Globally
(Cross-listed with WLC). (1-0) Cr. 1. Repeatable, maximum of 2 credits.
Prereq: Minimum of 3 cr. of study abroad and/or internship abroad
Students returning from study abroad gain perspective on the personal, academic, and professional impact of their time spent abroad through readings and discussions. Students will be expected to make one presentation about the culture they experienced to an audience outside of ISU. Offered on a satisfactory-fail basis only.

Iowa Lakeside Laboratory (IA LL)

Courses primarily for undergraduates:

IA LL 293: Natural History Workshop
Cr. 1-2. SS.
Offered as demand warrants. Five-day-long, nontechnical introductions to a specific aspect of the natural history of the Upper Midwest or techniques for studying natural history.

IA LL 293G: Prairies
Cr. 1-2. SS.
Offered as demand warrants. Five-day-long, nontechnical introductions to a specific aspect of the natural history of the Upper Midwest or techniques for studying natural history.

IA LL 302: Plant-Animal Interactions
Cr. 4. Alt. SS., offered odd-numbered years.
Prereq: One course in the biological sciences
Introduction to ecology and co-evolution of plants and animals; emphasis on dispersal, pollination, and plant-herbivore interactions; field and laboratory work, reading, discussion.

IA LL 303I: Undergraduate Internships
(Cross-listed with NREM). Cr. 1-5. Repeatable. SS.
Prereq: Permission of instructor and sophomore standing
Placement with county conservation boards, camps, parks, etc. for experience as interpreters, rangers, and technicians.

IA LL 312I: Ecology
(Cross-listed with A ECL, ENSCI). Cr. 4. SS.
An introduction to the principles of ecology at the population, community and ecosystem level. Field studies of local lakes, wetlands and prairies are used to examine factors controlling distributions, interactions, and roles of plants and animals in native ecosystems.

IA LL 326I: Ornithology
(Cross-listed with A ECL). Cr. 4. SS.
The biology, ecology, and behavior of birds with emphasis on field studies of local avifauna. Group projects stress techniques of population analysis and methodology for population studies.

IA LL 333: Animals and Their Ecosystems
(4-0) Cr. 4.
Prereq: Introductory biology
Vertebrate and invertebrate animals of the Midwest are observed in nature either through passive observational techniques or active trapping exercises. Once identified, animals are placed in their proper taxonomic position (e.e., put onto the "Tree of Life"). They also are put into ecological perspective, including habitat pereferences (i.e., wetland, lake, prairie, forest, river, edge), trophic position, and activity patterns. Conservation status is discussed.

IA LL 364: Biology of Aquatic Plants
Cr. 4. Alt. SS., offered even-numbered years.
A field-oriented introduction to the taxonomy and ecology of aquatic plants in lakes, wetlands and rivers. Individual or group projects.

IA LL 367: Plant Taxonomy
Cr. 4. SS.
Principles of classification and evolution of vascular plants; taxonomic tools and collection techniques; use of keys. Field and laboratory studies emphasizing identification of local flowering plants and recognition of major plant families.

IA LL 371I: Introduction to Insect Ecology
(Cross-listed with ENT). (3-3) Cr. 4. Alt. SS., offered odd-numbered years.
Field and laboratory study of insects, their diversity, life history; emphasis on ecology and behavior.

IA LL 402I: Watershed Hydrology and Surficial Processes
(Cross-listed with AGRON, ENSCI). Cr. 4. SS.
Prereq: Four courses in physical or biological sciences or engineering
Effects of geomorphology, soils, and land use on transport of water and materials (nutrients, contaminates) in watersheds. Fieldwork will emphasize investigations of the Iowa Great Lakes watershed.

IA LL 403: Evolution
Cr. 4. SS.
Mechanisms and patterns in microevolution and macroevolution. Field exercises will emphasize studies of natural selection, adaptation, genetic variation, and population genetics of local plant and animal populations.

IA LL 404I: Behavioral Ecology
(Cross-listed with A ECL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: Two semesters of biology
Animal coloniality, courtship, territoriality, predator defense, habitat selection, foraging, mating systems, and parental care will be examined in the field in order to evaluate various ecological and evolutionary theories of animal behavior.

IA LL 408I: Aquatic Ecology
(Dual-listed with IA LL 508I). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

IA LL 415: Freshwater Invertebrates
Cr. 4. SS.
Prereq: One or more ecology courses
Field-oriented introduction to the identification, life-history, and ecology of common, free-living freshwater invertebrates of north-temperate lakes, rivers, and wetlands. Emphasis on the role of invertebrates in aquatic food chains and litter processing.

IA LL 419I: Vertebrate Ecology and Evolution
(Cross-listed with A ECL). Cr. 4. SS.
Field and laboratory study of representative vertebrates of northwestern Iowa. Observations and experimentation emphasize ecological histories by integrating concepts of functional morphology, behavioral ecology, and evolutionary biology.

IA LL 420I: Amphibians and Reptiles
(Cross-listed with A ECL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: Two semesters of biology
Ecology, behavior, and conservation biology of amphibians and reptiles with emphasis on their anatomy and morphology; temperature and water regulation; locomotion; life history; reproduction; population and community ecology; and conservation.

IA LL 422I: Prairie Ecology
(Cross-listed with ENSCI). Cr. 4. SS.
Prereq: Familiarity with basic principles in biological sciences and ecology
Basic patterns and underlying physical and biotic causes of both regional and local distributions of plants and animals of North American prairies; field and laboratory analyses and projects.

IA LL 425I: Aquatic Toxicology and Wetland Dynamics in Freshwater Systems
Cr. 4. SS.
Prereq: Introductory biology course and general chemistry course
Fundamental knowledge and understanding of the scientific concepts related to the physio-chemical and biological environment. Problems and issues (global, national, regional, and local) associated with freshwater systems and how wetland restoration can be used to ameliorate problems. Discussion and application of basic tools used to assess aquatic toxicological problems.

IA LL 427I: Field Archaeology
(Cross-listed with ANTHR). Cr. 4. SS.
Nature of cultural and environmental evidence in archaeology and how they are used to model past human behavior and land use; emphasis on Iowa prehistory; basic reconnaissance surveying and excavation techniques.

IA LL 435I: Illustrating Nature I Sketching
(Cross-listed with BPM I). Cr. 2. SS.
Sketching plants, animals and terrain. Visual communication, development of a personal style, and integration of typographic and visual elements on a page will be emphasized.

IA LL 436I: Illustrating Nature II Photography
(Cross-listed with BPM I). Cr. 2. SS.
Beginning to intermediate technical and compositional aspects of color photography of natural areas and their plants and animals.

IA LL 450: Topics in Ecology and Sustainability
(Dual-listed with IA LL 550). Cr. 1-4.
Prereq: general biology course
Scientific introduction to ecology and evolution of important groups of organisms: algae to vertebrates, different ecological phenomena (e.g., fire and climate change), varying landforms, different ecosystems (e.g., prairies and aquatic systems); emphasis on sustainability with introduction to concepts, issues, and practices; ability to communicate environmental information through a variety of means.

IA LL 461I: Introduction to GIS
(Cross-listed with ENSCI, ENV S, L A). Cr. 4. SS.
Descriptive and predictive GIS modeling techniques, spatial statistics, and map algebra. Application of GIS modeling techniques to environmental planning and resource management.

IA LL 463I: Soil Formation and Landscape Relationships
(Dual-listed with IA LL 563I). (Cross-listed with AGRON, ENSCI). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

IA LL 480I: Ecology and Systematics of Diatoms
(Dual-listed with IA LL 580I). Cr. 4. SS.
Field and laboratory study of freshwater diatoms; techniques in collection, preparation, and identification of diatom samples; study of environmental factors affecting growth, distribution, taxonomic characters; project design and execution including construction of reference and voucher collections and data organization and analysis.

IA LL 484: Plant Ecology
Cr. 4. SS.
Principles of plant population, community, and ecosystem ecology illustrated through studies of native vegetation in local prairies, wetlands and forests. Group or individual projects.

IA LL 490I: Iowa Lakeside Laboratory
(Cross-listed with ANTHR, NREM). Cr. 1-6. Repeatable, maximum of 9 credits.
Prereq: 8 credits in biology and permission of instructor
Research opportunities for undergraduate students in the biological sciences. No more than 9 credits in Biol 490 may be counted toward graduation and of those, only 6 credits may be applied to the major.

IA LL 493: Natural History Workshop
Cr. 1-2. SS.
Offered as demand warrants. Five day-long, non-technical introductions to a specific aspect of the natural history of the Upper Midwest or techniques for studying natural history.

IA LL 494: Ecosystems of North America
Cr. 2-4. SS.
Prereq: A general ecology course and permission of the instructor
An extended field trip to study a particular type of ecosystem (prairie, coastal wetland, forest, alpine, coral reefs, etc.) or the ecosystems of a specific region (Rocky Mountains, Gulf Coast, Appalachian Mountains, Deserts of the Southwest, Central America, etc.). Prior to the field trip, there will be an orientation period and after each field trip a review and synthesis period. A field trip fee will be assessed to cover travel expenses.

IA LL 499: Undergraduate Research
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification and permission of instructor

Courses primarily for graduate students, open to qualified undergraduates:

IA LL 501: Freshwater Algae
Cr. 4. SS.
Structure and taxonomy of freshwater algae based on field collected material; emphasis on genus-level identifications, habitats visited include lakes, fens, streams, and rivers; algal ecology.

IA LL 503: Graduate Internships
Cr. 1-5. SS.
Prereq: Permission of instructor and graduate standing
Placement with county conservation boards, camps, parks, schools, etc. for experience as interpreters, rangers, technicians, and teachers.

IA LL 508I: Aquatic Ecology
(Dual-listed with IA LL 408I). (Cross-listed with ENSCI, ENSCI, NREM, NREM). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

IA LL 523I: Fish Ecology
(Cross-listed with A ECL). Cr. 4. Alt. SS., offered even-numbered years.
Basic principles of fish interaction with the biotic and abiotic environment. Field methods, taxonomy, and biology of fish with emphasis on the fish fauna of northwestern Iowa.

IA LL 526I: Advanced Field Ornithology
(Cross-listed with A ECL). Cr. 2. SS.
Prereq: Concurrent registration in IA LL 326I
Field study of birds of the upper Midwest; extended field trip to Minnesota and Wisconsin; individual or group project.

IA LL 531I: Conservation Biology
(Cross-listed with A ECL, EEOB). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: IA LL 312I
Population-and community-level examination of factors influencing the viability of plant and animal populations from both demographic and genetic perspectives; assessment of biodiversity; design and management of preserves.

IA LL 532: Analysis of Environmental Data
(2-0) Cr. 2. SS.
Prereq: An undergraduate course in statistics, understanding of basic concepts such as correlation and regression, and familiarity with PC-based software for data analysis
Analysis of Environmental Data will provide students with training in the theory and application of a range of statistical techniques useful for the analysis of ecological and paleoecological data. Topics will include data management, exploratory data analysis, regression analysis, direct and indirect ordination methods, classification techniques, transfer functions and the analysis of temporal data. Practical classes will provide hands-on training in the use of statistical and graphical software including R, CANOCO, C2, and TWINSPAN. The course will be directed towards advanced undergraduate, graduate and working professionals in ecology and paleoecology.

IA LL 535I: Restoration Ecology
(Cross-listed with A ECL, EEOB, ENSCI). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: A course in ecology
Ecological principles for the restoration of native ecosystems; establishment (site preparation, selection of seed mixes, planting techniques) and management (fire, mowing, weed control) of native vegetation; evaluation of restorations. Emphasis on the restoration of prairie and wetland vegetation.

IA LL 550: Topics in Ecology and Sustainability
(Dual-listed with IA LL 450). Cr. 1-4.
Prereq: general biology course
Scientific introduction to ecology and evolution of important groups of organisms: algae to vertebrates, different ecological phenomena (e.g., fire and climate change), varying landforms, different ecosystems (e.g., prairies and aquatic systems); emphasis on sustainability with introduction to concepts, issues, and practices; ability to communicate environmental information through a variety of means.

IA LL 563I: Soil Formation and Landscape Relationships
(Dual-listed with IA LL 463I). (Cross-listed with AGRON, ENSCI). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

IA LL 564I: Wetland Ecology
(Cross-listed with EEOB, ENSCI). Cr. 4. SS.
Prereq: Ia LL 312I
Ecology, classification, creation, restoration, and management of wetlands. Field studies will examine the composition, structure and functions of local natural wetlands and restored prairie pothole wetlands. Individual or group projects.

IA LL 573: Techniques for Biology Teaching
(Cross-listed with A ECL, EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573A: Techniques for Biology Teaching : Animal Biology
(Cross-listed with A ECL, EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573B: Techniques for Biology Teaching: Plant Biology
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573C: Techniques for Biology Teaching: Fungi and Lichens
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573D: Techniques for Biology Teaching: Aquatic Ecology
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573E: Techniques for Biology Teaching: Prairie Ecology
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573F: Techniques for Biology Teaching: Wetland Ecology
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573G: Techniques for Biology Teaching: Limnology
(Cross-listed with A ECL, EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573H: Techniques for Biology Teaching: Animal Behavior
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573I: Techniques for Biology Teaching: Insect Ecology
(Cross-listed with A ECL, EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573J: Techniques for Biology Teaching: Biology of Invertebrates
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573K: Techniques for Biology Teaching: Non-invasive Use of Living Organisms
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573W: Techniques for Biology Teaching: Project WET
(Cross-listed with A ECL, EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 575I: Field Mycology
(Cross-listed with EEOB). Cr. 4. Alt. SS., offered even-numbered years.
Identification and classification of the common fungi; techniques for identification, preservation, and culture practiced with members of the various fungi groups.

IA LL 580I: Ecology and Systematics of Diatoms
(Dual-listed with IA LL 480I). (Cross-listed with EEOB). Cr. 4. SS.
Field and laboratory study of freshwater diatoms; techniques in collection, preparation, and identification of diatom samples; study of environmental factors affecting growth, distribution, taxonomic characters; project design and execution including construction of reference and voucher collections and data organization and analysis.

IA LL 590: Graduate Independent Study
(Cross-listed with A ECL, ANTHR, EEOB). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

IA LL 590I: Special Topics: Graduate Independent Study
(Cross-listed with A ECL, ANTHR, EEOB). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

IA LL 593: Natural History Workshop
Cr. 1-3.
Prereq: Permission of instructor
Graduate workshop on some aspect of the natural history of the Upper Midwest or on techniques for studying natural history.

Courses for graduate students:

IA LL 699I: Research
(Cross-listed with A ECL, ANTHR, EEOB, GDCB). Cr. 1-4. Repeatable.

Journalism and Mass Communication (JL MC)

Courses primarily for undergraduates:

JL MC 101: Mass Media and Society
(3-0) Cr. 3. F.S.SS.
Communication theory models and their application to the mass media; the mass communication process; organization, characteristics and responsibilities of the mass media; media literacy process.

JL MC 110: Orientation to Journalism and Communication
(1-0) Cr. 1. F.S.Alt. SS., offered irregularly.
Orientation to professional and pre-professional opportunities, writing for the mass media and curriculum requirements in the Greenlee School. Basic media writing preparation. Offered on a satisfactory-fail basis only.

JL MC 201: Reporting and Writing for the Mass Media
(1-4) Cr. 3.
Prereq: Greenlee majors only or departmental permission. Must pass departmental assessment exam in language skills before registering; ENGL 250; credit or concurrent enrollment in JL MC 110.
Generating story ideas, exercising news judgment and gathering information via interviews, observation and documentary sources to produce news and informational material for the mass media. Emphasis on analyzing and organizing information, as well as accuracy and principles of good writing. Use of AP Style.

JL MC 242: Visual Principles for Mass Communicators
(3-0) Cr. 3. F.S.
Understanding and analysis of the visual message. Visual perception, visual communication theory, design syntax, design elements and how they are applied in journalism and mass communication.

JL MC 302: Intermediate Reporting and Writing for the Mass Media
(2-2) Cr. 3.
Prereq: JL MC 110 and Minimum of C+ in JL MC 201
Writing for newspapers, magazines and digital media. Enhancing and refining skills in developing sources and generating story ideas. Information-gathering techniques, reporting and writing.

JL MC 303: Reporting and Writing for the Electronic Media
(2-2) Cr. 3.
Prereq: JL MC 110 and Minimum of C+ in JL MC 201
Researching, organizing, and writing for radio, television and digital media. Basic principles of news programming and storytelling across electronic media platforms. An emphasis on development, content and structure.

JL MC 306: Electronic Media Production
(2-2) Cr. 3. F.S.
Prereq: Minimum of C+ in Jl MC 201
Introduction to studio production using professional equipment. Course focus on visual concepts, maintenance and practical operation of studio equipment.

JL MC 307: Digital Video Production
(2-2) Cr. 3.
Prereq: Greenlee majors only.
Creation of video productions for use as communication tools in advertising, promotions, short documentaries and public relations. Technical and artistic fundamentals of video production including planning, scripting, shooting, lighting and digital editing.

JL MC 308: Electronic News Gathering and Production
(2-3) Cr. 3.
Prereq: Minimum of C+ in JL MC 201.
Field techniques in single-camera video production used to shoot and edit visual stories. Introduction to electronic news gathering.

JL MC 310: Fundamentals of Photojournalism
(2-2) Cr. 3. F.S.
Prereq: Minimum of C+ in JL MC 201
Basic photojournalism techniques. Includes camera operation, lighting, composition and photo reproduction techniques for print or computer-mediated applications. Emphasis on using the camera as a reporting tool. Basic use of digital imaging and editing software. Ethical issues involving photojournalism. A digital SLR camera is required.

JL MC 312: Advanced Techniques in Photojournalism
(2-2) Cr. 3. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: JL MC 310 or permission of instructor
Advanced techniques and problem solving, both ethical and technical, for photographers who seek to be members of newsgathering teams. Photographic storytelling using a combination of audio and still photography techniques to report stories for print and web publications. Hands on experience with latest digital imaging technology. A digital SLR camera is required.

JL MC 315: Multimedia Production
(2-2) Cr. 3. F.S.
Prereq: JL MC 308 or JL MC 310 or JL MC 316 or equivalent computer design proficiency
Visual storytelling concepts and principles for evaluating, constructing and designing information for the Web and other electronic publication systems. Issues of ethics and ownership of work pertinent to the new media.

JL MC 316: Introduction to Digital Publishing
(2-2) Cr. 3. F.S.
Prereq: Credit or enrollment in JL MC 242 and C+ or better in Jl MC 201
Digital publishing and beginning techniques in layout, photo editing and vector artwork. Application of visual principles to design simple print projects.

JL MC 317: Publishing for Mobile Devices
(2-2) Cr. 3. S.
Prereq: JL MC 316 or equivalent computer design proficiency and JL MC 310 or 315.
Creating, designing and publishing content for mobile devices (e.g., cell phones and tablets). Use of digital publishing tools (e.g., In Design). Exposure to animation and video editing software.

JL MC 344: Feature Writing
(2-2) Cr. 3.
Prereq: Minimum of C+ in JL MC 302 or P R 321
Reporting and writing short- and long- form stories for magazines, newspapers, corporate communication and the Web. Focus on departmental stories, personal essays, trend or conflict articles and personality profiles. Emphasis on immersion reporting. Majors may not apply both 344 and Engl 303 toward graduation.

JL MC 346: Public Affairs Reporting
(2-2) Cr. 3.
Prereq: Minimum of C+ in JL MC 302 or P R 321
Reporting and writing about government, business, and other institutions; identification of and access to public records; investigative reporting techniques; developing major stories about government and nonprofit organizations; and ethical issues.

JL MC 347: Science Communication
(Dual-listed with JL MC 547). (2-2) Cr. 3.
Prereq: Graduate classification. Nonmajors and minors by permission of instructor.
Reporting and writing about science and technology topics for general audiences. Outlets for stories include print, broadcast and online media. Story topics include reporting about basic, applied and social sciences, as well as ethical, political and policy issues related to science and technology.

JL MC 349: News and Feature Editing
(2-2) Cr. 3.
Prereq: Minimum of C+ in JL MC 302 or P R 321
Editing content for multiple platforms, including websites, magazines, newspapers, and newsletters. Adapting material for audiences, including selection and organization of text and visuals, grammar, punctuation, usage, logic and accuracy. Designing print and online layouts. Using search engine optimization and social media to promote content.

JL MC 354: Advanced Electronic Media Production
(2-3) Cr. 3.
Prereq: JL MC 206.
Application of advanced television techniques: writing, producing, and managing live and recorded information programs.

JL MC 390: Professional Skills Development
(Cross-listed with ADVRT, P R). Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Minimum of C+ in JL MC 201; other vary by topic. Instructor permission for non-majors.
Check with Greenlee School for course availability.

JL MC 401: Mass Communication Theory
(3-0) Cr. 3.
Prereq: Junior classification
Theory and research in mass communication processes and effects; the scientific process; methods of measuring, evaluating and reporting mass communication research.

JL MC 406: Media Management
(Dual-listed with JL MC 506). (3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Decision-making functions of media. Basic media market analysis, media organization and management, circulation and audience development, technological developments affecting management decisions, and relationships with labor and regulatory agencies that affect media operations.

JL MC 449: Editorial Strategies
(3-0) Cr. 3. S.
Prereq: JL MC 242, JL MC 316, JL MC 349 or concurrent enrollment; junior classification
Skills and strategies for editorial decision-making and management, including short and long range issue planning. Developing proposals, business plans and prototypes for content, design and layouts of publications for multiple platforms and diverse audiences, including new and existing online and print magazines, newspapers, newsletters and websites. Editing complex manuscripts, with continued emphasis on grammar, punctuation, usage, syntax and logic.

JL MC 453: Electronic Media Technology and Public Policy
(3-0) Cr. 3.
Prereq: Junior classification
Issues and policies affecting historical, contemporary and future developments of electronic media and their technologies.

JL MC 454: Critical Analysis and History of the Moving Image
(3-0) Cr. 3.
Prereq: Junior classification
Evolution of motion picture and television content and other visual technologies. Theories and techniques for evaluating and critiquing film and video.

JL MC 460: Law of Mass Communication
(3-0) Cr. 3.
Prereq: JL MC 110 and minimum of C+ in JL MC 201; junior classification. Nonmajors by permission of department.
First Amendment law, libel, privacy, obscenity, contempt, copyright, trademark, the Federal Communications Act; laws affecting advertising, legal publication, and other business activities of the media.

JL MC 461: History of American Journalism
(3-0) Cr. 3.
Prereq: Junior classification
Role of the mass media, including advertising and public relations, in shaping the social, economic and political history of America; impact of change in these areas on the development, traditions and philosophies of the media.

JL MC 462: Media Ethics, Freedom, Responsibility
(3-0) Cr. 3.
Prereq: JL MC 110 and minimum of C+ in JL MC 201. Greenlee majors only.
Ethics and professionalism in the practice of journalism, public relations and advertising.

JL MC 464: Journalism and Literature
(3-0) Cr. 3.
Prereq: Junior classification
A study of journalism's impact on literary writing and literature's impact on journalism, as seen through the works of esteemed American author-journalists.

JL MC 474: Communication Technology and Social Change
(3-0) Cr. 3.
Prereq: Junior classification
Examination of historical and current communication technologies, including how they shape and are shaped by the cultural and social practices into which they are introduced.
Meets International Perspectives Requirement.

JL MC 476: World Communication Systems
(Dual-listed with JL MC 576). (3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
World communication systems and social, political, and economic factors determining flow, character, and volume of news. Impact of media information, advertising and public relations on nations and societies. Comparative analysis of role and impact of traditional modes of communication, the mass media and computer-mediated systems. Meets International Perspectives Requirement.

JL MC 477: Ethnicity, Gender, Class and the Media
(3-0) Cr. 3. F.S.SS.
Prereq: Junior classification
Portrayals of ethnic groups, gender, and social class in the media in news, advertising, information and entertainment; the effects of mass media on social issues and population groups.
Meets U.S. Diversity Requirement

JL MC 490: Independent Study in Communication
Cr. arr.
Prereq: Junior classification and contract with supervising professor to register
Independent studies are research-based. Students may study problems associated with a medium, a professional specialization, a philosophical or practical concern, a reportorial method or writing technique, or a special topic in their field. Credit is not given for working on student or professional media without an accompanying research component. No more than 3 credits of Jl MC 490 may be used toward a degree in journalism and mass communication or advertising.

JL MC 497: Special Topics in Communication
(Cross-listed with ADVRT, P R). Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: Junior classification. See Schedule of Classes for possible pre-requisites.
Seminars or one-time classes on topics of relevance to students in communication.

JL MC 499: Professional Media Internship
Cr. 1-3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, formal faculty adviser approval.
Required of all Greenlee School majors. A 400-hour (for 3 credits) internship in the student's journalism and mass communication or advertising or public relations specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

JL MC 499A: Professional Media Internship: Required
Cr. 3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, formal faculty adviser approval.
Initial, required internship. A 400-hour (for 3 credits) internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

JL MC 499B: Professional Media Internship: Optional
Cr. 1-3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, formal faculty adviser approval.
Optional internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

JL MC 501: Theories of Mass Communication
(3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Historical overview of mass communication theories. Examination of major areas of research activity and theoretical development related to organization, functions, and effects of mass communication.

JL MC 502: Fundamentals of Communication Research Methods
(3-0) Cr. 3.
Prereq: JL MC 501 or concurrent enrollment.
Research methods in journalism and mass communication, including problem selection, sampling, hypothesis formulation, research design, data collection and analysis. Designing a research strategy appropriate for a variety of communication-related questions and assessing the appropriateness, validity, and generalizability of research results.

JL MC 506: Media Management
(Dual-listed with JL MC 406). (3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Decision-making functions of media. Basic media market analysis, media organization and management, circulation and audience development, technological developments affecting management decisions, and relationships with labor and regulatory agencies that affect media operations.

JL MC 510: Strategies of Communication
(3-0) Cr. 3.
Prereq: JL MC 501
The process of developing professional communication and persuasion strategies, with emphasis on problem definition, behavioral objectives, situation analysis, strategy formulation, and justification through application of communication theories and research.

JL MC 520: Public Relations Theory and Methods
(3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Overview of dominant theories and research methods applied to the study and practice of public relations.

JL MC 521: Theories of Visual Communication
(3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Explores the theoretical frameworks in visual communication, including concepts of perception, visual language, visual persuasion, and the social, political and cultural implications of the use of images. Understanding the function of images in changing knowledge, attitudes and behavior.

JL MC 547: Science Communication
(Dual-listed with JL MC 347). (2-2) Cr. 3.
Prereq: Graduate classification. Nonmajors and minors by permission of instructor.
Reporting and writing about science and technology topics for general audiences. Outlets for stories include print, broadcast and online media. Story topics include reporting about basic, applied and social sciences, as well as ethical, political and policy issues related to science and technology.

JL MC 560: Risk Perception and Communication
(3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Study of risk communication principles, models and theories applicable to any risk communication situation. Emphasis on science, technology and risk issues, such as food, health, agriculture and the environment. Examines roles of scientists and communicators in cultivating a public informed about scientific and technological issues.

JL MC 561: Media and Society: Interrelationships
(3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Media roles and functions in society including interrelationships between the media and a variety of social actors and forces. Theories and practices regarding social networking and communication via social media; influence of social media and social networking.

JL MC 574: Communication Technologies and Social Change
(3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Personal, organizational, and social implications of the use of communication technologies. Includes theories and empirical research across the continuum of perspectives, from techno-utopianism through an anti-technology stance.
Meets International Perspectives Requirement.

JL MC 576: World Communication Systems
(Dual-listed with JL MC 476). (3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
World communication systems and social, political, and economic factors determining flow, character, and volume of news. Impact of media information, advertising and public relations on nations and societies. Comparative analysis of role and impact of traditional modes of communication, the mass media and computer-mediated systems.
Meets International Perspectives Requirement.

JL MC 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor

JL MC 590A: Special Topics: Media Studies
Cr. arr. Repeatable.
Prereq: Permission of instructor

JL MC 590B: Special Topics: Professional Specialization
Cr. arr. Repeatable.
Prereq: Permission of instructor

JL MC 590C: Special Topics: Research Problems and Methods
Cr. arr. Repeatable.
Prereq: Permission of instructor

JL MC 590D: Special Topics: Technique and Style
Cr. arr. Repeatable.
Prereq: Permission of instructor

JL MC 590E: Special Topics: Specialized Communication
Cr. arr. Repeatable.
Prereq: Permission of instructor

JL MC 591: Professional Internship
Cr. 1-2. F.S.SS.
Prereq: Permission of instructor
Supervised internship experience. Offered on a satisfactory-fail basis only.

JL MC 592: Introduction to Graduate Study in Journalism and Mass Communication
(1-0) Cr. 1.
Prereq: Graduate classification in JL MC.
Overview of advanced study in journalism and mass communication with special emphasis on requirements for obtaining the master of science degree.

JL MC 598: Seminars in Mass Communication
Cr. 1-3. Repeatable, maximum of 3 credits.
Prereq: graduate classification or instructor permission.
Seminar in Mass Communication.

JL MC 598A: Seminars in Mass Communication: Audiences and Effects
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598B: Seminars in Mass Communication: Communication Technology
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598C: Seminars in Mass Communication: Professional Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598D: Seminars in Mass Communication: Development Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598E: Seminars in Mass Communication: Evaluation Methods
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598F: Seminars in Mass Communication: International Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598G: Seminars in Mass Communication: Mass Communication History
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598H: Seminars in Mass Communication: Mass Communication Law
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598I: Seminars in Mass Communication: Media Management
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598J: Seminars in Mass Communication: Research Methods
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598K: Seminars in Mass Communication: Society and Mass Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598L: Seminars in Mass Communication: Journalism and Mass Communication Education
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598M: Seminars in Mass Communication: Visual Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598N: Seminars in Mass Communication: Broadcast Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598O: Seminars in Mass Communication: Communication Theory
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598P: Seminars in Mass Communication: Computer Mediated Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598Q: Seminars in Mass Communication: Science, Technology and Risk Communication.
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 599: Creative Component
Cr. arr. Repeatable.
Prereq: Approved creative component proposal

Courses for graduate students:

JL MC 699: Thesis Research
Cr. arr. Repeatable.
Prereq: Approved thesis proposal

Kinesiology (KIN)

Courses primarily for undergraduates:

KIN 101: Swimming I
(0-3) Cr. 1. F.S.SS.
Basic course for nonswimmers. Emphasis on two fundamental strokes and personal water safety skills. Offered on a satisfactory-fail basis only.

KIN 102: Swimming II
(0-3) Cr. 1. F.S.
Prereq: KIN 101 or equivalent skill
Intermediate course. Emphasis on learning and improving five basic strokes and personal water safety skills. Offered on a satisfactory-fail basis only.

KIN 108: Aquatic Fitness
(0-3) Cr. 1. F.S.
Prereq: KIN 102 or equivalent skill
Water related exercises, activities, and swimming workouts to improve physical fitness. Offered on a satisfactory-fail basis only.

KIN 122: Badminton
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental badminton skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 129: Bowling
(0-2) Cr. 1. F.S.SS.
Introduction to bowling skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 135: Golf
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental golf skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 144: Racquetball
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental racquetball skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 153: Ice Skating
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental ice skating skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 158: Tennis
(0-2) Cr. 1. F.S.SS.
Introduction to basic skills (forehand, backhand, service) and basic knowledge of game play. Offered on a satisfactory-fail basis only.

KIN 163: Physical Fitness
(0-3) Cr. 1. F.S.SS.
Evaluation of fitness status. Exercises, activities, and programs to improve physical fitness. Improve physical fitness and weight control. Offered on a satisfactory-fail basis only. Credit for only KIN 163 or 258 may be applied toward graduation.

KIN 164: Walking for Fitness
(0-3) Cr. 1. F.S.SS.
Fitness walking as an activity to improve health and fitness; values of this type of activity as a lifetime endeavor with knowledge and usage of pedometers. Offered on a satisfactory-fail basis only.

KIN 165: Running for Fitness
(0-2) Cr. 1. F.S.SS.
Running as a physical activity to improve physical fitness and health. Promotion of this activity as a lifetime endeavor. Offered on a satisfactory-fail basis only.

KIN 166: Weight Training
(0-3) Cr. 1. F.S.SS.
Introduction to fundamental skills of weight training and strategic game play. Offered on a satisfactory-fail basis only.

KIN 168: Judo
(0-2) Cr. 1. F.S.
Fundamentals of self defense, focusing on throwing with the hands, hips and feet as well as applying pins, chokes and arm-bars. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self control, & indomitable spirit. Emphasis on learning a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only.

KIN 170: Tae Kwon Do/Karate I
(0-2) Cr. 1. F.S.
Teaches fundamentals of self-defense, focusing on hand and foot striking and blocking techniques. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only.

KIN 171: Tae Kwon Do/Karate II
(0-2) Cr. 1. F.S.
Teaches advanced application of self-defense focusing on hand and foot striking and blocking techniques. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only.

KIN 173: Hap Ki Do/Martial Self-Defense
(0-2) Cr. 1. F.S.
Teaches fundamentals of self-defense focusing on joint locks, pressure points and throwing techniques to escape from an attacker. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health & citizenship. Offered on a satisfactory-fail basis only.

KIN 182: Volleyball
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental volleyball skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 185: Soccer
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental soccer skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 210: Concepts of Fitness and Wellness
(2-0) Cr. 2. F.S.
Coverage of behavioral skills needed to adopt and maintain lifestyles conducive to fitness and wellness. Provides students with knowledge and skills needed to adopt and maintain healthy lifestyles. Includes self-assessments and content on physical activity, nutrition, weight control, stress management and other lifestyle behaviors related to health. For non-kinesiology majors.

KIN 231: Fundamentals of Tumbling and Gymnastics
(0-3) Cr. 1. F.
Prereq: Eligibility for admission to KIN teacher education program
Fundamentals of tumbling and gymnastics apparatus. Skill enhancement, analysis, understanding practice and the development of progressions.

KIN 232: Fundamentals of Team Sports
(0-3) Cr. 1. F.
Prereq: Eligibility for admission to KIN teacher education program
Fundamentals of indoor and outdoor team sports, for example basketball, volleyball, flag football, and soccer. Skill enhancement, analysis, understanding practice and the development of progressions.

KIN 236: Fundamentals of Individual Sports and Fitness
(0-3) Cr. 1. S.
Prereq: Eligibility for admission to KIN teacher education program
Fundamentals of individual sports and fitness, for example disc golf, bowling, badminton, and weight training. Skill enhancement, analysis, understanding practice and the development of progressions.

KIN 252: Disciplines and Professions in Kinesiology and Health
(1-0) Cr. 1. F.S.
Overview of the various disciplines and professions that comprise the field of Kinesiology (the study of human movement) and help students determine the career option that best fits their interests.

KIN 253: Orientation and Learning Community in Kinesiology and Health
(1-0) Cr. 1. F.S.
Prereq: Concurrent enrollment or credit in KIN 252
Overview of ISU policies and procedures, academic advising operations, degree requirements, program of study planning, and campus resources. Students will have out-of-class activities and work with faculty, staff and mentors to explore careers in Kinesiology and complete assignments related to identification & development of their skills and interests. Department of Kinesiology students only. Offered on a satisfactory-fail basis only.

KIN 258: Physical Fitness and Conditioning
(1-3) Cr. 2. F.S.
Prereq: Kinesiology and health majors only
Introduction to five components of fitness: cardiorespiratory, muscular strength, muscular endurance, flexibility, and body composition. Students will be introduced to basic exercise prescription and evaluation principles, develop skills to assess each component of fitness, and learn different exercise modalities to enhance each component. Credit for only one of the following courses may be applied toward graduation: KIN 163, 258.

KIN 259: Leadership Techniques for Fitness Programs
(1-3) Cr. 2. F.S.
Prereq: KIN 258
Development of exercise leadership skills for a variety of activities. Includes planning, promotion, and teaching techniques for developing fitness in others using a variety of exercise modalities including group fitness and weight training. Kinesiology and health majors only.

KIN 266: Advanced Strength Training and Conditioning
(1-2) Cr. 2. F.S.
Prereq: KIN 258
This course is designed to enhance the student's current level of knowledge and expertise to an advanced level in the area of strength training and conditioning. The course will prepare students interested in taking the National Strength and Conditioning Association Certified and Conditioning Specialist's exam. The course will focus on the assessment and implementation of training programs with strong emphasis on the areas of resistance training, metabolic training, flexibility, reaction time, speed, and agility. Kinesiology and health majors only and permission of instructor needed.

KIN 280: Directed Field Experience in Elementary Physical Education
(0-3) Cr. 1. F.S.
Observing, planning, and facilitating movement experiences of children in an elementary school setting. Offered on a satisfactory-fail basis only.

KIN 281: Directed Field Experience in Secondary Physical Education
(0-3) Cr. 1. F.S.
Prereq: Admission to Educator Preparation Program
Observing, planning, and facilitating movement experiences of students in a middle and/or high school setting. Offered on a satisfactory-fail basis only.

KIN 282: Field Experience with Educational Outreach
(0-2) Cr. 1. F.S.
Prereq: Admission to Educator Preparation Program
Planning and facilitating physical education experiences for children in a community outreach setting. Experiences take place on campus. Offered on a satisfactory-fail basis only.

KIN 284: Elementary and Pre-school Movement Education
(2-3) Cr. 3. F.S.SS.
Prereq: 3 credits in human development and family studies
Approaches to teaching movement skills, health-related fitness and school-based physical activities (in the classroom, in PE, during recess) to pre-school and elementary school age children are covered. Emphasis is placed on planning and conducting developmentally appropriate movement experiences for preschool and elementary aged children throughout the school day based upon educational psychology, exercise psychology and motor development research. Practical experience is provided. Credit in only one of the following courses may be applied toward graduation: KIN 284, 312.

KIN 285: Pre-Internship in Kinesiology and Health
(Cross-listed with H S). Cr. 1-2. F.S.SS.
Prereq: Kinesiology and Health major and permission of internship coordinator
Pre-internship experience with a health or fitness organization based on option. Offered on a satisfactory-fail basis only.

KIN 290: Independent Study
Cr. 1. Repeatable, maximum of 3 credits. F.
Study under supervision of faculty.

KIN 312: Movement Education in Elementary School Physical Education
(2-2) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280
Planning for management and instruction of developmentally appropriate physical education for children pre-school through grade six. Laboratory experience required. Credit for only one of KIN 284 or KIN 312 may be applied toward graduation.

KIN 313: Teaching Secondary Physical Education
(2-3) Cr. 3. S.
Prereq: Admission to Educator Preparation Program, KIN 281
Current theory, practice and research on teaching focusing on management, instructional, and learning styles of students in secondary schools.

KIN 315: Coaching Theory and Administrative Issues
(3-0) Cr. 3. F.S.SS.
Study in the theory, ethics, strategy, and mechanics of coaching various interscholastic and/or intercollegiate sports. Emphasis on formulating a philosophy, identifying goals and psychological aspects, teaching skills, and developing strategies.

KIN 345: Management of Health-Fitness Programs and Facilities
(3-0) Cr. 3. F.S.
Application of management concepts to the fitness industry, e.g., understanding customers, marketing, program management, financial management, legal issues, and evaluation and planning.

KIN 355: Biomechanics
(3-0) Cr. 3. F.S.SS.
Prereq: PHYS 111 or PHYS 115
Mechanical basis of human performance; application of mechanical principles to exercise, sport and other physical activities.

KIN 358: Physiology of Exercise
(3-0) Cr. 3. F.S.SS.
Prereq: BIOL 255, BIOL 255L, BIOL 256 and BIOL 256L
Physiological basis of human performance; effects of physical activity on body functions.

KIN 360: Sociology of Sport and Exercise
(3-0) Cr. 3. F.S.
Prereq: SOC 134 and one of STAT 101, STAT 104 or STAT 226/STAT 326, or KIN 471
Sport and exercise as social systems and as institutions related to other institutions such as the polity, the economy, mass media, and education.

KIN 363: Basic Electrocardiography
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Understanding of human electrocardiography, including normal and abnormal 12-lead ECGs and arrhythmia identification.

KIN 365: Sport Psychology
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101 or PSYCH 230
Psychological factors that influence performance in sport settings. The influence of personality, anxiety, motivation and social factors. Psychological skills training and strategic methods for improvement of athletic performance.

KIN 366: Exercise Psychology
(3-0) Cr. 3. F.S.SS.
Prereq: PSYCH 101 or PSYCH 230
Psychological theories for understanding and predicting health-oriented exercise behavior. Psychological and psychobiological responses to exercise. Psychological interventions for increasing exercise participation and adherence rates.

KIN 372: Motor Control and Learning Across the Lifespan
(3-0) Cr. 3. F.S.SS.
Prereq: PSYCH 101 or PSYCH 230, BIOL 255, BIOL 256
Introduction to major concepts of neuromotor control, behavioral motor control and motor learning in the child, adult and older adult, with emphasis on the adult system.

KIN 385: Strategies for Professional School and Field Experience Opportunities
(Cross-listed with H S). Cr. 0.5. F.S.
Prereq: Junior classification; to be taken minimum of two semesters prior to graduation or field experience placement.
Search techniques and preparation of relevant material for work and/or professional school admission. Information specifically related to health care and kinesiology fields. Field experience process and procedures will be reviewed.

KIN 391: Service Learning Leadership Experience
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Applied service learning experiences designed to provide students with opportunities to apply classroom knowledge to real world applications. Students will gain professional skills and programming experience while supporting health, education and wellness programming in school, work site or community settings. Offered on a satisfactory-fail basis only.

KIN 395: Adapted Physical Education
(Dual-listed with KIN 595). (2-3) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280/281
Etiology, characteristics, needs and movement experiences for individuals with disabling conditions. Designed to provide appropriate methods of physical education instruction for students including those with disabilities as identified by the Individuals with Disabilities Education Act and students who are talented and gifted. Assessments and strategies to differentiate instruction and to adapt activities for all exceptional learners will be addressed. Laboratory experience required. KIN 595 may not be taken by students who previously earned credit in KIN 395.

KIN 399: Recreational Sport Management
(3-0) Cr. 3. F.
Prereq: SOC 134
The role of sport in developing fitness, recreational opportunities, and tourism, with special emphasis on issues related to youth sport, volunteerism, and the marketing of sport events and facilities.

KIN 417: Supervised Teaching in Physical Education in the Secondary School
Cr. arr. F.S.
Prereq: KIN 281, KIN 282, KIN 313, KIN 355, KIN 395, KIN 471, KIN 475; admission to Teacher Education; approval before enrolling in the course.
Supervised teaching in the secondary schools.

KIN 418: Supervised Teaching in Physical Education in the Elementary School
Cr. 8. F.S.
Prereq: KIN 280, KIN 282, KIN 312, KIN 355, KIN 395, KIN 471, KIN 475. Students must be fully admitted to Teacher Education and must apply for approval to enroll at the beginning of the semester prior to registering
Supervised teaching in the elementary schools.

KIN 445: Legal Aspects of Sport
(3-0) Cr. 3. S.
Students will understand legal concepts and terminology relevant to sport/activity, identify strategies for limiting liability in sport/fitness programs, and identify solutions for elimination of discriminatory practices in sport and physical activity.

KIN 455: Research Topics in Biomechanics
(3-0) Cr. 3.
Prereq: KIN 355 or permission of instructor
Examination of biomechanics and kinesiology research literature to evaluate the application of mechanical principles and analyses to human movement in exercise, sport, physical activity, and activities of daily living and to assess research outcomes and their implications for motor performance, movement energetic, musculoskeletal loading, and injury.

KIN 458: Principles of Fitness Assessment and Exercise Prescription
(3-2) Cr. 4. F.S.
Prereq: KIN 258, KIN 358
Principles of cardiac risk factor identification and modification; risk classification of potential exercise clients; fitness assessments; developing comprehensive exercise prescriptions for individuals.

KIN 459: Internship in Exercise Leadership
(0-3) Cr. 1. F.S.
Prereq: C- or better in KIN 259, CPR certification, concurrent enrollment in KIN 458
Observation and practice of exercise leadership techniques in an on-campus adult fitness program.

KIN 462: Medical Aspects of Exercise
(3-0) Cr. 3. F.S.
Prereq: KIN 358
The role of exercise in preventive medicine. Impact of exercise on various diseases, and the effect of various medical conditions on the ability to participate in vigorous exercise and competitive sports. Principles of exercise testing and prescription for individuals with these conditions. Environmental and nutritional aspects of exercise.

KIN 467: Exercise and Health: Behavior Change
(Dual-listed with KIN 567). (3-0) Cr. 3. S.
Prereq: Introductory course with emphasis on exercise psychology (i.e., KIN 366 or equivalent)
Advanced analysis of theoretical health behavior models and their application to physical activity behavior. Includes practical techniques, tools and interventions (e.g., counseling skills, motivational interviewing) to enhance exercise prescription and motivation, and considerations for working with special populations.

KIN 471: Measurement in Physical Education
(Dual-listed with KIN 571). (2-3) Cr. 3. S.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practice and research on teaching focusing on management, instructional, and learning styles of students in secondary schools.

KIN 472: Neural Basis of Human Movement
(Dual-listed with KIN 572). (3-0) Cr. 3. S.
Prereq: KIN 372 or PSYCH 310
Addresses the role of the central nervous system in the control of voluntary human movement, with the focus on the cerebral cortex, basal ganglia and cerebellum. Content organized around specific nervous system damage (such as stroke, apraxia, spasticity, or spinal cord damage) and functional movements (such as reaching and grasping, balance and gait). Converging evidence from human movement disorders, brain imaging, animal lesion and single cell studies provide the primary basis for the content.

KIN 473: Physical Dimensions of Aging
Cr. 3. F.
Prereq: KIN 355 or KIN 358 or KIN 372
Understanding the physiological, behavioral, and cognitive changes associated with aging with focus on the effects of physical activity on the aging human system. Discussions of what it means to become older, what a person can expect during the aging process, and what kind of control a person has over the aging process.

KIN 475: Physical Education Curriculum Design and Program Organization
(Dual-listed with KIN 575). (3-0) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practices and principles applied to curriculum development for programs in physical education, K-12. Organizing for teaching in a variety of school settings.

KIN 480: Functional Anatomy
(3-0) Cr. 3. F.S.
Prereq: KIN 355; BIOL 155 or BIOL 255 and BIOL 256
The structure and function of human muscular, skeletal and nervous systems. The relationship of these systems to efficient and safe human motion.

KIN 481: Biomechanics Lab
(0-2) Cr. 1.
Prereq: KIN 355
Learning lab techniques in Biomechanics and engaging in the experimental process.

KIN 482: Exercise Physiology Lab
(0-2) Cr. 1.
Prereq: KIN 358
Learning lab techniques in Exercise Physiology and engaging in the experimental process.

KIN 483: Exercise Psychology Lab
(0-2) Cr. 1.
Prereq: KIN 366
Learning lab techniques in Exercise Psychology and engaging in the experimental process.

KIN 484: Assessment and Control of Locomotion
(0-2) Cr. 1.
Prereq: KIN 372
Learning lab techniques in Motor Control and engaging in the experimental process.

KIN 485: Internship in Exercise Science
Cr. 1-16.
Prereq: Senior classification and advance registration
Observation and practice in fitness agencies. Offered on a satisfactory-fail basis only.

KIN 485A: Internship in Exercise Science: Health/Fitness Management.
Cr. 1-16.
Prereq: Prereq: C- or better in KIN 458, KIN 459 and KIN 462, Kinesiology and Health majors only. Cumulative GPA 2.0.
Observation and practice in selected exercise science agencies. Offered on a satisfactory-fail basis only.

KIN 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits from KIN advanced core and permission of coordinator
Independent study of problems of areas of interest in exercise and sport science and related areas.

KIN 490A: Independent Study: Exercise and Sport Science
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits from KIN advanced core and permission of coordinator
Independent study of problems of areas of interest in exercise and sport science and related areas.

KIN 490H: Independent Study: Honors
Cr. 1-2. Repeatable, maximum of 4 credits.
Prereq: 6 credits from KIN advanced core and permission of coordinator
Independent study of problems of areas of interest in exercise and sport science and related areas.

KIN 495: Special Topics in Kinesiology
Cr. 1-3.
Prereq: Junior or Senior classification
Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

KIN 501: Research Methods in Physical Activity
(3-0) Cr. 3. Repeatable.
Prereq: Graduate classification in kinesiology and health
Methods and techniques used in the design and interpretation of research involving physical activity. Emphasis on styles of writing, library use, and computer applications.

KIN 505: Research Laboratory Techniques in Exercise Physiology
(0-4) Cr. 2.
Prereq: KIN 358 or equivalent course with basic laboratory experience
Application and use of laboratory research equipment in exercise physiology, including operation, calibration, and use in selected situations.

KIN 510: Advanced Medical Aspects of Exercise
(2-0) Cr. 2.
Prereq: KIN 358
The role of exercise in preventive medicine. Impact of exercise on various diseases, and the effect of various medical conditions on the ability to participate in vigorous exercise and competitive sports. Principles of exercise testing and prescription for individuals with these conditions.

KIN 512: Movement Education in Elementary School Physical Education
(2-2) Cr. 3. F.
Planning for management and instruction of developmentally appropriate physical education for children pre-school through grade six. Laboratory experience required. Emphasis on evaluating published research on physical education and school-wide physical activity.

KIN 515: Injury Biomechanics
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Kin 355 or permission of instructor.
Utilization of biomechanical principles to model injury mechanisms. Introduction to tissue mechanics of bone, articular cartilage, ligament, tendon, and muscle. Biomechanics of lower extremity, upper extremity, and head/neck/trunk injuries.

KIN 516: Quantitative Analysis of Human Movement
(3-1) Cr. 3.
Prereq: KIN 355
Application of the principles of mechanics to the analysis of human motion. Investigation of the effects of kinematics and kinetics on the human body with special emphasis on exercise and sport applications. Includes consideration of two-dimensional and three-dimensional imaging techniques and force measurements.

KIN 517: Musculoskeletal Modeling
(3-1) Cr. 3. F.
Prereq: KIN 355 or permission from instructor
Systematic problem-solving approaches and design of computer programs for biomechanical analyses. Estimation of anthropometric parameters and mechanical properties of muscles, bones, and joints. Integration of anthropometrics, kinematics, and muscle mechanics into simulations of human movement.

KIN 518: Student Teaching in Elementary Physical Education
(0-8) Cr. 8. F.S.
Prereq: KIN 512, KIN 570, KIN 575
Student teaching for 8 weeks in an elementary school.

KIN 519: Student Teaching in Secondary Physical Education
(0-8) Cr. 8. F.S.
Prereq: KIN 512, KIN 570, KIN 575
Student teaching for 8 weeks in a middle or high school.

KIN 520: The Social Analysis of Sport
(3-0) Cr. 3.
Prereq: KIN 360; open to majors only or by permission of instructor
Sociological analysis of sport with emphasis on sociological theory, sports structure, and function in modern industrialized society; the systems of sport in regard to their role structure; formal organization, and professionalization and its differentiation along social class, age, and sex.

KIN 521: Advanced Topics in Exercise and Sport Psychology
(3-0) Cr. 3.
Prereq: KIN 365 or KIN 366, 3 courses in psychology; open to majors only or by permission of instructor
Aspects of psychology which form a basis for understanding and explaining behavior in the context of exercise and sport. Emphasis on evaluating published research, particularly theory and research methodology. Student presentations.

KIN 549: Advanced Vertebrate Physiology I
(Cross-listed with AN S, NUTRS). (4-0) Cr. 4. F.
Prereq: Biol 335; credit or enrollment in BBMB 404 or BBMB 420
Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems.

KIN 550: Advanced Physiology of Exercise I
(2-3) Cr. 3.
Prereq: KIN 505
Concepts and methods of assessing neurological, muscular, cardiovascular, and respiratory adjustments to exercise.

KIN 551: Advanced Physiology of Exercise II
(2-3) Cr. 3.
Prereq: KIN 505
Analysis of factors affecting work capacity and performance. Human energy metabolism concepts and measurement.

KIN 552: Advanced Vertebrate Physiology II
(Cross-listed with AN S, NUTRS). (3-0) Cr. 3. S.
Prereq: BIOL 335; credit or enrollment in BBMB 404 or BBMB 420
Cardiovascular, renal, respiratory, and digestive physiology.

KIN 558: Physical Fitness - Principles, Programs and Evaluation
(2-3) Cr. 3.
Prereq: KIN 358
Physiological principles of physical fitness, design and administration of fitness programs; testing, evaluation, and prescription; electrocardiogram interpretation.

KIN 560: Principles of Motor Control and Learning
(2-3) Cr. 3.
Prereq: KIN 372
Theoretical perspectives of motor control and learning will be examined as well as factors that facilitate motor learning. Motor control and learning will also be addressed by studying functional tasks such as reach and grasp, posture and locomotor, handwriting, catching and/or speech.

KIN 561: Motor Development and Physical Activity
(2-0) Cr. 2-3.
Prereq: PSYCH 230
Addresses theories and underlying mechanisms of motor development and motor control applied to typically and atypically developing children. Developmental control of balance, locomotion, reach-to-grasp, and other functional skills will be discussed, as will the role of physical activity in a child's life.

KIN 567: Exercise and Health: Behavior Change
(Dual-listed with KIN 467). (3-0) Cr. 3. S.
Prereq: Introductory course with emphasis on exercise psychology (i.e., KIN 366 or equivalent)
Advanced analysis of theoretical health behavior models and their application to physical activity behavior. Includes practical techniques, tools and interventions (e.g., counseling skills, motivational interviewing) to enhance exercise prescription and motivation, and considerations for working with special populations.

KIN 570: Physical Activity Assessment for Health Related Research
(2-2) Cr. 3.
This course will cover the broad scope of research in physical activity and public health. Emphasis will be placed on the application of physical activity assessment techniques since accurate measures are needed to more accurately assess the health benefits from physical activity and to evaluate the effectiveness of behavioral interventions designed to promote physical activity.

KIN 571: Measurement in Physical Education
(Dual-listed with KIN 471). (2-3) Cr. 3. S.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practice and research on teaching focusing on management, instructional, and learning styles of students in secondary schools.

KIN 572: Neural Basis of Human Movement
(Dual-listed with KIN 472). (3-0) Cr. 3. S.
Prereq: KIN 372 or PSYCH 310
Addresses the role of the central nervous system in the control of voluntary human movement, with the focus on the cerebral cortex, basal ganglia and cerebellum. Content organized around specific nervous system damage (such as stroke, apraxia, spasticity, or spinal cord damage) and functional movements (such as reaching and grasping, balance and gait). Converging evidence from human movement disorders, brain imaging, animal lesion and single cell studies provide the primary basis for the content.

KIN 575: Physical Education Curriculum Design and Program Organization
(Dual-listed with KIN 475). (3-0) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practices and principles applied to curriculum development for programs in physical education, K-12. Organizing for teaching in a variety of school settings.

KIN 590: Special Topics
Cr. 1-3. Repeatable.

KIN 590A: Special Topics: Physical Education
Cr. 1-3. Repeatable.

KIN 590B: Special Topics: Health and Exercise Promotion
Cr. 1-3. Repeatable.

KIN 590D: Special Topics: Exercise Physiology
Cr. 1-3. Repeatable.

KIN 590E: Special Topics: Sport Sociology
Cr. 1-3. Repeatable.

KIN 590F: Special Topics: Sport/Exercise Psychology
Cr. 1-3. Repeatable.

KIN 590G: Special Topics: Motor Behavior
Cr. 1-3. Repeatable.

KIN 590H: Special Topics: Biomechanics
Cr. 1-3. Repeatable.

KIN 590I: Special Topics: Research Ethics
Cr. 1-3. Repeatable.

KIN 591: Supervised Field Experience
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 591A: Supervised Field Experience: Physical Education
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 591B: Supervised Field Experience: Health and Exercise Promotion
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 591D: Supervised Field Experience: Exercise Physiology
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 592: Practicum in College Teaching
Cr. 1-3. Repeatable, maximum of 3 credits. F.S.SS.
Supervised experience with teaching an upper division, classroom-based course. Offered on a satisfactory-fail basis only.

KIN 595: Adapted Physical Education
(Dual-listed with KIN 395). (2-3) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280/281
Etiology, characteristics, needs and movement experiences for individuals with disabling conditions. Designed to provide appropriate methods of physical education instruction for students including those with disabilities as identified by the Individuals with Disabilities Education Act and students who are talented and gifted. Assessments and strategies to differentiate instruction and to adapt activities for all exceptional learners will be addressed. Laboratory experience required. KIN 595 may not be taken by students who previously earned credit in KIN 395.

KIN 599: Creative Component
Cr. 1-3. Repeatable.

Courses for graduate students:

KIN 615: Seminar
Cr. 1-3. Repeatable.

KIN 620: Advance Research Methods in Physical Activity
(3-0) Cr. 3. S.
Prereq: KIN 501, STAT 401 and STAT 402. Doctoral students only
Culminating seminar designed to synthesize statistical and design courses with practical research issues using data from physical activity.

KIN 670: Molecular Biology of Muscle
(Cross-listed with AN S). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BBMB 405, BBMB 420, or BBMB 502
Ultrastructure of muscle; chemistry, structure, function, and molecular biology of muscle proteins. Molecular aspects of muscle contraction, development and turnover. Cytoskeletal proteins and dynamics.

KIN 699: Research
Cr. 1-6. Repeatable.

Landscape Architecture (L A)

Courses primarily for undergraduates:

L A 201: Studio: Landscape Interpretation and Representation
(1-15) Cr. 6. F.
Prereq: Enrollment in the professional program
Reading and representing varied landscapes; development of aesthetic sensitivity to the geomorphology, vegetation, and cultural influences on these landscapes. Small-scale interventions and exploration of landscape phenomena and change. Emphasis on a variety of documentation and drawing techniques.

L A 202: Studio: Site Design I
(1-15) Cr. 6. S.
Prereq: L A 201
Fundamental issues of landscape planning and design at a site scale. Projects introduce a variety of (objective and subjective) site inquiry methods, space and place making, and sensitive integration of architecture and landscape for specific land uses. User needs, precedent study, programming, site engineering, planting design, and outdoor space design expressed through a variety of three-dimensional modeling, graphic, and written media.

L A 211: Digital Design Methods for Landscape Architecture
(3-0) Cr. 3. S.
Introduction of computer applications and standards used by landscape architects and other design professions and their place in a replicable work flow. Foundational knowledge and basic skills in a range of industry-standard 2D, 3D, and 4D computer applications used for design development and communication.

L A 221: Native Plants of the Savanna Ecotone
(2-3) Cr. 3. F.
Prereq: Enrollment in the professional program
Observation and study of the wetland, prairie, and woodland vegetation native to the savanna ecotone. Emphasis on plant communities, their distribution, structure, habitat and aesthetics. Plant identification and use in landscape design. Precedent and case studies of vegetation preservation, restoration and use in built works.

L A 222: Introduced Plants of the Midwest
(2-3) Cr. 3. S.
Prereq: L A 221
Identification, observation, and study of plants introduced to cultivation in the Midwest region. Plant cultural requirements, including adaptations to climate changes, solar exposure, and soil conditions. Investigation of history of plant introduction and use in designed landscape, including consequent impacts of plant introduction such as plant invasion. Introduction to planting design at the site scale, including matching plant cultural requirements to site conditions, functional uses of plants and expressive composition using plant form, texture and color.

L A 241: Developing Identity as a Landscape Architect
(1-0) Cr. 1. F.
Prereq: Enrollment in the professional program
Development of life skills for conflict resolution, effective interpersonal communication, and CPR/First Aid. Examination of personal values as they relate to the backgrounds, abilities, attitudes, and values of others; exploration of how these influence personal decision-making and group interaction. Reading, discussion, class activities, journal-keeping, writing. Offered on a satisfactory-fail basis only.

L A 270: Foundations in Natural Resource Policy and History
(Cross-listed with ENV S, NREM). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
The development of natural resource conservation philosophy and policy from the Colonial Era to the present. North American wildlife, forestry, and environmental policy; national parks and other protected lands; federal and state agencies. Relationship to cultural contexts, including urban reform and American planning movement. Discussion of common pool resources, public and private lands.

L A 272: Cultural Landscape Studies
(3-0) Cr. 3. F.
Prereq: Enrollment in the professional program
Exploration of cultural landscapes, from broad settlement patterns to individual sites, with an emphasis on the origins and evolution of landscapes. Investigation of relationships between vernacular and designed landscapes. Landscapes considered as modes of cultural production that shape and are shaped by social, political, and economic processes. Exploration of landscapes as persistent (yet ephemeral) repositories of culture. Lectures, reading, field studies, and writing.
Meets U.S. Diversity Requirement

L A 274: The Social and Behavioral Landscape
(3-0) Cr. 3. S.
Exploration of social and behavioral factors pertinent to design of the domestic, civic, and commercial landscape. Focus on working familiarity with design principles as they relate to the behavior and activities of people across a broad demographic and cultural spectrum; application of these principles to design of outdoor environments. Lectures and discussions, including group exercises and field trips.
Meets U.S. Diversity Requirement

L A 281: Investigating Landscape Form, Process, and Detail
(1-6) Cr. 3. F.
Prereq: Enrollment in professional program
Exploration of the poetics and principles of landscape construction. Investigation and interpretation of landform and geomorphic processes such as the hydrologic cycle, erosion, and sedimentation. Close observation and representation of detail design, with an emphasis on material types, their connections, and weathering. Readings, field studies, and drawings in analog and digital media.

L A 282: Landscape Dynamics
(2-2) Cr. 3. S.
Prereq: Sophomore standing
Understand design implications presented by geotechnical and ecological processes in the landscape including ecology, vegetation, soils and water. Understand the influence of landforms, geology, plants, soils, and water on the creation of landscape designs. Course relates current issues including water quality impairment, erosion, and invasive species with design strategies such as stormwater management, soil quality management, and plant community restoration. Field trips.

L A 301: Site Design II
(1-15) Cr. 6. F.
Prereq: L A 202
Development of half-acre to hundred-acre landscape design and planning proposals, potentially in collaboration with students in other programs. Apply critical methodological frameworks to shape site systems while providing appropriate support for diverse user groups and creating culturally meaningful places. Assess and interpret a program of use, organize subjective and objective site inventory and analysis, develop functional and poetic design strategies for infrastructure and natural systems, and craft artistic and functionally explicit landscape architectural proposals. Development of appropriate technique and high level of craft in representations to support design thinking process and final scheme presentation.

L A 302: Ecological Design at the Regional Scale
(1-15) Cr. 6. S.
Prereq: L A 282, L A 301, L A 381 and NREM 120
Application of ecological theories and processes in design and planning at the hundred plus-acre scale specifically focusing on urban and urban fringe landscapes. Apply advanced landscape analysis of soil, water, and vegetation utilizing geographic information systems. Particular focus on stream and wetland restoration, mitigation, and regulations and developing design representations for public use.

L A 309: Field Travel
Cr. 1. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Enrollment in the professional program and permission of instructor
Observation of and reflection on professional practice and landscapes in urban, rural, and wilderness areas. Offered on a satisfactory-fail basis only.

L A 322: Fundamentals of Planting Design
(2-3) Cr. 3.
Prereq: L A 221
The art and techniques of creating plant compositions in the landscape that respond to cultural and biophysical contexts. Investigation of soil properties and plant/soil relationships relevant to the built environment. Methods of site inventory and analysis, developing plant palettes and composing plant assemblages that address expressive and functional needs. Introduction to the techniques of preparing planting plans, including standards for plant selection, plant lists and plant specification.

L A 341: Contemporary Landscape Architecture
(1-0) Cr. 1. S.
Prereq: L A 301
Exploration of contemporary landscape architectural practice through individualized research into practicing firms. Preparation of paper and presentation outlining broad framework and specific parameters of a selected area of contemporary practice using specific projects as examples. Work may result in invitation of current practitioner(s) as a lecture series or event. Resume and portfolio preparation in advance of required off-campus semester (L A 444 A, B or C).

L A 371: History of Modern Landscapes, 1750 to Present
(3-0) Cr. 3. S.
Investigation of landscape design concepts and trends as observed over time, from approximately 1750 to the present, with emphasis on the United States and Europe. Examination of significant figures and outstanding works (sites, gardens, landscapes, monuments, subdivisions, city plans, etc.) of varied geographic regions. Analysis of the social, economic, political, and technical forces contributing to the development of landscape design styles, vocabulary, and literature. Lectures, readings, projects, research papers.

L A 373: Gardens and Landscapes from Antiquity to 1750
(3-0) Cr. 3. F.
Investigation of international landscape design concepts and trends as observed over time, from pre-history to the mid 18th century. Examination of significant figures and outstanding works (sites, gardens, landscapes, monuments, subdivisions, city plans, etc.) of varied geographic regions. Analysis of the social, economic, political, and technical forces contributing to the development of landscape design styles, vocabulary, and literature. Lectures, readings, projects, research papers.
Meets International Perspectives Requirement.

L A 381: Shaping the Land
(3-0) Cr. 3. F.
Prereq: L A 282 and MATH 143 or MATH 145
Design of landforms to achieve aesthetic, functional, and safety goals. Landform changes to accommodate human uses and activities. Impacts and implications of landform transformation on the surrounding environment. Surface and subsurface drainage design, storm water runoff best management practices, contour manipulation to incorporate slopes, swales, culverts, pads, retaining walls, walks, steps, terraces, buildings, and other structures in the landscape. Road layout and alignment, parking lot design, and earthwork volume estimates. Design communication using CAD, perspectives, cross-sections, contour maps, landform models, and narratives. Class exercises, case study precedents, and preliminary construction documents.

L A 401: Community Design
(1-15) Cr. 6. F.
Prereq: L A 402
Physical planning and design of places utilizing community-based methods. Projects address social and cultural dimensions of placemaking such as reuse of abandoned sites, in-fill development, and community visioning. Emphasis on development of user-client relationship skills and design research. Integrated seminar component.

L A 401H: Community Design: Honors
(1-15) Cr. 7. F.
Prereq: L A 402
Physical planning and design of places utilizing community-based methods. Projects address social and cultural dimensions of placemaking such as reuse of abandoned sites, in-fill development, and community visioning. Emphasis on development of user-client relationship skills and design research. Integrated seminar component.

L A 402: Urban Design
(1-15) Cr. 6. F.
Prereq: L A 302
Comprehensive planning and design for urban sites or for sites within urban contexts. Projects typically include planning for a variety of integrated land uses, and cover the full range of design scales from master planning to proposals for site details. Emphasis on written and verbal as well as graphic communications. Integrated seminar component.

L A 402H: Urban Design: Honors
(1-15) Cr. 7. F.
Prereq: L A 302
Comprehensive planning and design for urban sites or for sites within urban contexts. Projects typically include planning for a variety of integrated land uses, and cover the full range of design scales from master planning to proposals for site details. Emphasis on written and verbal as well as graphic communications. Integrated seminar component.

L A 403H: Senior Thesis Preparation Tutorial
Cr. 2. F.
Prereq: L A 402, permission of thesis advisor, enrollment in Honors program
Preparation for senior thesis.

L A 404: Advanced Landscape Architectural Design
(1-15) Cr. 6. Repeatable, maximum of 2 times. S.
Prereq: L A 401
Advanced forum for the demonstration of sophistication in landscape architectural design. Experimentation and innovation are encouraged.

L A 404H: Advanced Landscape Architectural Design: Honors
(1-15) Cr. 6-7. Repeatable, maximum of 2 times. S.
Prereq: L A 401
Advanced forum for the demonstration of sophistication in landscape architectural design. Experimentation and innovation are encouraged.

L A 405H: Senior Thesis
(0-15) Cr. 6. S.
Prereq: L A 401, L A 402, L A 403, enrollment in Honors program and permission of adviser, chair and thesis adviser
Individual advanced forum for the demonstration of sophistication in landscape architectural design. Experimentation and innovation are expected.

L A 417: Urban and Peri-urban Watershed Assessment
(Dual-listed with L A 517). (Cross-listed with ENV S). (2-3) Cr. 3. F.
Prereq: Junior classification and 6 credits of natural science
Assessment and reduction of impacts in urban and peri-urban watershed areas. Course prepares students to work with various analysis methods for vegetation, topography, stormwater and stream condition as well as work with data from other disciplines. Emphasis on communicating with the public. Introductory GIS and GPS technologies are utilized. Learning is largely field-based.

L A 442: Professional Practice
(Dual-listed with L A 542). (2-0) Cr. 2. S.
Prereq: L A 481
Studies of conventional and developing forms of public and private practice. Explore relationships between professional life and the culture of the professional design firm; investigate firm identities and structures; understand design projects, their delivery process, and contractual agreements. Lecture and class discussion.

L A 444: Landscape Architecture Independent Educational Enrichment
Cr. R. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 341 or permission of adviser and chair
Independent educational enrichment through exploration of landscape architectural practice in a professional internship, international studies, or out-of-region national study experience.

L A 444A: Landscape Architecture Independent Educational Enrichment: Professional Internship
Cr. R. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 341 or permission of adviser and chair
Independent educational enrichment through exploration of landscape architectural practice in a professional internship, international studies, or out-of-region national study experience.

L A 444B: Landscape Architecture Independent Educational Enrichment: Study Abroad
Cr. R. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 341 or permission of adviser and chair
Independent educational enrichment through exploration of landscape architectural practice in a professional internship, international studies, or out-of-region national study experience.

L A 444C: Landscape Architecture Independent Educational Enrichment: National Student Exchange
Cr. R. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 341 or permission of adviser and chair
Independent educational enrichment through exploration of landscape architectural practice in a professional internship, international studies, or out-of-region national study experience.

L A 454: Fundamentals of Remote Sensing
(Dual-listed with L A 554). (Cross-listed with C R P). (3-0) Cr. 3. F.
Introduction to remote sensing techniques needed for basic analysis of satellite images, including: filtering and conflation techniques, stacking, pan sharpening, image rectification, image enhancement, unsupervised and supervised classification. Practical applications in a variety of topics to understand how to interpret images.

L A 457: Landscape Parametrics & Design Computing
(Dual-listed with L A 557). (3-0) Cr. 3. F.
Prereq: Junior classification
Exploration of computational representation of the landscape palette. Geometric parameters for terrain, vegetation, water, weather and lighting effects are modeled and developed algorithmically. Basic computer programming logic and computer graphics interactivity are combined to produce stand-alone software application prototypes that address core landscape design principles.

L A 458: Web Mapping/GIS
(Dual-listed with L A 558). (Cross-listed with C R P). (2-2) Cr. 3.
Prereq: CRP 451/551, LA 302. GEOL 452/552 or instructor permission.
Use and development of online mapping tools to support participatory GIS, Volunteered Geographic Information, information sharing, geodesign and decision making actions. Geoprocessing and Web Scripting/coding and user interface design. Laboratory emphasis practical applications and uses of Web GIS.

L A 459: Digital Design Methods for Landscape Architecture
(Dual-listed with L A 559). (Cross-listed with C R P). (3-0) Cr. 3. S.
Introduction to digital tools used by landscape architects for design communication, visualization, and design development. Include 2D drafting, 3D modeling, image CAD, geospatial data handling (GIS), and animation. Emphasis on concepts and workflow interoperability.

L A 461I: Introduction to GIS
(Cross-listed with ENSCI, ENV S, IA LL). Cr. 4. SS.
Descriptive and predictive GIS modeling techniques, spatial statistics, and map algebra. Application of GIS modeling techniques to environmental planning and resource management.

L A 478: Topical Studies in Landscape Architecture
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections. Course contact hours can range from (2-0) to (3-0) depending on number of credits.

L A 478A: Topical Studies in Landscape Architecture: Landscape Design
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478B: Topical Studies in Landscape Architecture: Planting Design
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478C: Topical Studies in Landscape Architecture: Construction
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478D: Topical Studies in Landscape Architecture: History/Theory/Criticism
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478E: Topical Studies in Landscape Architecture: Landscape Planning
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478F: Topical Studies in Landscape Architecture: Urban Design
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478G: Topical Studies in Landscape Architecture: Graphics
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478H: Topical Studies in Landscape Architecture: Honors
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478I: Topical Studies in Landscape Architecture: Interdisciplinary Studies
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478J: Topical Studies in Landscape Architecture: International Studies
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478K: Landscape Architecture: Computer Applications
(Dual-listed with L A 578K). Cr. 2-3. Repeatable. F.S.SS.
Prereq: Senior classification or graduate standing
Offerings vary with each term; check with department for available sections. Course contact hours can range from (2-0) to (3-0) depending on number of credits.

L A 478L: Topical Studies in Landscape Architecture: Ecological Design
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior classification or graduate standing
Offerings vary with each term; check with department for available sections.

L A 478M: Topical Studies in Landscape Architecture: Landscape Architecture: Social/Behavioral
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior classification or graduate standing
Offerings vary with each term; check with department for available sections.

L A 478N: Topical Studies in Landscape Architecture: Natural Resources
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior classification or graduate standing
Offerings vary with each term; check with department for available sections.

L A 481: Landscape Construction
(Dual-listed with L A 581). (3-0) Cr. 3. F.
Prereq: L A 381
Development of construction details with emphasis on materials and their aesthetic and functional uses as building materials. Explore characteristics and uses of construction materials and application of wood systems, paving systems, retaining walls, masonry and concrete systems, and metals; investigate structural theory of wood systems. Preliminary preparation of construction documents.

L A 482: Advanced Landscape Construction
(Dual-listed with L A 582). (3-0) Cr. 3. S.
Prereq: L A 481
Advanced site construction issues, including proposal preparation, construction documentation, project scheduling, estimating, and specification writing.

L A 490: Independent Study
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490A: Independent Study: Landscape Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490B: Independent Study: Planting Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490C: Independent Study: Construction
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490D: Independent Study: History/Theory/Criticism
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490E: Independent Study: Landscape Planning
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490F: Independent Study: Urban Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490G: Independent Study: Graphics
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490H: Independent Study: Honors
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490I: Independent Study: Interdisciplinary Studies
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490J: Independent Study: International Studies
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490K: Independent Study: Computer Applications
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490L: Independent Study: Ecological Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490M: Independent Study: Social/Behavioral
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490N: Independent Study: Natural Resources
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 491: Environmental Law and Planning
(Dual-listed with L A 591). (Cross-listed with C R P, ENV S). (3-0) Cr. 3. S.
Prereq: 6 credits in natural sciences
Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs.

Courses primarily for graduate students, open to qualified undergraduates:

L A 509: Field Travel
Cr. 1. Repeatable, maximum of 2 times.
Prereq: Enrollment in the professional program and permission of instructor
Observation of and reflection on professional and academic practice and landscapes. Field study and travel to conferences and educational events. Reading and final report. Offered on a satisfactory-fail basis only.

L A 517: Urban and Peri-urban Watershed Assessment
(Dual-listed with L A 417). (2-3) Cr. 3. F.
Prereq: Junior classification and 6 credits of natural science
Assessment and reduction of impacts in urban and peri-urban watershed areas. Course prepares students to work with various analysis methods for vegetation, topography, stormwater and stream condition as well as work with data from other disciplines. Emphasis on communicating with the public. Introductory GIS and GPS technologies are utilized. Learning is largely field-based.

L A 522: Advanced Plant Technology
(1-4) Cr. 3. F.
Prereq: Junior or graduate standing
Planting design and emergent technologies for design performance in the urban built environment. Emphasis on innovative strategies for planting design and plant technology in building design, sustainable streetscapes, and urban systems integrating storm water and urban "hardscape" design. Interviews with practitioners, technical experts and agency program leaders will complement readings, lecture and site visits to exemplary project sites.

L A 541: Design Inquiry
(3-0) Cr. 3. S.
Prereq: Graduate standing
Examination of design inquiry and research methods relevant to landscape architectural projects, including bibliographical, historical, numerical, statistical, survey, and geographical methods. Readings, discussions, and application problems. Preparation of a written research proposal.

L A 542: Professional Practice
(Dual-listed with L A 442). (2-0) Cr. 2. S.
Prereq: L A 481
Studies of conventional and developing forms of public and private practice. Explore relationships between professional life and the culture of the professional design firm; investigate firm identities and structures; understand design projects, their delivery process, and contractual agreements. Lecture and class discussion.

L A 543: Colloquium I: Landscape Architecture Research
(0-1) Cr. 1. S.
Prereq: Graduate standing.
Graduate forum on current research in landscape architecture. Weekly presentations of scholarly and professional work by department faculty. Readings, discussions, and development of student research focus. Offered on a satisfactory-fail basis only.

L A 545: Colloquium II: Interdisciplinary Research
Cr. 1. Repeatable. F.
Prereq: LA 543 or graduate standing.
Student-run graduate forum on current research in landscape architecture and related disciplines. Weekly presentations by invited faculty from the departments across the College of Design, University, and professional guests. Readings, discussions, and writing. Offered on a satisfactory-fail basis only.

L A 554: Fundamentals of Remote Sensing
(Dual-listed with L A 454). (Cross-listed with CRP). (3-0) Cr. 3. F.
Introduction to remote sensing techniques needed for basic analysis of satellite images, including: filtering and conflation techniques, stacking, pan sharpening, image rectification, image enhancement, unsupervised and supervised classification. Practical applications in a variety of topics to understand how to interpret images.

L A 557: Landscape Parametrics & Design Computing
(Dual-listed with L A 457). (3-0) Cr. 3. F.
Prereq: Junior classification
Exploration of computational representation of the landscape palette. Geometric parameters for terrain, vegetation, water, weather and lighting effects are modeled and developed algorithmically. Basic computer programming logic and computer graphics interactivity are combined to produce stand-alone software application prototypes that address core landscape design principles.

L A 558: Web Mapping/GIS
(Dual-listed with L A 458). (Cross-listed with C R P). (2-2) Cr. 3.
Prereq: CRP 451/551, LA 302. GEOL 452/552 or instructor permission.
Use and development of online mapping tools to support participatory GIS, Volunteered Geographic Information, information sharing, geodesign and decision making actions. Geoprocessing and Web Scripting/coding and user interface design. Laboratory emphasis practical applications and uses of Web GIS.

L A 559: Digital Design Methods for Landscape Architecture
(Dual-listed with L A 459). (Cross-listed with C R P). (3-0) Cr. 3. S.
Introduction to digital tools used by landscape architects for design communication, visualization, and design development. Include 2D drafting, 3D modeling, image CAD, geospatial data handling (GIS), and animation. Emphasis on concepts and workflow interoperability.

L A 567: Advanced GIS Landscape Modeling
(0-6) Cr. 3.
Prereq: L A 302 or C R P 451/C R P 551
Application of Geographic Information Systems (GIS) modeling techniques to landscape planning and management issues. Selection, acquisition, and conversion of digital landscape data. Modeling applications for studio projects, outreach projects, and research projects.

L A 571: Landscape Architectural Theory
(3-0) Cr. 3. F.
Prereq: graduate classification or permission of instructor
Examination of the development of ideas in landscape architecture in their historical context of social practices and knowledge systems. Emphasis on exposure to key modern and contemporary texts and projects in landscape architecture, architecture, art, and related fields. Readings, discussions, and writings.

L A 580: Thesis, Creative Component Tutorial
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Permission of major professor
Hands-on participation in a creative or research activity in the student's area of specialization. Development of a detailed prospectus that defines the thesis or creative component.

L A 581: Landscape Construction
(Dual-listed with L A 481). (3-0) Cr. 3. F.
Prereq: L A 381
Development of construction details with emphasis on materials and their aesthetic and functional uses as building materials. Explore characteristics and uses of construction materials and application of wood systems, paving systems, retaining walls, masonry and concrete systems, and metals; investigate structural theory of wood systems. Preliminary preparation of construction documents.

L A 582: Advanced Landscape Construction
(Dual-listed with L A 482). (3-0) Cr. 3. S.
Prereq: L A 481
Advanced site construction issues, including proposal preparation, construction documentation, project scheduling, estimating, and specification writing.

L A 583: Landscape TopoGraphics
(3-0) Cr. 3. F.
Prereq: LA 602
Design of landforms to achieve aesthetic, functional, and safety goals. Impacts and implications of landform transformation on the surrounding environment. Design communication using CAD, perspectives, cross-sections, contour maps, landform models, and narratives. Class exercises, case study precedents, and preliminary construction documents.

L A 590: Special Topics
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590A: Special Topics: Landscape Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590B: Special Topics: Planting Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590C: Special Topics: Construction
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590D: Special Topics: History/Theory/Criticism
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590E: Special Topics: Landscape Planning
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590F: Special Topics: Urban Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590G: Special Topics: Graphics
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590I: Special Topics: Interdisciplinary Studies
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590J: Special Topics: International Studies
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590K: Special Topics: Computer Applications
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590L: Special Topics: Ecological Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590M: Special Topics: Social/Behavioral
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590N: Special Topics: Natural Resources
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 591: Environmental Law and Planning
(Dual-listed with L A 491). (Cross-listed with C R P). (3-0) Cr. 3. S.
Prereq: 6 credits in natural sciences
Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs.

L A 594: Environmental Justice in Built Environments
(3-0) Cr. 3. S.
Prereq: Graduate standing or senior classification.
Examination of the equitable distribution of environmental burdens and benefits for sustainable and resilient cities. Focus on impact of climate change, social exclusion, and physical isolation on cumulative risk amongst vulnerable populations. Synthesis of recent social and environmental research to develop innovative physical planning and urban design strategies that support healthy behaviors.

L A 599: Creative Component
Cr. 1-8. Repeatable, maximum of 8 credits. F.S.SS.
Prereq: Permission of major professor
Comprehensive study and original development of a project selected by the student and approved by the major professor. Completed project must be submitted to and approved by a graduate faculty committee as evidence of mastery of the principles of landscape architecture.

Courses for graduate students:

L A 601: Studio I: Design Representation
(3-0) Cr. 3. F.
Prereq: Graduate standing
Introduction to history, techniques, and conventions of landscape architecture representation. Production of design drawings that facilitate critical thinking, the testing of design ideas, and effective communication. Use of two- and three-dimensional media, both analog and digital.

L A 602: Studio II: Land Form and Plant Scape
(1-15) Cr. 6. S.
Prereq: LA 601
Landscape design integrating knowledge of land patterns, plant ecosystems, and human processes. Project involve landform and plants at varied scale of design. Emphasis on competencies in design based in natural process, human behavior, and representation.

L A 603: Studio III: Performance Landscapes
(1-15) Cr. 6. S.
Prereq: LA 602
Theory and methods of landscape design at a variety of scales to achieve desired cultural and biophysical impacts. Development and use of performance metrics drawn from design, humanities, and science. Construction of integrated rhetorical structures of representation and analysis and critical viewpoints to create rigorous design "arguments" and meaningful, just and vibrant environments.

L A 604: Studio IV: City Matters
(1-15) Cr. 6. S.
Prereq: LA 603
Exploration of sociopolitical, ecological, and visual-spatial conditions of the urban environment through design at multiple scales. Focus on urban projects that highlight the complexity of human, ecological, and infrastructural systems. Development of innovative strategies for sustainable, healthy, and just cities. Special attention us paid to building material and construction of physical elements in cities.

L A 605: Studio V: Land Works/Land Digits
(1-15) Cr. 6.
Prereq: LA 604
Landscape design focusing on broadening the representational palette for landscape architectural concepts to complex sites at multiple scales. Emphasis on technical competency through advanced skills in design research, digital representation and teamwork.

L A 699: Thesis Research
Cr. 1-8. Repeatable, maximum of 8 credits. F.S.SS.
Prereq: Permission of major professor

Latin (LATIN)

Courses primarily for undergraduates:

LATIN 101: Elementary Latin I
(4-0) Cr. 4. F.
Grammar and vocabulary of classical Latin, within the context of Roman culture; reading knowledge through texts adapted from classical authors.

LATIN 102: Elementary Latin II
(4-0) Cr. 4. S.
Prereq: LATIN 101
Grammar and vocabulary of classical Latin, within the context of Roman culture; reading knowledge through texts adapted from classical authors. Meets International Perspectives Requirement.

LATIN 201: Intermediate Latin
Cr. arr. F.
Prereq: LATIN 102
Emphasis on grammatical principles, composition and reading Latin texts.
Meets International Perspectives Requirement.

LATIN 332: Introduction to Latin Literature
Cr. arr. S.
Prereq: LATIN 201
Readings in Latin Literature with emphasis on critical analysis of style, structure or thought.
Meets International Perspectives Requirement.

LATIN 490: Independent Study
Cr. 1-6. Repeatable, maximum of 9 credits.
Prereq: 6 credits in Latin and permission of department chair
Designed to meet the needs of students who seek work in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. No more than 9 credits in Latin 490 may be counted toward graduation.

Leadership Studies (LD ST)

Courses primarily for undergraduates:

LD ST 122: Leading with Purpose
(1-0) Cr. 1. F.S.
Designed for emerging student leaders, this course will provide students with basic leadership skills covering strengths identification, personal skills development, goal achievement, values-based behaviors, and mission statement development.

LD ST 270: Campus Leadership Development
(3-0) Cr. 3. F.S.SS.
Theory and practice of effective leadership in a campus context. Study of effective leadership models and leadership in complex systems. Expectation of engagement in campus activities. Assessed service-learning component.

LD ST 290: Special Projects
Cr. 1-3. F.S.SS.
Prereq: Freshman or sophomore classification; Permission of the instructor.
Special projects for the Leadership Studies Program.

LD ST 322: Leadership Styles and Strategies in a Diverse Society
(3-0) Cr. 3. F.S.SS.
Prereq: Sophomore classification
Developing and practicing leadership skills through understanding personal leadership styles, leadership theory and communication theory, including how they relate to gender issues and cultural diversity; exploring personality types, communication styles, and leadership styles, networking and developing mentoring relationships; setting goals and participating in leadership opportunities and service.
Meets U.S. Diversity Requirement

LD ST 333: Women and Leadership
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: Sophomore classification
This course will examine historical and contemporary barriers to and opportunities for women's leadership in a variety of contexts, including professions and public service. It will examine theories of women's leadership, gender differences in leadership styles, and the perceptions and expectations about women's leadership. Multiple perspectives of women's leadership will be highlighted through lectures, readings, videos, guest speakers and group work.
Meets U.S. Diversity Requirement

LD ST 422: Leadership Capstone Seminar: Theory to Practice
(3-0) Cr. 3. S.
Prereq: LD ST 322
Critical analysis of leadership theory to inform practice, with emphasis on ethical leadership and the alignment of personal and organizational values.

LD ST 488: Research on Women and Leadership
(Cross-listed with W S). (3-0) Cr. 3.
Research on women and leadership in selected content areas (e.g., business, education, politics and public service, and popular culture). Following an overview of quantitative and qualitative methods and critical analyses of journal articles on women and leadership, students will work in groups in selected content areas to research, write and present paper.

LD ST 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.Alt. SS., offered irregularly.
Prereq: Permission of the instructor.
Independent study for the Leadership Studies Program. No more than 6 credits of LD ST 490 may count toward graduation.

Learning and Leadership Sciences (L L S)

Courses primarily for undergraduates:

L L S 112: Foundations of Learning and Productive Team Membership
(2-0) Cr. 2. F.
Introduction to developing intentional learners and worthy team members. Learning as the foundation of human enterprise; intellectual curiosity; ethics as a personal responsibility; everyday leadership; effective team and community interactions including team learning and the effects on individuals; and growth through understanding self, demonstrating ownership of own learning, and internalizing commitment to helping others. Intentional mental processing as a means of enhancing learning. Interconnectedness of the individual, the community, and the world.

L L S 114: Developing Responsible Learners and Effective Leaders
(2-0) Cr. 2. S.
Prereq: L L S 112
Focus on team and community. Application of fundamentals of human learning; evidence of development as a responsible learner; intentional mental processing as a habit of mind; planning and facilitating learning opportunities for others; responsibility of the individual to the community and the world; leading from within; holding self and others accountable for growth and development as learners and leaders.

L L S 212: Habits of Mind and Decision-Making in Leadership
(2-0) Cr. 2. F.
Prereq: L L S 114
Application of theories about habits of mind, mindset, and critical thinking to structured cross-disciplinary problem-solving scenarios. Development and utilization of personal and team action plans for specific habits of mind associated with leadership.

L L S 312: Problem Solving and Action Planning in Leadership
(2-0) Cr. 2. S.
Prereq: L L S 212
Transfer of theories about learning and leadership to practice. Leading for change. Using knowledge of self and interactive skills to explore interdependence. Development of an action plan that addresses a real-world problem.

L L S 412: Learning and Leadership in Practice
(0-9) Cr. 3. F.
Prereq: L L S 312
Teamwork in a practicum to execute a project that will positively change the community. Application of learning and leadership theory: framing a problem, justifying approaches, taking action, getting feedback, and planning new actions. Application to be accompanied by continual reflection and feedback. Development of final portfolio to showcase cumulative leadership growth in the Learning and Leadership Sciences minor.

Liberal Arts and Sciences Cross-Disciplinary Studies (LAS)

Courses primarily for undergraduates:

LAS 101: Orientation for Open Option and Preprofessional Students
(1-0) Cr. 1. F.
Introduction to all undergraduate colleges. Provides information about university resources and services, assists with a successful academic transition to the university, and helps initiate the process of identifying academic major(s) and eventual career paths. Required of all first-year students in Open Option and Preprofessional Programs. Offered on a satisfactory-fail basis only.

LAS 103: Frontiers of the Discipline
(1-0) Cr. 1. Repeatable.
Learning Community/ Seminar focusing entirely on the "cutting edge" research activities of faculty members. Offered on a satisfactory-fail basis only. A maximum of three total credits of LAS 103A, 103B, 103C, 103D, 103E can count for graduation.

LAS 103A: Frontiers of the Discipline: General
(1-0) Cr. 1. Repeatable.
Learning Community/ Seminar focusing entirely on the "cutting edge" research activities of faculty members. Offered on a satisfactory-fail basis only. A maximum of three total credits of LAS 103A, 103B, 103C, 103D, 103E can count for graduation.

LAS 103B: Frontiers of the Discipline: Humanities
(1-0) Cr. 1. Repeatable.
Learning Community/ Seminar focusing entirely on the "cutting edge" research activities of faculty members. Offered on a satisfactory-fail basis only. A maximum of three total credits of LAS 103A, 103B, 103C, 103D, 103E can count for graduation.

LAS 103C: Frontiers of the Discipline: Communication
(1-0) Cr. 1. Repeatable.
Learning Community/ Seminar focusing entirely on the "cutting edge" research activities of faculty members. Offered on a satisfactory-fail basis only. A maximum of three total credits of LAS 103A, 103B, 103C, 103D, 103E can count for graduation.

LAS 103D: Frontiers of the Discipline: Mathematics and Natural Sciences
(1-0) Cr. 1. Repeatable.
Learning Community/ Seminar focusing entirely on the "cutting edge" research activities of faculty members. Offered on a satisfactory-fail basis only. A maximum of three total credits of LAS 103A, 103B, 103C, 103D, 103E can count for graduation.

LAS 103E: Frontiers of the Discipline: Social Sciences
(1-0) Cr. 1. Repeatable.
Learning Community/ Seminar focusing entirely on the "cutting edge" research activities of faculty members. Offered on a satisfactory-fail basis only. A maximum of three total credits of LAS 103A, 103B, 103C, 103D, 103E can count for graduation.

LAS 105: BOLD Learning Community Orientation
(1-0) Cr. 1. F.
Prereq: Member of the BOLD Learning Community.
Orientation to the university for the "Bridging Opportunities in Leadership and Diversity" (BOLD) Learning Community students. Support for academic, social, and leadership development. Opportunity to connect with campus and college resources, explore career opportunities and build group identity. Includes regular one to one peer mentoring with multicultural student leaders. Offered on a satisfactory-fail basis only.

LAS 106: BOLD Learning Community Seminar
(1-0) Cr. 1. S.
Prereq: Member of the BOLD Learning Community.
Continued exploration of university services, academic, social, and leadership development for BOLD Learning Community students. Individual and group identity development. Includes regular one-on-one peer mentoring with multicultural student leaders and an assessed service-learning component. Offered on a satisfactory-fail basis only.

LAS 125: Connections
(1-0) Cr. 1.
Prereq: First year student
Links a large lecture class with a small learning community / seminar. In each case the professor teaching the large lecture facilitates a small weekly seminar. Informal discussions about critical issues of the day connected to lecture topics through films, public lectures and other events which students and the faculty leader attend. Offered on a satisfactory-fail basis only.

LAS 125A: Connections: General
(1-0) Cr. 1.
Prereq: First year student
Links a large lecture class with a small learning community / seminar. In each case the professor teaching the large lecture facilitates a small weekly seminar. Informal discussions about critical issues of the day connected to lecture topics through films, public lectures and other events which students and the faculty leader attend. Offered on a satisfactory-fail basis only.

LAS 125B: Connections: Humanities
(1-0) Cr. 1.
Prereq: First year student
Links a large lecture class with a small learning community / seminar. In each case the professor teaching the large lecture facilitates a small weekly seminar. Informal discussions about critical issues of the day connected to lecture topics through films, public lectures and other events which students and the faculty leader attend. Offered on a satisfactory-fail basis only.

LAS 125C: Connections: Communication
(1-0) Cr. 1.
Prereq: First year student
Links a large lecture class with a small learning community / seminar. In each case the professor teaching the large lecture facilitates a small weekly seminar. Informal discussions about critical issues of the day connected to lecture topics through films, public lectures and other events which students and the faculty leader attend. Offered on a satisfactory-fail basis only.

LAS 125D: Connections: Mathematics and Natural Sciences
(1-0) Cr. 1.
Prereq: First year student
Links a large lecture class with a small learning community / seminar. In each case the professor teaching the large lecture facilitates a small weekly seminar. Informal discussions about critical issues of the day connected to lecture topics through films, public lectures and other events which students and the faculty leader attend. Offered on a satisfactory-fail basis only.

LAS 125E: Connections: Social Sciences
(1-0) Cr. 1.
Prereq: First year student
Links a large lecture class with a small learning community / seminar. In each case the professor teaching the large lecture facilitates a small weekly seminar. Informal discussions about critical issues of the day connected to lecture topics through films, public lectures and other events which students and the faculty leader attend. Offered on a satisfactory-fail basis only.

LAS 151: Dean's Leadership Seminar I
(1-0) Cr. 1. F.
Prereq: Selection based on application.
Beginning to study leadership through applied examples, including the importance of community, communication, trust, shared responsibility, modeling the way, and inspiring a shared vision. Students will be introduced to campus leadership opportunities.

LAS 152: Dean's Leadership Seminar II
(1-0) Cr. 1. S.
Prereq: Selection based on application.
Continuing to study leadership through applied examples, including the importance of challenging the process, enabling others to act, and encouraging the heart. Students will engage more deeply in campus leadership opportunities.

LAS 290: Special Projects
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of the College of Liberal Arts and Sciences.

LAS 290A: Special Projects: LAS Ambassadors
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of the College of Liberal Arts and Sciences.

LAS 290B: Special Projects: Advising Project
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of the College of Liberal Arts and Sciences.

LAS 290C: Special Projects: Pre-Law Project
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of the College of Liberal Arts and Sciences.

LAS 290D: Special Projects: General
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of the College of Liberal Arts and Sciences.

LAS 290E: Special Projects: Career Services
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of the College of Liberal Arts and Sciences.
Offered on a satisfactory-fail basis only.

LAS 290S: Special Projects: STEM Scholars
Cr. 1-3. Repeatable.
Permission of the College of Liberal Arts and Sciences. Offered on a satisfactory-fail basis only.

LAS 291: Service Learning
Cr. 1-4. Repeatable, maximum of 6 credits.
Prereq: Permission of the dean of the College of Liberal Arts and Sciences
Service work as appropriate to the student s degree program. Academic work under faculty supervision may include written project, report, and guided reading. Offered on a satisfactory-fail basis only.

LAS 291A: Service Learning: General
Cr. 1-4. Repeatable, maximum of 6 credits.
Prereq: Permission of the dean of the College of Liberal Arts and Sciences
Service work as appropriate to the student s degree program. Academic work under faculty supervision may include written project, report, and guided reading. Offered on a satisfactory-fail basis only.

LAS 291B: Service Learning: U.S. Diversity Project
Cr. 1-4. Repeatable, maximum of 6 credits.
Prereq: Permission of the dean of the College of Liberal Arts and Sciences
Service work as appropriate to the student s degree program. Academic work under faculty supervision may include written project, report, and guided reading. Offered on a satisfactory-fail basis only.

LAS 291C: Service Learning: International Perspectives Project
Cr. 1-4. Repeatable, maximum of 6 credits.
Prereq: Permission of the dean of the College of Liberal Arts and Sciences
Service work as appropriate to the student s degree program. Academic work under faculty supervision may include written project, report, and guided reading. Offered on a satisfactory-fail basis only.

LAS 298: Internship/Co-op
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of Liberal Arts and Sciences Career Services; Liberal Arts and Sciences majors; sophomore classification
Students participating in an internship or co-op on a full-time basis must register for this course prior to beginning their work experience to remain in full-time student status. Offered on a satisfactory-fail basis only.

LAS 350: Topics in Interdisciplinary Studies
(3-0) Cr. 1-4. Repeatable, maximum of 8 credits.

LAS 350A: Topics in Interdisciplinary Studies: Interdisciplinary
(3-0) Cr. 1-4. Repeatable, maximum of 8 credits.

LAS 350B: Topics in Interdisciplinary Studies: Humanities
(3-0) Cr. 1-4. Repeatable, maximum of 8 credits.

LAS 350C: Topics in Interdisciplinary Studies: Mathematics and Natural Science
(3-0) Cr. 1-4. Repeatable, maximum of 8 credits.

LAS 350D: Topics in Interdisciplinary Studies: Social Sciences
(3-0) Cr. 1-4. Repeatable, maximum of 8 credits.

LAS 385: The Holocaust
(3-0) Cr. 3. F.S.SS.
An examination of the religious, social, scientific, and historical contexts for the Nazi destruction of European Jewry. Topics covered include anti-Semitism, German volkish philosophy, eugenics, World War II, the Final Solution, rescuers, and contemporary issues.
Meets International Perspectives Requirement.

LAS 398: Internship/Co-op
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of Liberal Arts and Sciences Career Services; Liberal Arts and Sciences majors; junior classification
Students participating in an internship or co-op on a full-time basis must register for this course prior to beginning their work experience to remain in full-time student status. Offered on a satisfactory-fail basis only.

LAS 490: Independent Study
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Permission of the instructor for LAS 490G; other topics need: permission of the dean of the College of Liberal Arts and Sciences
No more than 9 credits of LAS 490 may be applied toward graduation.

LAS 490A: Independent Study: General
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Permission of the instructor for LAS 490G; other topics need: permission of the dean of the College of Liberal Arts and Sciences
No more than 9 credits of LAS 490 may be applied toward graduation.

LAS 490E: Independent Study: Entrepreneurial Studies
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Permission of the instructor for LAS 490G; other topics need: permission of the dean of the College of Liberal Arts and Sciences
No more than 9 credits of LAS 490 may be applied toward graduation.

LAS 491: Service Learning
Cr. 1-4. F.S.SS.
Prereq: Permission of the dean of the College of Liberal Arts and Sciences
Service work as appropriate to the student's degree program. Academic work under faculty supervision may include written project, report, and guided reading.

LAS 491A: Service Learning: General
Cr. 1-4. F.S.SS.
Prereq: Permission of the dean of the College of Liberal Arts and Sciences
Service work as appropriate to the student's degree program. Academic work under faculty supervision may include written project, report, and guided reading.

LAS 491B: Service Learning: U.S. Diversity Project
Cr. 1-4. F.S.SS.
Prereq: Permission of the dean of the College of Liberal Arts and Sciences
Service work as appropriate to the student's degree program. Academic work under faculty supervision may include written project, report, and guided reading.
Meets U.S. Diversity Requirement

LAS 491C: Service Learning: International Perspectives Project
Cr. 1-4. F.S.SS.
Prereq: Permission of the dean of the College of Liberal Arts and Sciences
Service work as appropriate to the student's degree program. Academic work under faculty supervision may include written project, report, and guided reading.
Meets International Perspectives Requirement.

LAS 498: Internship/Co-op
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of Liberal Arts and Sciences Career Services; Liberal Arts and Sciences majors; senior classification
Students participating in an internship or co-op on a full-time basis must register for this course prior to beginning their work experience to remain in full-time student status. Offered on a satisfactory-fail basis only.

LAS 499: Internship
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of Liberal Arts and Sciences Career Services; Liberal Arts and Sciences majors
Semester-long internship appropriate to the student's degree program. Must include an academic component under faculty supervision such as written projects, reports, and guided reading. Students must register for this course prior to beginning their internship.

Library (LIB)

Courses primarily for undergraduates:

LIB 160: Information Literacy
(1-0) Cr. 1. F.S.SS.
Prereq: For students whose native language is not English: Completion of ENGL 101 requirement.
Eight-week course required for undergraduate degree. Provides a solid understanding of information literacy and the research process with emphases on finding, evaluating, and using scholarly information; the ethical and legal framework related to information use; and utilization of library discovery tools. To be taken as early as possible in the student's undergraduate career. See course descriptions of ENGL 150 and ENGL 250 for requirements related to LIB 160. Offered on a satisfactory-fail basis only.

Linguistics (LING)

Courses primarily for undergraduates:

LING 101: Introduction to the Study of Linguistics
(1-0) Cr. 1. S.
Cross-disciplinary perspectives on the study of linguistics. Applications of linguistics to real world problems. Careers in linguistics.

LING 119: Introduction to World Languages
(Cross-listed with WLC). (3-0) Cr. 3.
Study of language diversity and the personal, social and political effects of diversity. Language families, attitudes toward language and language use, language and culture, multilingualism, foreign language learning, written codes, official languages, and language policy.
Meets International Perspectives Requirement.

LING 120: Computers and Language
(Cross-listed with ENGL). (3-0) Cr. 3.
Introduction to the use of linguistic knowledge in computer applications today and the basic computational techniques used in such applications. The development of these techniques throughout the history of computational linguistics. How the study of language has contributed to the advancement of technology and how certain computational problems have influenced the way linguists study language.

LING 207: Introduction to Symbolic Logic
(Cross-listed with PHIL). (3-0) Cr. 3. S.
Introduction to fundamental logical concepts and logical symbolism. Development of natural deduction through first order predicate logic with identity. Applications to arguments in ordinary English and to philosophical issues. Linguistics majors should take LING/PHIL 207 as early as possible.

LING 219: Introduction to Linguistics
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.
Prereq: Sophomore classification
Introduction to linguistic concepts and principles of linguistic analysis with English as the primary source of data. Sound and writing systems, sentence structure, vocabulary, and meaning. Issues in the study of usage, regional and social dialects, language acquisition, and language change.

LING 220: Descriptive English Grammar
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.
Prereq: ENGL 250
Overview of grammatical structures and functions. Parts of speech; phrase, clause, and sentence structure; sentence types and sentence analysis; rhetorical grammar and sentence style; terminology. Not a remedial, English composition, or ESL course.

LING 275: Introduction to Communication Disorders
(Cross-listed with CMDIS). (3-0) Cr. 3.
Survey of nature, causes, and types of major communication disorders including phonological, adult and child language, voice, cleft palate, fluency, and hearing disorders.

LING 286: Communicating with the Deaf
(Cross-listed with CMDIS). (3-0) Cr. 3.
Learn to communicate with the deaf using Signed English and Signed Pidgin English. Other topics covered include types, causes, and consequences of hearing loss, hearing technology (hearing aids, assistive listening devices, and cochlear implants), education of hearing-impaired children, Deaf culture, and the history of manual communication.
Meets U.S. Diversity Requirement

LING 305: Language, Thought and Action
(Cross-listed with SP CM). (3-0) Cr. 3.
Prereq: ENGL 250
The study of symbolic processes and how meaning is conveyed in words, sentences, and utterances; discussion of modern theories of meaning; and an exploration of relationships among language, thought and action.

LING 309: Introduction to Culture and Language
(Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 recommended
Introduction to study of language, culture and society from an anthropological perspective. Focus on language and thought, ethnography of speaking, discourse and narrative, writing and literacy, and media communication. Discussion of key theories and methods of linguistic anthropology.
Meets International Perspectives Requirement.

LING 322: Language and Society
(Cross-listed with ENGL). Cr. 3. S.
Prereq: ENGL/LING 219
Introduction to variation in language use in society. Survey of factors affecting language use, including background characteristics of language users, location, and purpose of interaction in addition to institutional, state, and national language policies.

LING 324: Introduction to Teaching ESL Literacy
(Cross-listed with ENGL). Cr. 3. F.
Prereq: ENGL/LING 219
Introduction to the issues and methods involved in teaching literacy skills to English as a second language (ESL) learners. The nature of literacy and materials and methods for developing ESL literacy at the middle school, high school, and adult ages across multiple levels of competency.

LING 325: Teaching Methods for ESL Learners: Oral Communication Skills
(Cross-listed with ENGL). Cr. 3. S.
Prereq: ENGL/LING 219
Issues and methods in teaching oral communication skills (listening, speaking, pronunciation) to English as a second language (ESL) learners. The nature of oral language ability. Materials and Methods for developing oral communication skills at middle school, high school, and adult contexts.

LING 331: Theory of Computing
(Cross-listed with COM S). (3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228, MATH 166, and in COM S 230 or CPR E 310; ENGL 250
Models of computation: finite state automata, pushdown automata and Turing machines. Study of grammars and their relation to automata. Limits of digital computation, unsolvability and Church-Turing thesis. Chomsky hierarchy and relations between classes of languages.

LING 351: Introduction to Spanish-English Translation
(Cross-listed with SPAN). (3-0) Cr. 3. F.S.
Prereq: SPAN 301, SPAN 303 or SPAN 304
Introduction to the theory, methods, techniques, and problems of translation. Consideration of material from business, literature, and the social sciences. Taught in Spanish.
Meets International Perspectives Requirement.

LING 352: Introduction to Spanish Phonology
(Cross-listed with SPAN). (3-0) Cr. 3. F.S.
Prereq: SPAN 301, SPAN 303 or SPAN 304
An introductory study of the articulation, classification, distribution, and regional variations of the sounds of the Spanish language. Taught in Spanish.
Meets International Perspectives Requirement.

LING 354: Introduction to Spanish-English Interpretation
(Dual-listed with LING 554). (Cross-listed with SPAN). (3-0) Cr. 3. F.S.
Prereq: SPAN 351
Introduction to the theory, methods, techniques, and problems of consecutive and simultaneous interpretation. Consideration of material from business, agriculture, law, design, medicine, literature, advertisement, and sports. Taught in Spanish.
Meets International Perspectives Requirement.

LING 371: Phonetics and Phonology
(Cross-listed with CMDIS). (3-0) Cr. 3.
Prereq: ENGL 219
Analysis of speech through study of individual sounds, their variations, and relationships in context; English phonology; practice in auditory discrimination and transcription of sounds of American English; description of speech sounds in terms of their production, transmission, and perception.

LING 395: Study Abroad
Cr. 3-10. Repeatable, maximum of 2 times.
Instruction in issues of language policy, practice and learning. Observation and experience with language use outside of the United States.
Meets International Perspectives Requirement.

LING 413: Psychology of Language
(Cross-listed with PSYCH). (3-0) Cr. 3.
Prereq: PSYCH 101
Introduction to psycholinguistics. Topics may include origin of language, speech perception, language comprehension, reading, bilingualism, brain bases of language, and computational modeling of language processes.

LING 420: History of the English Language
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.
Prereq: ENGL 219 or LING 219, ENGL 220 or LING 220
Comparison of English to other languages by family background and by type. Analysis of representative Old, Middle, Early Modern and present-day English texts, including both literary works and non-literary documents.

LING 422: Women, Men, and the English Language
(Cross-listed with ENGL, W S). (3-0) Cr. 3. S.
Prereq: ENGL 219 or LING 219
The ways men and women differ in using language in varied settings and the ways in which language both creates and reflects gender divisions.
Meets U.S. Diversity Requirement

LING 425: Second Language Learning and Teaching
(Cross-listed with ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 219 or LING 219; junior classification
The process of second language learning and principles and techniques of teaching second languages. Learning and teaching in specific situations and for particular purposes. Current applications of technology in teaching and assessment.

LING 437: Grammatical Analysis
(Cross-listed with ENGL). (3-0) Cr. 3. F.
Prereq: ENGL 220 or LING 220; ENGL 219 or LING 219 or introductory course in linguistics; junior classification
Theories and methods for analysis of syntax and morphology.

LING 462: Contrastive Analysis of Spanish/ English for Translators
(Cross-listed with SPAN). (3-0) Cr. 3.
Prereq: SPAN 351
Linguistic study of the major differences between the Spanish and English grammatical systems and their applications in the translation of Spanish to English. Taught in Spanish.

LING 463: Hispanic Dialectology
(Cross-listed with SPAN). (3-0) Cr. 3.
Prereq: SPAN 352
Intensive study of the phonology, morphosyntax and lexicon of the Hispanic dialects of Spain and Latin America in their historical context. Taught in Spanish.
Meets International Perspectives Requirement.

LING 471: Language and Reading Development in Children
(Cross-listed with CMDIS). (3-0) Cr. 3.
Prereq: CMDIS 275 or PSYCH 230 or ENGL 219 or LING 219
Theories and developmental processes related to the components of language(semantics, syntax, morphology, phonology, and pragmatics); the development of metalinguistic knowledge; theories and developmental processes of reading.

LING 480: Topics in Communication Disorders
(Cross-listed with CMDIS). (3-0) Cr. 3. F.S.
Prereq: CMDIS/LING 275, CMDIS/LING 371, and BIOL 255; permission of instructor.
Guided examination of topics in preparation for graduate work in Speech-Language Pathology or Audiology. Primary course delivery by WWW.

LING 480A: Topics in Communication Disorders: Anatomy and Physiology of Speech and Hearing
(Cross-listed with CMDIS). (3-0) Cr. 3. F.S.
Prereq: CMDIS/LING 275, CMDIS/LING 371, and BIOL 255; permission of instructor.
Guided examination of topics in preparation for graduate work in Speech-Language Pathology or Audiology. Primary course delivery by WWW.

LING 480B: Topics in Communication Disorders: Articulation and Phonological Disorders
(Cross-listed with CMDIS). (3-0) Cr. 3. F.S.
Prereq: CMDIS/LING 275, CMDIS/LING 371, and BIOL 255; permission of instructor.
Guided examination of topics in preparation for graduate work in Speech-Language Pathology or Audiology. Primary course delivery by WWW.

LING 480C: Topics in Communication Disorders: Evaluation and diagnosis of communication disorders
(Cross-listed with CMDIS). (3-0) Cr. 3. F.S.
Prereq: CMDIS/LING 275, CMDIS/LING 371, and BIOL 255; permission of instructor.
Guided examination of topics in preparation for graduate work in Speech-Language Pathology or Audiology. Primary course delivery by WWW.

LING 486: Methods in Elementary School World Language Instruction
(Cross-listed with C I, WLC). (3-0) Cr. 3. F.
Prereq: 25 credits in a world language
Planning, implementation, and assessment of standards-based, student-centered, and thematic instruction in the elementary (K-8) classroom. Special emphasis on K-8 students' communicative skills, cultural knowledge, and content learning.

LING 487: Methods in Secondary School World Language Instruction
(Cross-listed with C I, WLC). (3-0) Cr. 3. F.
Prereq: 25 credits in a world language, admission to the teacher education program, OPI
Theories and principles of contemporary world language learning and teaching. Special emphasis on designing instruction and assessments for active learning.

LING 490B: Independent Study: Linguistics
(Cross-listed with ENGL). Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee or Linguistics Adviser
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

LING 490D: Independent Study: Linguistic Anthropology
(Cross-listed with ANTHR). Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology.
No more than 9 credits of Anthr 490 may be counted toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

LING 510: Introduction to Computers in Applied Linguistics
(Cross-listed with ENGL). (3-0) Cr. 3. F.
Prereq: Graduate classification
Use of software and web applications for language teaching, linguistic analysis, and statistical analysis. Issues and problems in applied linguistics related to computer methods.

LING 511: Introduction to Linguistic Analysis
(Cross-listed with ENGL). (3-0) Cr. 3. F.
Prereq: Graduate classification
Principles and methods of linguistic analysis with emphasis on phonology, morphology, and syntax. Description of linguistic variation and current theoretical approaches to linguistics.

LING 512: Second Language Acquisition
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theory, methods, and results of second language acquisition research with emphasis on approaches relevant to second language teaching.

LING 513: Language Assessment Practicum
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.SS.
Prereq: ENGL 519 or LING 519
Advanced practicum in language assessment.

LING 514: Sociolinguistics
(Cross-listed with ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theories and methods of examining language in its social setting. Analysis of individual characteristics (e.g., age, gender, ethnicity, social class, region), interactional factors (e.g., situation, topic, purpose) and national policies affecting language use.

LING 515: Statistical Natural Language Processing
(Cross-listed with ENGL, HCI). (3-0) Cr. 3.
Prereq: STAT 330 or equivalent, recommended ENGL 219 or LING 219, or ENGL 511 or LING 511
Introduction to computational techniques involving human language and speech in applications such as information retrieval and extraction, automatic text categorization, word prediction, intelligent Web searching, spelling and grammar checking, speech recognition and synthesis, statistical machine translation, n-grams, POS-tagging, word-sense disambiguation, on-line lexicons and thesauri, markup languages, corpus analysis, and Python programming language.

LING 518: Teaching English as a Second Language Methods and Materials
(Cross-listed with ENGL). (3-0) Cr. 3. F.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Introduction to approaches, methods, techniques, materials, curricular design, and assessment for various levels of ESL instruction. Attention to issues related to the teaching of listening, speaking, reading, writing, vocabulary, pronunciation, and culture.

LING 519: Second Language Assessment
(Cross-listed with ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 511 or LING 511
Principles of second language assessment including reliability, validity, authenticity and practicality. Constructing, scoring, interpreting, and evaluating second language tests for a variety of situations.

LING 520: Computational Analysis of English
(Cross-listed with ENGL, HCI). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 510 or LING 510, and ENGL 511 or LING 511
Concepts and practices for analysis of English by computer with emphasis on the applications of computational analysis to problems in applied linguistics such as corpus analysis and recognition of learner language in computer-assisted learning and language assessment.

LING 524: Literacy: Issues and Methods for Nonnative Speakers of English
(Cross-listed with ENGL). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theoretical and practical issues and techniques in the teaching of literacy in a variety of contexts, involving children and adults at basic skill levels and teens and adults in academic and vocational programs.

LING 525: Research and Teaching of Second Language Pronunciation
(Cross-listed with ENGL). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theoretical and practical issues and techniques in the teaching of second language pronunciation as it relates to other areas of language, especially listening and speaking skills. Topics will include segmental and suprasegmental features; intelligibility; pronunciation in language assessment; classroom, technology and individual instruction; and research issues. Topics will be relevant to those intending to teach or research in various contexts.

LING 526: Computer-Assisted Language Learning
(Cross-listed with ENGL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ENGL 511 or LING 511 or equivalent
Theory, research, and practice in computer use for teaching nonnative speakers of English. Methods for planning and evaluating computer-based learning activities.

LING 527: Discourse Analysis
(Cross-listed with ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Methods and theoretical foundations for linguistic approaches to discourse analysis. Applications of discourse analysis to the study of texts in a variety of settings, including academic and research contexts.

LING 528: English for Specific Purposes
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Issues and techniques in analyzing, teaching, and assessing English for specific purposes. Topics include theories of specific purpose language use, analysis of learner needs in target language contexts, and corpus-informed syllabus and materials development for teaching and assessment.

LING 537: Corpus Approaches to Grammatical Analysis
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 220 or LING 220; ENGL 219, LING 219, ENGL 511, LING 511, or introductory course in linguistics; graduate classification
Corpus-informed analysis of syntax in authentic writing and speech, with emphasis on approaches used in applied linguistics.

LING 554: Introduction to Spanish-English Interpretation
(Dual-listed with LING 354). (Cross-listed with SPAN). (3-0) Cr. 3. F.S.
Prereq: SPAN 351
Introduction to the theory, methods, techniques, and problems of consecutive and simultaneous interpretation. Consideration of material from business, agriculture, law, design, medicine, literature, advertisement, and sports. Taught in Spanish.
Meets International Perspectives Requirement.

LING 588: Supervised Practice Teaching in Teaching English as a Second Language
(Cross-listed with ENGL). (1-5) Cr. 3. F.S.SS.
Prereq: 9 credits toward the TESL/TEFL Certificate, 15 credits toward the TESL/AL master's degree, or 18 credits completed toward the ESL Endorsement option.
Intensive observation of ESL instruction and supervised practice in teaching learners of English in a context appropriate to the student teacher's goals. ENGL 588 cannot be used for teacher licensure and cannot be taken during student teaching.

LING 590: Special Topics
(Cross-listed with ENGL). Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

LING 590B: Special Topics: Teaching English as a Second Language (TESL)/Applied Linguistics
(Cross-listed with ENGL). Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

LING 590G: Special Topics: Applied Linguistics and Technology
(Cross-listed with ENGL). Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

LING 591: Studies in Applied Linguistics
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in TESL/Applied Linguistics
Intensive study of applied linguistic theory as it relates to specific issues in language acquisition, teaching, or use.

LING 591B: Directed Readings: Teaching English as a Second Language (TESL)/Applied Linguistics
(Cross-listed with ENGL). Cr. arr. Repeatable.

LING 591G: Directed Readings: Applied Linguistics and Technology
(Cross-listed with ENGL). Cr. arr. Repeatable.

Courses for graduate students:

LING 623: Research Methods in Applied Linguistics
(Cross-listed with ENGL). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 511 or LING 511, ENGL 517 or LING 517, ENGL 519 or LING 519
Survey of research traditions in applied linguistics. Focus on theoretical and practical aspects of quantitative and qualitative approaches to applied linguistic study, including experimental and quasiexperimental methods, classroom observation and research, introspective methods, elicitation techniques, case studies, interactional analysis, ethnography, and program evaluation. Computational tools and resources for linguistic research will be highlighted.

LING 626: Computer-Assisted Language Testing
(Cross-listed with ENGL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ENGL 510 or LING 510, ENGL 511 or LING 511, ENGL 519 or LING 519
Principles and practice for the use and study of computers and the Internet in second language assessment.

LING 630: Seminar in Applied Linguistics
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable.
Prereq: ENGL 510 or LING 510, ENGL 511 or LING 511
Topic changes each semester. Topics include advanced methods in natural language processing, technology and literacy in a global context, feedback in CALL programs, technology and pronunciation, and advances in language assessment.

LING 688: Practicum in Technology and Applied Linguistics
(Cross-listed with ENGL). (1-5) Cr. 3. F.S.SS.
Prereq: ENGL 510 or LING 510, ENGL 626 or LING 626, or equivalent; at least 2nd year PhD student in Applied Linguistics and Technology
Focus on integrating theoretical knowledge with practical expertise. Assess client needs; develop, integrate, and evaluate solutions. Practical understanding of computer applications used in multimedia development. Create web-based or CD-ROM-based multimedia materials. Work with advanced authoring applications.

Management (MGMT)

Courses primarily for undergraduates:

MGMT 310: Entrepreneurship and Innovation
(3-0) Cr. 3. F.S.
Prereq: Sophomore classification
Review of the entrepreneurial process with emphasis on starting a new business. How to analyze opportunities, develop an innovative product, organize, finance, market, launch, and manage a new venture. Deals with the role of the entrepreneur and the importance of a business plan. Speakers and field project.

MGMT 313: Feasibility Analysis and Business Planning
(3-0) Cr. 3. F.S.
Prereq: MGMT 310
Developing an idea for a new business venture, conducting a feasibility study, researching the potential market, analyzing the competition, and writing a formal business plan. Basic business functions are discussed in terms of their application to conducting feasibility analysis and writing a business plan for an entrepreneurial venture.

MGMT 367: International Entrepreneurship
(3-0) Cr. 3.
Prereq: junior standing
The essentials of operating an entrepreneurial firm in an international environment. Topics include understanding the role of entrepreneurship in economic development, starting and developing a business in an international market, financing international ventures, international management issues and exchange rates.
Meets International Perspectives Requirement.

MGMT 370: Management of Organizations
(3-0) Cr. 3. F.S.SS.
Prereq: ECON 101 or ECON 102 or equivalent
A management functions approach is used to explain what managers do in organizations; how they deal with external constituents, how they structure their companies, and how they deal with employees. A contingency approach is used as a framework for understanding how to increase the effectiveness and efficiency of organizations in today's dynamic, highly competitive business environment.

MGMT 371: Organizational Behavior
(3-0) Cr. 3. F.S.
Prereq: MGMT 370
The study of individual attributes, interpersonal relations, and employee attitudes in organizations. Instructional emphasis is placed on how management concepts such as reward systems, job design, leadership, teams, etc., can be used to manage employee attitudes and behavior.

MGMT 372: Responsible Management and Leadership in Business
(3-0) Cr. 3. F.S.
Prereq: PHIL 230
Professional responsibilities of executives in terms of personal conduct and individual integrity, executive leadership style and values, formal organizational ethics policies, board and chief executive leadership roles, governance reform and ethics, corporate social responsibility, stakeholder management, strategies for sustainable development, pursuit of societal and corporate goals, and the manager as architect of corporate values and culture.

MGMT 377: Competitive Strategy
(3-0) Cr. 3. F.
Prereq: MGMT 370
Developing competitive strategy and achieving competitive advantage in firms, including: industry analysis, generic strategies, hypercompetition, competing against time, and building distinctive capabilities.

MGMT 410: Social Entrepreneurship
(3-0) Cr. 3. F.S.
Prereq: Sophomore classification
This course will introduce students to issues related to the role of social entrepreneurship in helping to solve social problems, including innovation, opportunity recognition, planning and the launch of new non-profit organizations.

MGMT 414: International Management
(3-0) Cr. 3. F.S.
The nature and economic role of the multinational firm and entrepreneurial ventures, including the impact of legal, political, and cultural variables upon firm performance and managerial activity; case studies illustrate interdependent nature of functional areas of business projected across national boundaries.

MGMT 415: Managing New Ventures
(3-0) Cr. 3. F.S.
Prereq: MGMT 310 or Business major with junior standing
Examination of business problems and main issues concerning new ventures. Students work in teams to identify problems in growing and new firms. The emphasis is on analyzing and solving an existing business problem. Includes a field project, a report, and a presentation to a business owner.

MGMT 419: Social Responsibility of Business
(3-0) Cr. 3. S.
A consideration of the role of business in society. Critical analysis of ethical, managerial, and public issues as they affect the corporation.

MGMT 471: Personnel and Human Resource Management
(3-0) Cr. 3. F.S.
Prereq: Junior standing
Recruitment and selection, utilization, and development of people in organizations. Examination of each personnel function; interrelationships among the functions.

MGMT 472: Management of Diversity
(3-0) Cr. 3. F.S.
Prereq: Junior classification
One of the most crucial problems in organizations today is the management of diversity. Attempts to define the difference between equal employment opportunity/affirmative action, which has a legal basis, and diversity which has an educational basis. Organized around the concepts of: (1) cultural diversity and cultural unity; (2) development of skills and tools to manage diversity; and (3) structure of diversity development programs in organizations.
Meets U.S. Diversity Requirement

MGMT 478: Strategic Management
(3-0) Cr. 3. F.S.SS.
Prereq: MGMT 370; ACCT 285; FIN 301; MKT 340; SCM 301; graduating senior
Strategy formulation, implementation, and evaluation and control in today's organizations. Emphasis is on strategic planning and decision making using the case method and/or projects.

MGMT 490: Independent Study
Cr. 1-3. Repeatable.
Prereq: MGMT 370, senior classification, permission of instructor

Courses primarily for graduate students, open to qualified undergraduates:

MGMT 502: Organizational Behavior
(3-0) Cr. 3. F.
Prereq: Enrollment in MBA program or departmental permission
Understanding human behavior in organizations and the nature of sustainable organizations from a managerial perspective. Special emphasis is placed on how individual differences, such as perceptions, personality, and motivation, influence individual and group behavior in organizations and on how behavior can be influenced by job design, leadership, groups, and the structure of organizations.

MGMT 503: Professional Responsibility in Business and Society
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or department permission, ACCT 501, FIN 501, MGMT 502, MKT 501
Ethical and social responsibilities of top managers in corporations. Topics include stakeholder management, corporate social responsibilities, strategies for sustainable development, pursuit of societal and corporate goals, board and chief executive leadership roles, governance reform and ethics, and executive leadership style and values. The presentation of course concepts is facilitated by the use of cases, discussion scenarios, and ethical dilemmas.

MGMT 504: Strategic Management
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission, ACCT 501, FIN 501, MGMT 502, MKT 501
Critical analysis of case studies in strategic management with an emphasis on integrative decision making. Strategy implementation in light of the global, legal, economic, cultural, and political contexts of business.

MGMT 565: Early Stage Entrepreneurship - Mind to Market
(3-0) Cr. 3.
Prereq: Graduate classification
Commercialization of new technology. Topics covered include market analysis, intellectual property, product development, feasibility analysis, and new business evaluation.

MGMT 566: Entrepreneurship and New Business Creation
(3-0) Cr. 3.
Prereq: Graduate classification or permission of instructor.
The essentials of starting and operating a new business. Topics include current research on entrepreneurial perspective, starting and developing a new business, financing the venture, managing the growing firm, and special issues.

MGMT 567: International Entrepreneurship
(3-0) Cr. 3.
Essentials of operating an entrepreneurial firm in an international environment. Topics include international entrepreneurship, starting and developing a business in an international market, financing international ventures, international management issues, exchange rates, and culture.

MGMT 569: Technology Entrepreneurship
(3-0) Cr. 3.
Prereq: Graduate standing or instructor's permission
Identification of high-potential, technology-intensive commercial opportunities, resources? gathering, and risk management under environmental uncertainty. Focus on technology ventures and firms that use technology strategically across several industries. Topics include key success factors and forecasting analysis across main value-chain activities.

MGMT 570: Managing Employee Attitudes and Behaviors
(3-0) Cr. 3. F.SS.
Prereq: MGMT 371 or MGMT 502 or PSYCH 450
Advanced topics germane to the management of individuals and groups over their work lives; sustained work commitment, motivation and job/career satisfaction, absenteeism, turnover, stress, leadership and career development (e.g., career ladders, mentoring).

MGMT 571: Seminar in Personnel and Human Resources Management
(3-0) Cr. 3. S.
Prereq: MGMT 371 or MGMT 502 or SOC 420
Topics and issues in personnel management with a focus on the management of human resources in organizations. Current personnel practices, philosophies, and behavioral science research.

MGMT 572: Personality and Management
(3-0) Cr. 3.
Prereq: Graduate standing or permission of instructor
Personality and individual differences have significant implications for human resource management, organizational behavior and strategic management. Research has shown that these characteristics affect many core management topics including motivation, leadership, and decision making. Surveys the literature relating personality and individual differences to management and organizations. Students will complete a wide variety of personality assessments and get their results, and reflect on how personality and individual differences can be practically relevant in the modern work environment.

MGMT 581: Contemporary Topics in Strategy
(3-0) Cr. 3. F.
Prereq: MGMT 504 or permission of instructor
Discussion of concepts and techniques used in long range strategic planning. Examination of planning practices in business and not-for-profit organizations. Topics include environmental scanning, industry analysis, forecasting, corporate and competitive strategies, and tactics.

MGMT 582: Corporate Governance and Top Management
(Cross-listed with ACCT). (3-0) Cr. 3.
Prereq: MGMT 503 or permission
Duties, structure, and functioning of top management teams and corporate boards of directors. CEO/board tenure and succession planning, top management compensation, board committee composition, assessment of CEO and board performance, theories of corporate governance, management of the corporate strategic agenda, governance codes, international governance, and chairman/CEO duality. Case studies and contemporary issues discussed.

MGMT 583: Strategic Management of Innovation
(3-0) Cr. 3.
Prereq: MGMT 504 or permission of instructor
Critical analysis and discussion of cases focused on strategic management of innovation. Assessment of a firm s innovative capabilities and competitive dynamics to manage innovative processes. Practical applications through emphasis on implementation including internal corporate venturing, management of the corporate R&D function, and institutionalization of innovation.

MGMT 584: Management Consulting
(3-0) Cr. 3.
Prereq: MGMT 504 or permission of instructor
Provides the opportunity for students to understand the role of the professional consultant, the issues facing the management consulting industry, the competencies of various management consulting firms, the nature and form of strategic consulting engagement, and the nature and scope of strategic change in business firms. Students will learn about management consulting functions and will practice the consultant role though cases and field studies.

MGMT 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
For students wishing to do individual research in a particular area of management.

Courses for graduate students:

MGMT 601: Philosophy of Science
(3-0) Cr. 3.
Prereq: enrollment in the PhD program
This course provides a philosophical introduction to the theoretical and empirical development of scientific knowledge. It focuses on a variety of basic problems common to the social sciences: the nature of explanation, the structure of theories, forms of knowledge, scientific laws, nature of theory and ethics. The purpose of the course is to help doctoral students define a research context by addressing the purposes, assumptions and primary components of scientific inquiry.

MGMT 602: Organizational Theory
(3-0) Cr. 3.
Prereq: enrollment in the PhD program
This seminar involves the examination of the core theories and perspectives in organizational theory, as well as their applications and extensions. This material addresses the fundamental rationale for organizations in modern society, basic processes of organizing and organizational structure, a consideration of inter-organizational relationships and the external environment, and a variety of factors that help determine organizational effectiveness.

MGMT 603: Strategic Management of Technology and Innovation
(3-0) Cr. 3.
Prereq: MGMT 601
This course will offer a critical review of organizational decision making with respect to technology and innovation. Students will learn how technological change can alter the basis of competition; how competitive strategy drives technology investment decisions; how market-orientation should be the other backbone of technological innovation; and best practices of organizing and managing the new product development process to achieve strategic goals.

MGMT 604: Seminar in Organizational Behavior
(3-0) Cr. 3.
Prereq: enrollment in the PhD program
The purpose of this seminar is to introduce behavioral science literature relevant to the study of behavior in organizational settings. The course will focus on the individual's role within organizations and cover topics such as individual differences, motivation, leadership, decision-making. Learning, risk taking, interpersonal relations, etc. Both theoretical and empirical contributions will be examined, with emphasis on integration of diverse theoretical perspectives.

MGMT 650: Research Practicum I
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a research manuscript to be submitted to a peer-reviewed academic journal. Students will work with a faculty mentor on a research project.

MGMT 651: Research Practicum
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a second research manuscript to be submitted to a peer-reviewed academic journal. Although students work under the supervision of a faculty mentor, the students will take independent responsibility for the research project.

MGMT 699: Dissertation
Cr. 1-12.
Prereq: Graduate classification, permission of dissertation supervisor
Research.

Management Information Systems (MIS)

Courses primarily for undergraduates:

MIS 207: Fundamentals of Computer Programming
(Cross-listed with COM S). (3-1) Cr. 3. F.S.
Prereq: MATH 150 or placement into MATH 140/MATH 141/MATH 142 or higher
An introduction to computer programming using an object-oriented programming language. Emphasis on the basics of good programming techniques and style. Extensive practice in designing, implementing, and debugging small programs. Use of abstract data types. Interactive and file I/O. Exceptions/error-handling. This course is not designed for computer science, software engineering, and computer engineering majors. Credit may not be applied toward graduation for both Com S 207/MIS 207 and Com S 227.

MIS 301: Management Information Systems
(3-0) Cr. 3.
Prereq: COM S 113 or BUSAD 150
The role of information technology in organizations. Overview of methodologies for design and development of systems including decision support systems, expert systems, data bases, end-user computing, etc. Computer applications relate concepts to practice. Lecture and laboratory work emphasizes the enabling role of IT in contemporary organizations.

MIS 307: Intermediate Business Programming
(3-0) Cr. 3.
Prereq: MIS 207/COM S 207 or COM S 227; credit or enrollment in MIS 301
Introduction to the concepts and use of data structures, file accesses and object oriented programming methodologies in contemporary business environments. Application development environments will be covered.

MIS 310: Information Systems Analysis
(3-0) Cr. 3.
Prereq: credit or enrollment in MIS 301
Critical analysis of business processes, data and process modeling, feasibility studies, CASE tools, and developing system design specifications.

MIS 320: Database Management Systems
(3-0) Cr. 3.
Prereq: Credit or enrollment in MIS 301
Database design, development, and implementation. Focus on data models, both classical and object oriented. Uses relational and/or object oriented database management systems.

MIS 340: Project Management
(Cross-listed with SCM). (3-0) Cr. 3.
Prereq: credit or enrollment in MIS 301
Equips students to support team activities in the general project management environment and better manage their careers. Practical experience using project management techniques and tools. Course topics include project initiation and execution, risk assessment, estimating and contracts, planning, human factors, and standard methods.

MIS 368: Spreadsheet-based Marketing Analytics
(Cross-listed with MKT). (3-0) Cr. 3. F.S.
Prereq: MKT 340
Use of spreadsheets to conduct various analyses to support marketing strategies. Topics include data visualization and exploration, marketing models and consultative problem-solving skills. Development of skills such as formulating problems, structuring and prioritizing problems, synthesizing results and communicating intuition from quantitative analyses.

MIS 407: Advanced Business Programming
(3-0) Cr. 3.
Prereq: MIS 307
Advanced software development and topics in contemporary programming languages. Topics include basic syntax, advanced programming techniques, file structures and management, database access, algorithm design, web forms and graphical user interfaces.

MIS 434: Electronic Commerce Strategy
(3-0) Cr. 3.
Prereq: MIS 301, MKT 340, SCM 301
Overview of business strategies and technologies used for electronic commerce. Emphasis is on the strategic, operational, and technical issues associated with global electronic commerce using class lecture/discussion and case studies.

MIS 435: Information Systems Infrastructure
(3-0) Cr. 3.
Prereq: MIS 301
Overview of Internet and telecommunications technology used in business applications. Understand Internet and network protocols, network and application architectures, design, and implementation.

MIS 436: Introduction to Business Analytics
(3-0) Cr. 3.
Prereq: MIS 320
Introduction to the field of business analytics (BA). Students will examine BA processes and techniques used in transforming data to knowledge and creating value for organizations. Business cases, presentations by business professionals, class lectures and discussions on data analysis, design and modeling, and extensive hands-on analytical exercises.

MIS 439: Topics in Management of Information Systems
(3-0) Cr. 3. Repeatable.
Prereq: MIS 301, permission of instructor
A variety of topics will be covered and topics may vary between semesters. Some of the topics are information resources management, electronic commerce, decision support systems, and expert systems.

MIS 440: Supply Chain Information Systems
(Cross-listed with SCM). (3-0) Cr. 3.
Prereq: MIS 301, SCM 301
Internal and inter-organizational information systems necessary for a supply chain to achieve competitive advantage. Topics include: design, development, implementation, and maintenance of supply chain information systems; enterprise resource planning; advanced planning and scheduling, manufacturing execution systems; and the interface between manufacturing planning and control processes, logistics processes, and the information system.

MIS 445: Enterprise Systems and Architecture
(3-0) Cr. 3.
Prereq: MIS 301
Contemporary theories, concepts, and practices in network infrastructure, network design, and information security. Design, install, and administer a complex network infrastructure. Study security threats and attacks and countermeasures. Investigate exposure to attacks, firewalls, and development of intrusion detection systems. Other security topics such as risk management, IT audit, and security regulations will also be addressed.

MIS 446: Advanced Business Analytics
(3-0) Cr. 3.
Prereq: MIS 320
Projects-based course which provides an in-depth understanding of BA methods of visualization, data mining, text mining, web-mining, and predictions through the use of specific BA tools. For students who are interested in understanding advanced techniques and applications of data analytics and acquiring hands-on skills for making intelligent business decisions in data-rich organizations.

MIS 447: Information Systems Development
(3-0) Cr. 3.
Prereq: MIS 301
Design of business systems using contemporary tools and methods such as SQL, CASE tools, OOD tools, etc. Focuses on synthesizing concepts from earlier MIS courses.

MIS 450: Enterprise Resource Planning Systems in Supply Chain
(Cross-listed with SCM). (3-0) Cr. 3.
Prereq: SCM 301, MIS 301 or I E 148, I E 341
Examination of the role of enterprise resource planning systems (ERP) in the supply chain. Hands-on experience with a major software application in use by many corporations to manage and improve the efficiency of their supply chains and operations. Students will develop a more process-centric perspective about how a supply chain operates and how ERP enables and supports such operations.

MIS 490: Independent Study
Cr. 1-3. Repeatable.
Prereq: MIS 301, senior classification, permission of instructor

MIS 495: Case Practicum
(3-0) Cr. 3. Repeatable, maximum of 2 times. F.S.
Prereq: MIS 301
Students explore different practical scenarios related information systems projects and cases. Students acquire necessary skills and knowledge to solve practical issues associated with presented cases and problems. Students compete at different venues around the country.

Courses primarily for graduate students, open to qualified undergraduates:

MIS 501: Management Information Systems
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission.
This course exposes the student to current theories and practices appropriate for understanding the role and application of information systems for individuals, organizations, and society within a globally competitive context. The course focuses on information technology and its uses in improving work practices, products, and tools for individuals and organizations. The course also addresses issues pertaining to current and emerging topics in the development and use of technology, the role of technology in and its alignment with organizational strategy and sustainable business practices, information system planning and the development of enterprise architectures, and human interface and personal characteristics in the design and use of technology.

MIS 532: Advanced Business Software Development
(3-0) Cr. 3.
Prereq: MIS 531 or equivalent
A survey of business-oriented programming languages with emphasis on state-of-the-art development techniques for business software. Topics include object-oriented and Internet programming issues and methods.

MIS 533: Data Management for Decision Makers
(3-0) Cr. 3.
Prereq: MIS 501
Addresses data needs of functions such as marketing, finance, and production. Advanced skills needed to design, develop and use database, data warehousing and data mining systems for effective decision support. Emphasis on importance of contemporary technologies.

MIS 534: Electronic Commerce
(3-0) Cr. 3.
Prereq: MIS 501
Overview of how modern communication technologies including the internet and world wide web have revolutionized the way we do business. Provides an understanding of various internet technologies and how companies are using the internet for commercial purposes. Explores future scenarios on the use of these technologies and their impact on various industries and the society.

MIS 535: Telecommunications Management
(3-0) Cr. 3.
Prereq: MIS 501
Issues involved in the management of telecommunications function. Overview of communications technology used in various business applications, local area network, wide area network, broad band network, wireless and voice networks. Internet technologies and protocols. Analyzing the strategic impact of these technologies on organizations. Strategic planning for telecommunications, including network planning and analysis.

MIS 536: Business Analytics Foundation
(3-0) Cr. 3.
Introduction to Business Analytics (BA) concepts and tools. Hands-on lab exercises and business case studies in data preparation, data querying and data visualization. Also covers various modeling techniques in predictive and prescriptive analytics.

MIS 537: Project Management
(3-0) Cr. 3.
Prereq: MIS 501
Prepares students to support team activities in the general project management environment and provides them with a working understanding of the full scope of project management activities. Students will also have practical experience using project management techniques and tools. Course topics include project initiation and execution, risk assessment, estimating and contracts, planning, human factors, and standard methods. The course follows the recommended content areas of the Project Management Institute, and provides students with a recognized foundational training in project management.

MIS 538: Business Process Systems
(3-0) Cr. 3.
Prereq: MIS 501
Examine current and historical perspectives on business process management. Topics include process identification, mapping, and improvement. Additional topics will address business process automation and integration, business process outsourcing. Investigate current and potential tools and methods for business process management. Include process management projects.

MIS 539: Topics in Management of Information Systems
(3-0) Cr. 3. Repeatable.
Prereq: MIS 501
A variety of topics may be offered in different semesters. Topics may include electronic commerce, information resources management, decision support systems, and expert systems.

MIS 546: Advanced Business Analytics
(3-0) Cr. 3. F.S.
An in-depth discussion of various advanced topics in Business Analytics (BA) such as Big Data Analytics, Text Analytics, and Web Analytics. Extensive hands-on exercises of using BA tools to solve real-world problems. Preparation for students' capstone projects.

MIS 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
For students wishing to do individual research in a particular area of MIS.

MIS 598: Research Seminar in Management Information Systems
(3-0) Cr. 3.
Prereq: Graduate classification
Examines issues such as the nature and content of information systems research; aspects of starting and pursuing research topics in information systems; exploring and understanding relevant research methods and tools. Develop preliminary research proposals.

MIS 599: Creative Component
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

Courses for graduate students:

MIS 601: Behavioral Issues in IS Research
(3-0) Cr. 3.
Prereq: MIS 501 or equivalent, enrollment in PhD program
The state of behavioral research in the IS function. MIS activities in an organization span the following three major areas: design and implementation of the MIS, use of the MIS, and management of the MIS function. Each of these processes is carried out at several levels: individual, group, organizational and inter-organizational. Identify behavioral issues of relevance for the cells defined by the process and level dimensions. Reading and discussion of the research literature surrounding the development, use, and implications of information technology.

MIS 602: Current Issues in IS Research
(3-0) Cr. 3.
Prereq: MIS 501 or equivalent, enrollment in PhD program
Three fundamental areas of Information Systems, namely, infrastructure, management, and processes. Infrastructure studies examine the IT architecture including computing, communication, data, and application. Management focuses on addressing the value added notion of IT. Finally processing addresses topics related to enabling role of IT in myriad of areas.

MIS 603: Seminar on IT Strategy and Structure
(3-0) Cr. 3.
Prereq: MIS 601
Strategic issues in IT management. Address issues such as aligning IT strategy with corporate strategy and functional strategies, IT structure, valuation, governance and control, and related topics. Provide students with research skills related to the boundary between IT and the firm's external environment.

MIS 604: Collaboration, Knowledge, and Intelligence in Organizations
(3-0) Cr. 3.
Prereq: MIS 601
Research issues in the emerging areas of collaboration, knowledge management, and enterprise intelligence. Topics will include emerging and contemporary technologies of Data Mining, Knowledge Discovery from Databases, Web Mining, organizational memory, and knowledge management.

MIS 650: Research Practicum I
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a research manuscript to be submitted to a peer-reviewed academic journal. Students will work with a faculty mentor on a research project.

MIS 651: Research Practicum II
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a second research manuscript to be submitted to a peer-reviewed academic journal. Although students work under the supervision of a faculty mentor, the students will take independent responsibility for the research project.

MIS 655: Organizational and Social Implications of Human Computer Interaction
(Cross-listed with HCI). (3-0) Cr. 3.
Prereq: Graduate classification
Examine opportunities and implications of information technologies and human computer interaction on social and organizational systems. Explore ethical and social issues appurtenant to human computer interaction, both from a proscriptive and prescriptive perspective. Develop informed perspective on human computer interaction. Implications on research and development programs.

MIS 699: Research
Cr. 3-6. Repeatable.
Prereq: Graduate classification, permission of dissertation supervisor
Research.

Marketing (MKT)

Courses primarily for undergraduates:

MKT 340: Principles of Marketing
(3-0) Cr. 3. F.S.SS.
Prereq: credit or current enrollment in ECON 101
The role of marketing in society. Markets, marketing institutions, and marketing functions with emphases on product, price, marketing communication, and marketing channel decisions.

MKT 343: Personal Sales
(3-0) Cr. 3.
Prereq: MKT 340
Analysis of the theory and practice of personal selling with the context of relationship marketing and salesforce automation. Topics include: goal setting, prospecting, time/territory management, questioning, presentations, objections, commitment and customer service; simulations of selling situations.

MKT 351: Services Marketing
(3-0) Cr. 3. F.
Prereq: MKT 340
In-depth appreciation and understanding of the unique challenges inherent in creating, managing, and delivering quality services. Students will be introduced to and have the opportunity to work with concepts, tools, and strategies that address these challenges.

MKT 368: Spreadsheet-based Marketing Analytics
(Cross-listed with MIS). (3-0) Cr. 3. F.S.
Prereq: MKT 340
Use of spreadsheets to conduct various analyses to support marketing strategies. Topics include data visualization and exploration, marketing models and consultative problem-solving skills. Development of skills such as formulating problems, structuring and prioritizing problems, synthesizing results and communicating intuition from quantitative analyses.

MKT 410: Promotional Strategy
(3-0) Cr. 3. F.S.
Prereq: Credit or enrollment in MKT 447
Principles, concepts, and problems involved in the development and implementation of promotional strategies. Coordination of a variety of promotional elements: advertising, sales promotion, direct marketing, public relations and publicity of web communications, and personal selling.

MKT 442: Sales Management
(3-0) Cr. 3. F.S.
Prereq: MKT 340
Functional aspects of sales force management; personal selling methods; procedures for recruiting, selecting, and training new salespeople; compensation and expense control systems; problems of sales force motivation and supervision; methods of territorial and quota assignment; sales department budgets; distributor-dealer relations; other selected topics.

MKT 443: Strategic Marketing Management
(3-0) Cr. 3. F.S.SS.
Prereq: MKT 444, MKT 447
Analysis of major elements of strategic marketing management. May include case studies or business simulations involving decision making using marketing tools from previous courses. (For marketing majors only.).

MKT 444: Marketing Research
(3-0) Cr. 3. F.S.
Prereq: MKT 340, STAT 226
Marketing research techniques: problem formulation, research design, questionnaire construction, sampling, data collection procedures, and analysis and interpretation of data related to marketing decisions.

MKT 445: Customer Relationship Management
(3-0) Cr. 3. F.S.
Prereq: MKT 340
Examines how customer data can be used to enhance decisions relating to acquisition, development and retention. Topics include customer lifetime value, customer as assets, customer loyalty programs and customization.

MKT 446: Retailing
(3-0) Cr. 3. F.S.
Prereq: MKT 340
Basic areas of retail management: buying, merchandising, retail promotion, store location, store layout, credit management, and inventory control. Emphasis on practical application of retail management principles.

MKT 447: Consumer Behavior
(3-0) Cr. 3. F.S.
Prereq: MKT 340
Study of how consumers select, purchase, use, and dispose of goods and services. Includes analyses of how markets and others influence these processes. Application of concepts and methods of the behavioral sciences to marketing management decision making.

MKT 448: Global Marketing
(3-0) Cr. 3. F.S.
Prereq: MKT 340
Marketing from a global perspective and familiarity with the problems and perspectives that global companies face. Concepts and principles of marketing strategies, market assessment, identify marketing opportunities, entry decision, emerging markets, effects of political, legal, economic and cultural environments, and decisions relating to segmentation, positioning, branding, product, price, distribution and promotions in a global setting.

MKT 449: Marketing Seminar
(3-0) Cr. 3.
Prereq: MKT 340
Analysis of current issues and problems in marketing with emphasis on new theoretical and methodological developments. Additional seminars may be offered.

MKT 451: Marketing Channels
(3-0) Cr. 3. F.S.
Prereq: MKT 340
Focuses on marketing channels, the downstream part of a value chain, companies that come together to bring products and services from their point of origin to the point of consumption. Topics include channel institutions, channel design, channel coordination and implementation. Highlights international and technological aspects of marketing channels so that students can successfully develop and manage marketing channels in a contemporary business environment.

MKT 453: Brand Management
(3-0) Cr. 3. F.S.
Prereq: MKT 447
Examines the role of brands and branding in market environments characterized by intense competition and consumer power. Covers issues relating to why branding is important to firms, what brands represent to consumers, and what should be done to manage them effectively.

MKT 490: Independent Study
Cr. 1-3. Repeatable.
Prereq: MKT 340, senior classification; permission of instructor

MKT 492: Comparative Marketing
(3-0) Cr. 3. SS.
Prereq: MKT 340
Provides experience to students in culture, social, economic, and political environment of marketing in a foreign country. Students complete a term project (e.g., a marketing plan) based on information collected in the foreign country. Students attend briefings by experts/officials of private and public organizations.

Courses primarily for graduate students, open to qualified undergraduates:

MKT 501: Marketing
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission
An analytical approach to the study of marketing issues and challenges of business firms and nonprofit organizations. Emphasis on the influence of the global marketplace and the marketing environment on marketing decision making; the determination of the organization's products, prices, channels and communication strategies; an orientation that ensures sustainability of marketing operations; and the organization's system for planning and controlling its marketing effort.

MKT 540: Advanced Marketing Management
(3-0) Cr. 3. F.S.
Prereq: MKT 501
Strategic marketing and decision making, with emphasis on cases utilizing qualitative and quantitative techniques and marketing models.

MKT 541: International Marketing
(3-0) Cr. 3. F.
Prereq: MKT 501, MKT 509
Scope and nature of global marketing operation; the context of international environment in which firms operate. Recent developments of international business activities, and a framework for better understanding of the basic forces driving international business and marketing operations. Development of market entry strategies and global marketing mix policies, as well as export operations. Organizational issues related to the globalization of the firm.

MKT 542: New Product Development and Marketing
(3-0) Cr. 3. S.
Prereq: MKT 501
Principles and concepts of new product development and introduction; decision areas include market definition and structure, idea generation, concept evaluation, test marketing, launch tracking, and global product planning; models and techniques of new product evaluation used by consumer product companies.

MKT 543: Services Marketing
(3-0) Cr. 3.
Prereq: MKT 501 and instructor permission
In-depth appreciation and understanding of the unique challenges inherent in managing and delivering quality services. Students will be introduced to and have the opportunity to work with tools and strategies that address these challenges.

MKT 544: Marketing Research
(3-0) Cr. 3. S.
Prereq: MKT 501, BUSAD 502 or STAT 401
Marketing research methods are examined with emphasis on the use of advanced research methods in business research. Application of advanced sampling, measurement, and data analysis methods in research on market segmentation, market structure, consumers' perceptions and decision processes, marketing communication, new product development, and pricing.

MKT 545: Integrated Marketing Communication
(3-0) Cr. 3.
Prereq: MKT 501
Introduces the student to the field of marketing communications. Covers a number of topics and areas essential for understanding how to design and evaluate communication strategies necessary for the successful marketing of products and services. An integrated marketing communications (IMC) perspective is employed in covering material, with a corresponding focus on various elements of an IMC strategy, including advertising, promotions, point-of-purchase communications, direct marketing techniques, and other topics.

MKT 546: Customer Relationship and Business-To-Business Marketing
(3-0) Cr. 3.
Prereq: MKT 501
Core concepts and issues involved in customer relationship strategy and management in consumer and business-to-business markets. Emphasis on customer opportunity analyses, customer relationship management tools and strategies.

MKT 547: Consumer Behavior
(3-0) Cr. 3. S.
Prereq: MKT 501
The behavior of consumers. Intensive review of literature from relevant disciplines. Applications of concepts and methods of the behavioral sciences to marketing management decision making.

MKT 549: Global Marketing Planning and Execution
(3-0) Cr. 3.
Prereq: MKT 501
Allows students to develop the ability to plan and execute a B2B business by integrating aspects of marketing with other business functions in the international context. Product strategy, innovation, foreign market entry, supply strategies for foreign markets, pricing strategy, market research, customer service, international payments, managing international subsidiaries, licensing, distribution strategy, and responding to changing international environmental conditions. Involves a simulation-based instruction in planning and managing an international B2B business.

MKT 551: Marketing Channels
(3-0) Cr. 3.
Prereq: MKT 501
Design of marketing channels, developing and managing relationships with resellers, and evaluating channel performance. Emphasis on international and technological aspects of marketing channels.

MKT 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
For students wishing to do individual research in a particular area of marketing.

Courses for graduate students:

MKT 601: Seminar in Consumer Behavior
(3-0) Cr. 3.
Prereq: MGMT 601
A rigorous foundation of the major conceptual and methodological paradigms in the consumer-behavior literature. Seeks to aid students in understanding the psychological, sociological, and anthropological roots of consumer behavior research. Read the latest research in the area reported in leading consumer behavior/psychology journals.

MKT 602: Marketing Strategy
(3-0) Cr. 3.
Prereq: MGMT 601
Review major contributions and recent developments in marketing strategy research and practice. Review commonly used modeling approaches and research methods to study strategic interaction between firms seeking to build competitive advantages. Provide an overview of empirical research regarding measurement, level and persistence of business success and implications of findings for theory and strategy development.

MKT 603: Customer Management Strategy and Implementation
(3-0) Cr. 3.
Prereq: Mkt 601
Addresses key strategy and implementation issues behind customer management. Topics such as typology of CM strategies, antecedents and outcomes; environmental and managerial influences on strategy formation; technology and impact on CM strategy; and value of CM strategy. Examine theories and concepts behind important CM issues such as customer satisfaction, customer loyalty and customer profitability.

MKT 604: Marketing Issues in Inter-Organizational Relations
(3-0) Cr. 3.
Prereq: MGMT 602
Inter-firm and network competition; relationship among suppliers, distributors, alliance partners, external employees, and internal employees. Theories including agency theory, network theory, relationship marketing, channels of distribution theories on cooperation versus competition, IOS theories.

MKT 644: Research Methods
(3-0) Cr. 3.
Prereq: Knowledge of introductory statistics, Stat 401, enrollment in the PhD program
Introduction to methodological issues that arise when addressing a wide variety of research questions in organizational and consumer studies. Address measurement issues (scales, reliability and construct validity), design (for experiments, surveys, or qualitative studies), sampling, and analysis (univariate and multivariate statistical procedures). Measurement issues in cross-cultural and international research will also be covered. It is assumed that students entering the course have knowledge of introductory statistics.

MKT 650: Research Practicum I
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a research manuscript to be submitted to a peer-reviewed academic journal. Students will work with a faculty mentor on a research project.

MKT 651: Research Practicum II
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a second research manuscript to be submitted to a peer-reviewed academic journal. Although students work under the supervision of a faculty mentor, the students will take independent responsibility for the research project.

MKT 699: Dissertation
Cr. 12.
Prereq: Graduate classification, permission of dissertation supervisor
Research.

Materials Engineering (MAT E)

Courses primarily for undergraduates:

MAT E 101: Materials Science & Engineering Learning Community Seminar
Cr. R. F.
Prereq: Enrollment in Materials Science Engineering Learning Community
Introduction to the Materials Science & Engineering Department and resources available to support student success. Offered on a satisfactory-fail basis only.

MAT E 214: Structural Characterization of Materials
(2-2) Cr. 3. F.S.
Prereq: MAT E 215, credit or enrollment in PHYS 221
Structural characterization of ceramic, electronic, polymeric and metallic materials. Techniques include optical and electron microscopy, x-ray diffraction, and thermal analysis. Identification of materials type, microstructure, and crystal structure.

MAT E 215: Introduction to Materials Science and Engineering I
(3-0) Cr. 3. F.S.
Prereq: Math 165 AND (CHEM 177 or CHEM 167)
Materials Engineering majors only. Structure and properties of ceramic, electronic, polymeric and metallic materials, emphasizing differences based on structure and bonding. Phase equilibria and phase transformations. Only one of Mat E 215, 273, or 392 may count toward graduation.

MAT E 215L: Introduction to Materials Science and Engineering I - Lab
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in MAT E 215 or MAT E 273 or MAT E 392
Materials Engineering majors only. Laboratory exercise in materials.

MAT E 216: Introduction to Materials Science and Engineering II
(3-0) Cr. 3. F.S.
Prereq: MAT E 215, Chem 178, Credit or enrollment in PHYS 222
Materials Engineering majors only. Fundamentals of ceramic, polymeric, and composite materials; degradation, electronic, thermal, magnetic, and optical properties of materials. Materials for energy, biomaterials, and nanomaterials.

MAT E 216L: Introduction to Materials Science and Engineering II - Lab
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in 216
Materials Engineering majors only. Laboratory exercise in materials.

MAT E 220: Globalization and Sustainability
(Cross-listed with ANTHR, ENV S, GLOBE, M E, SOC, T SC). (3-0) Cr. 3. F.S.
An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.
Meets International Perspectives Requirement.

MAT E 273: Principles of Materials Science and Engineering
(3-0) Cr. 3. F.S.SS.
Prereq: Sophomore classification; CHEM 167 or CHEM 177; MATH 165
Introduction to the structure and properties of engineering materials. Structure of crystalline solids and imperfections. Atomic diffusion. Mechanical properties and failure of ductile and brittle materials. Dislocations and strengthening mechanisms. Phase equilibria, phase transformations, microstructure development, and heat treatment principles of common metallurgical systems including steels and aluminum alloys. Structure and mechanical properties of ceramic, polymeric and composite materials. Thermal properties of materials. Corrosion and degradation. Basic electronic properties of materials. Engineering applications. Only one of Mat E 215, 272, 273. or 392 may count toward graduation

MAT E 311: Thermodynamics in Materials Engineering
(3-0) Cr. 3. F.
Prereq: CHEM 178, credit or enrollment in MAT E 216, PHYS 222, and MATH 267
Basic laws of thermodynamics applied to phase equilibria, transformations, and reactions in multicomponent multiphase materials systems; thermodynamic descriptions of heterogeneous systems; binary and ternary phase diagrams; interfaces, surfaces, and defects.

MAT E 314: Kinetics and Phase Equilibria in Materials
(3-0) Cr. 3. S.
Prereq: MAT E 216, MAT E 311
Kinetic phenomena and phase equilibria relevant to the origins and stability of microstructure in metallic, ceramic and polymeric systems. Application of thermodynamics to the understanding of stable and metastable phase equilibria, interfaces and their effects on stability: defects and diffusion, empirical rate equations for transformation kinetics, driving forces and kinetics of nucleation, diffusional and diffusionless phase transformations.

MAT E 316: Computational Methods in Materials
(3-0) Cr. 3. S.SS.
Prereq: MAT E 215
Use of mathematical and statistical computer tools for materials design and analysis. Applications of statistical principles to problems concerned with materials. Computer-assisted design of experiments.

MAT E 317: Introduction to Electronic Properties of Ceramic, Metallic, and Polymeric Materials
(3-0) Cr. 3. F.
Prereq: MAT E 216 and PHYS 222
Materials Engineering majors only. Introduction to electronic properties of materials and their practical applications. Classical conduction models and electronic properties of metallic and ceramic materials. Elementary quantum mechanics and band theory of electron states in solids. Quantum theory of metallic conduction. Elementary semiconductor theory and devices. Polarization and dielectric properties of materials. Electron conduction in polymeric systems. Magnetic properties and applications of metals and ceramics.

MAT E 321: Introduction to Ceramic Science
(3-0) Cr. 3. F.
Prereq: MAT E 216
Ceramic crystal structures, defects, diffusion and transport. Phase equilibria and microstructures. Thermal, electronic, optical and magnetic properties of ceramics.

MAT E 322: Introduction to Ceramic Processing
(2-3) Cr. 3. S.
Prereq: MAT E 216, MAT E 321
Synthesis and characterization of ceramic powders. Colloidal phenomena, rheology of suspensions, ceramic forming methods, and drying. High temperature ceramic reactions, liquid and solid-state sintering, grain growth, microstructure development. Processing/microstructure/property relationships.

MAT E 332: Semiconductor Materials and Devices
(Cross-listed with E E). (3-0) Cr. 3. S.
Prereq: PHYS 222; MAT E majors: MAT E 317; CPR E and E E majors: E E 230
Introduction to semiconductor material and device physics. Quantum mechanics and band theory of semiconductors. Charge carrier distributions, generation/recombination, transport properties. Physical and electrical properties and fabrication of semiconductor devices such as MOSFETs, bipolar transistors, laser diodes and LED's.

MAT E 334: Electronic & Magnetic Properties of Metallic Materials
(3-0) Cr. 3. S.
Prereq: MAT E 317
Electronic conduction in metals and the properties of conducting materials. Quantum mechanical behavior of free electrons and electrons in potentials wells, bonds and lattices. Development of the band theory of electron states in solids and the Free and Nearly Free Electron models. Density-of-states in energy bands and the Fermi-Dirac statistics of state occupancy. Quantum mechanical model of metallic conduction; Brillouin zones and Fermi surfaces. Additional topics include the thermal properties of metals, electron phase transitions in metallic alloys and the BCS theory of superconductivity. Classical and quantum mechanical treatment of the origins of magnetism in materials; orbital and spin angular momentum. Theory of magnetic behavior in dia-, para-magnetic, ferromagnetic materials.

MAT E 341: Metals Processing
(2-2) Cr. 3. F.
Prereq: 215 or 273 or 392, Mat E majors only
Theory and practice of metal processing, including casting; powder metallurgy; additive manufacturing; rolling; forging; extrusion; drawing; material removal; joining; surface modification; and heat treatment. Use of processing software.

MAT E 342: Structure/Property Relations in Nonferrous Metals
(3-0) Cr. 3. S.
Prereq: MAT E 215 or 273 or 392
Processing of metals and alloys to obtain desired mechanical properties by manipulation of their microstructure and composition of constituent phase(s). Relevance of defects to mechanical properties, plastic flow. Strengthening mechanisms in metals and alloys. Microstructure, heat treatment and mechanical properties of engineering alloys. Metal-matrix composites.

MAT E 348: Solidification Processes
(Cross-listed with I E). (2-2) Cr. 3. S.
Prereq: I E 248 and MAT E 273, or MAT E 215
Theory and applications related to metal casting, welding, polymer processing, powder metallurgy, and composites manufacturing, and related rapid manufacturing processes.

MAT E 351: Introduction to Polymeric Materials
(3-0) Cr. 3. S.
Prereq: MAT E 216, CHEM 331, credit or enrollment in Mat E 311
Introduction to polymeric materials, synthesis, structure and properties. Relationship between polymer composition, processing and properties.

MAT E 362: Principles of Nondestructive Testing
(Cross-listed with E M). (3-0) Cr. 3. S.
Prereq: PHYS 112 or PHYS 222
Radiography, ultrasonic testing, magnetic particle inspection, eddy current testing, dye penetrant inspection, and other techniques. Physical bases of tests, materials to which applicable, types of defects detectable, calibration standards, and reliability safety precautions.

MAT E 362L: Nondestructive Testing Laboratory
(Cross-listed with E M). (0-3) Cr. 1. S.
Prereq: Credit or enrollment in MAT E 362
Application of nondestructive testing techniques to the detection and sizing of flaws in materials and to the characterization of material's microstructure. Included are experiments in hardness, dye penetrant, magnetic particle, x-ray, ultrasonic and eddy current testing. Field trips to industrial laboratories.

MAT E 370: Toying with Technology
(Cross-listed with CPR E). (2-2) Cr. 3. F.S.
Prereq: C I 201 or C I 202
A project-based, hands-on learning course. Technology literacy, appreciation for technological innovations, principles behind many technological innovations, hands-on laboratory experiences based upon simple systems constructed out of LEGOs and controlled by small microcomputers. Future K-12 teachers will leave the course with complete lesson plans for use in their upcoming careers.

MAT E 391: Introduction to US Women's roles in Industry and Preparation for Summer Study
(3-0) Cr. 3. S.
Introduction to the historical role of women as related to US industry, family and community with emphasis on the years 1830 - 1945, but also related to the current climate. Topics completed in 392 with arranged lectures at Brunel University. Orientation for Brunel summer study program. Offered on a satisfactory-fail basis only. Credit for graduation allowable only upon completion of Mat E 392.
Meets U.S. Diversity Requirement

MAT E 392: Principles of Materials Science and Engineering
(3-0) Cr. 3. SS.
Prereq: MAT E 391, CHEM 167 or CHEM 177
Structure and properties of ceramic, electronic, polymeric and metallic materials, emphasizing differences based on structure and bonding. Phase equilibria and phase transformations. Taught on Brunel University campus. Only one of MAT E 215, 273, or 392 may count toward graduation.
Meets International Perspectives Requirement.

MAT E 394: Topics in Sustainable Engineering in Italy
(3-0) Cr. 3. S.
Prereq: Chem 167 or Chem 177
Fundamentals of sustainable engineering related to biofuels. Basics of food and biofuel chemistry and fluid dynamics. Preparation course for Italy as a case study for food and sustainable engineering. Orientation for summer study abroad program in Torino, Italy. Credit for graduation allowable only upon completion of the following summer's offering of Mat E 316 taught in Italy, along with additional sustainability lessons/tours.

MAT E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

MAT E 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

MAT E 401: Materials Engineering Professional Planning
Cr. R. F.
Prereq: Senior classification in materials engineering
Preparation for a career in materials engineering or graduate school; experiential learning, resumes, interviewing, Myers-Briggs Type Indicator, leadership, international opportunities, professional ethics, graduate school preparation and opportunities, and alternative career paths (med school, law school, etc.). Offered on a satisfactory-fail basis only.

MAT E 413: Materials Design and Professional Practice I
(2-2) Cr. 3. F.S.
Prereq: Senior status in Mat E
Fundamentals of materials engineering design, information sources, team behavior, professional preparation, quantitative design including finite-element analysis and computer aided design, materials selection, informatics and combinatorial methods. Analysis of design problems, development of solutions, selected case studies. Oral presentation skills. Preparations for spring project.

MAT E 414: Materials Design and Professional Practice II
(2-2) Cr. 3. F.S.
Prereq: Senior status in Mat E
Integration of materials processing, structure/composition, properties and performance principles in materials engineering problems. Multi-scale design of materials, materials processing, case studies including cost analysis, ethics, risk and safety. Team projects specified by either industry or academic partners. Written and oral final project reports.

MAT E 418: Mechanical Behavior of Materials
(3-0) Cr. 3. F.
Prereq: MAT E 216
Mechanical behavior of ceramics, metals, polymers, and composites. Relationships between materials processing and atomic aspects of elasticity, plasticity, fracture, and fatigue. Life prediction, stress-and failure analysis.

MAT E 425: Glass Science and Engineering
(2-3) Cr. 3. F.
Prereq: MAT E 216, MAT E 321
Composition, structure, properties manufacturing, and applications of inorganic glasses. Mechanical, structural, thermal, optical, ionic, electronic, and biological applications of inorganic glasses, especially silicate glasses. Contemporary topics in glass science and engineering such as glass optical fiber communication and flat panel display technologies. Laboratory exercises in the preparation and characterization of silicate glasses.

MAT E 432: Microelectronics Fabrication Techniques
(Dual-listed with M S E 532). (Cross-listed with E E). (2-4) Cr. 4.
Prereq: credit or enrollment in E E 332
Techniques used in modern integrated circuit fabrication, including diffusion, oxidation, ion implantation, lithography, evaporation, sputtering, chemical-vapor deposition, and etching. Process integration. Process evaluation and final device testing. Extensive laboratory exercises utilizing fabrication methods to build electronic devices. Use of computer simulation tools for predicting processing outcomes. Recent advances in processing CMOS ICs and micro-electro-mechanical systems (MEMS).

MAT E 433: Advanced Electronic Materials
(2-3) Cr. 3. S.
Prereq: MAT E 317
Charged point defects and formation equations. Non-stoichiometric conductors, dielectric, ferroelectric, and piezoelectric materials and applications. Optical properties, optical spectra of materials, optoelectronic devices. Magnetic and superconducting materials. Contemporary topics in advanced ceramics.

MAT E 443: Physical Metallurgy of Ferrous Alloys
(2-3) Cr. 3. S.
Prereq: 214, 216, 314
Production and processing of ferrous metals. Extraction of pig iron from ore. Steelmaking processes. Equilibrium and nonequilibrium phases in the Fe-C system. Properties and processing of cast irons, plain carbon and alloy steels, stainless and specialty steels. Transformation diagrams, hardenability, and surface treatments. Continuous casting, forging, hot rolling, quenching, and tempering as they apply to ferrous materials. Cost and mechanical performance considerations in cast iron and steel selection and heat treatment.

MAT E 444: Corrosion and Failure Analysis
(2-2) Cr. 3. S.
Prereq: MAT E 215 or 273 or 392 and credit or enrollment in MAT E 418
Corrosion and corrosion control of metallic systems. Corrosion fundamentals, classification of different types of metallic corrosion, corrosion properties of various engineering alloys, corrosion control. Failure analysis. Characteristics of common types of metallic failures, case studies of failures, designing to reduce failure risk.

MAT E 449: Structural Health Monitoring
(Dual-listed with M S E 549). (Cross-listed with C E). (3-0) Cr. 3.
Prereq: Senior classification in Engineering or permission of instructor
Introductory and advanced topics in structural health monitoring (SHM) of aeronautical, civil, and mechanical systems. Topics include sensors, signal processing in time and frequency domains, data acquisition and transmission systems, design of integrated SHM solutions, nodestructive evaluation techniques, feature extraction methods, and cutting edge research in the field of SHM. Graduate students will have a supervisory role to assist students in 449 and an additional design project or more in-depth analysis and design.

MAT E 453: Physical and Mechanical Properties of Polymers
(2-3) Cr. 3. F.
Prereq: MAT E 351
Overview of polymer chemical composition, microstructure, thermal and mechanical properties, rheology, and principles of polymer materials selection. Intensive laboratory experiments include chemical composition studies, microstructural characterization, thermal analysis, and mechanical testing.

MAT E 454: Polymer Composites and Processing
(Dual-listed with M S E 554). (3-0) Cr. 3. S.
Prereq: MAT E 351
Basic concepts in polymer composites, blends, and block copolymers. Phase separation and miscibility, microstructures and mechanical behavior. Fiber reinforced and laminated composites. Viscosity, rheology, viscoelasticity of polymers. Polymer melt processing methods such as injection molding and extrusion; selection of suitable processing methods and their applications.

MAT E 456: Biomaterials
(Dual-listed with M S E 556). (Cross-listed with B M E). (3-0) Cr. 3. F.
Prereq: MAT E 216 or MAT E 273 or MAT E 392
Presentation of the basic chemical and physical properties of biomaterials, including metals, ceramics, and polymers, as they are related to their manipulation by the engineer for incorporation into living systems. Role of microstructure properties in the choice of biomaterials and design of artificial organs, implants, and prostheses.

MAT E 457: Chemical and Physical Metallurgy of Rare Earth Metals
(Dual-listed with M S E 557). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MAT E 311 or CHEM 325 AND CHEM 324 or PHYS 322
Electronic configuration, valence states, minerals, ores, beneficiation, extraction, separation, metal preparation and purification. Crystal structures, phase transformations and polymorphism, and thermochemical properties of rare earth metals. Chemical properties: inorganic and organometallic compounds, alloy chemistry, nature of the chemical bonding. Physical properties: mechanical and elastic properties, magnetic properties, resistivity, and superconductivity.

MAT E 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, AER E, B M E, CPR E, E E, ENGR, I E, M E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

MAT E 467: Multidisciplinary Engineering Design II
(Cross-listed with AER E, CPR E, E E, ENGR, I E, M E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: Student must be within two semesters of graduation or receive permission of instructor.
Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

MAT E 481: Computational Modeling of Materials
(Dual-listed with M S E 581). (3-0) Cr. 3. F.
Prereq: Math 265 and (MatE 311 or ChE 381 or Chem 325 or Phys 304)
Introduction to the basic methods used in the computational modeling and simulation of materials, from atomistic simulations to methods at the mesoscale. Students will be expected to develop and run sample programs. Topics to be covered include, for example, electronic structure calculations, molecular dynamics, Monte Carlo, phase-field methods, etc.

MAT E 488: Eddy Current Nondestructive Evaluation
(Dual-listed with M S E 588). (Cross-listed with E E). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 265 and (MAT E 216 or MAT E 273 or E E 311 or PHYS 364)
Electromagnetic fields of various eddy current probes. Probe field interaction with conductors, cracks and other material defects. Ferromagnetic materials. Layered conductors. Elementary inversion of probe signals to characterize defects. Special techniques including remote-field, transient, potential drop nondestructive evaluation and the use of Hall sensors. Practical assignments using a 'virtual' eddy current instrument will demonstrate key concepts.

MAT E 490: Independent Study
Cr. arr. Repeatable.
Investigation of individual research or special topics.

MAT E 490C: Independent Study: Approved Student Submitted Proposal
Cr. arr. Repeatable. F.S.SS.
Prereq: permission of department
Independent study that is being proposed to be used toward graduation or minor requirements. This requires a proposal to the department's Curriculum Committee before the semester starts.

MAT E 490H: Independent Study: Senior Honors Project
Cr. arr. F.S.SS.
Prereq: permission of department
Independent study that is being proposed to be used for a Senior Honors Project (2 credits) and possibly for extra credits toward graduation or minor requirements. This requires a proposal to the department's Curriculum Committee before the semester starts.

MAT E 490R: Independent Study: Research
Cr. arr. F.S.SS.
Prereq: permission of department
Independent study that is being proposed strictly to gain research experience and the credits will not be used toward graduation or minor requirements. This requires a proposal to the department's Curriculum Committee before the semester starts.

Materials Science and Engineering (M S E)

Courses primarily for graduate students, open to qualified undergraduates:

M S E 510: Fundamentals of Structure and Chemistry of Materials
(3-0) Cr. 3. F.
Prereq: MATH 165, PHYS 221, and CHEM 167
Geometric and algebraic representations of symmetry. Pair distribution function. Structure, chemistry, and basic properties of covalent, ionic, and metallic solids, glasses and liquids, and polymers. Interactions of materials with particles and waves. Relationships between direct and reciprocal spaces. The kinematical theory of diffraction, with an introduction to the dynamical theory.

M S E 519: Magnetism and Magnetic Materials
(Cross-listed with E E). (3-0) Cr. 3. F.
Prereq: E E 311 or MAT E 317 or PHYS 364
Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, magnetic measurements of properties for materials evaluation.

M S E 520: Thermodynamics and Kinetics in Multicomponent Materials
(3-0) Cr. 3. F.
Prereq: MAT E 311 or CHEM 321, MATH 266 or MATH 267
A review of the fundamental principles of heat, work, basic thermodynamic relations, and criteria for equilibrium. Analytical treatments for the thermodynamic description of multicomponent chemical solutions and reacting systems are developed and employed to predict phase equilibria in materials systems. Builds on the thermodynamic construction to treat the kinetics of chemical reactions and phase transformations. Topics include general first order and second order transitions, along with chemical diffusion. Detailed examples involving nucleation and diffusion limited growth, spinodal decomposition, martensitic transformations, magnetic and electric transitions, and glass formation will be considered.

M S E 521: Mechanical Behavior and Manufacturing of Polymers and Composites
(Cross-listed with M E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M E 324 or MAT E 272 and E M 324
Effect of chemical structure and morphology on properties. Linear viscoelasticity, damping and stress relaxation phenomena. Structure and mechanics of filler and fiber reinforced composites. Mechanical properties and failure mechanisms. Material selection and designing with polymers. Processing of polymer and composite parts.

M S E 530: Solid State Science
(3-0) Cr. 3. S.
Prereq: MAT E 334 or E E 332 or PHYS 322
Development of a quantitative description of the electronic structure of solids starting with fundamentals of atoms, atomic bonding, basic crystallography, and band theory of solids. Continuum properties of solids in response to electromagnetic fields and thermal gradients. Quantitative description of the atomistic properties of solids through electron-electron interactions, electron-phonon interactions, and dipole interactions.

M S E 532: Microelectronics Fabrication Techniques
(Dual-listed with MAT E 432). (Cross-listed with E E). (2-4) Cr. 4.
Prereq: credit or enrollment in E E 332
Techniques used in modern integrated circuit fabrication, including diffusion, oxidation, ion implantation, lithography, evaporation, sputtering, chemical-vapor deposition, and etching. Process integration. Process evaluation and final device testing. Extensive laboratory exercises utilizing fabrication methods to build electronic devices. Use of computer simulation tools for predicting processing outcomes. Recent advances in processing CMOS ICs and micro-electro-mechanical systems (MEMS).

M S E 540: Mechanical Behavior of Materials
(3-0) Cr. 3. F.
Prereq: MAT E 418, MATH 266 or MATH 267
Mechanical behavior of materials with emphasis on micromechanics of deformation in three generic regimes: elasticity, plasticity, and fracture. A materials science approach is followed to understand and model the mechanical behavior that combines continuum mechanics, thermodynamics, kinetics, and microstructure. Some topics include elastic properties of materials, permanent deformation mechanisms at different temperatures (e.g., via dislocation motion and creep), and fracture in ductile and brittle materials. Specific classes of materials that are studied: metals, ceramics, polymers, glasses and composites.

M S E 549: Structural Health Monitoring
(Dual-listed with MAT E 449). (Cross-listed with C E). (3-0) Cr. 3.
Prereq: Senior classification in Engineering or permission of instructor
Introductory and advanced topics in structural health monitoring (SHM) of aeronautical, civil, and mechanical systems. Topics include sensors, signal processing in time and frequency domains, data acquisition and transmission systems, design of integrated SHM solutions, nodestructive evaluation techniques, feature extraction methods, and cutting edge research in the field of SHM. Graduate students will have a supervisory role to assist students in 449 and an additional design project or more in-depth analysis and design.

M S E 550: Nondestructive Evaluation
(Cross-listed with E M). (3-2) Cr. 4. S.
Prereq: E M 324, MATH 385
Principles of five basic NDE methods and their application in engineering inspections. Materials behavior and simple failure analysis. NDE reliability, and damage-tolerant design. Advanced methods such as acoustic microscopy, laser ultrasonics, thermal waves, and computed tomography are analyzed. Computer-based experiments on a selection of methods: ultrasonics, eddy currents, x-rays are assigned for student completion.

M S E 551: Characterization Methods in Materials Science
(2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MAT E 214
Characterization of ceramic, metal, polymer and glassy materials using modern analytical techniques. Spectroscopic (IR, Raman, UV/VIS/NIR, and NMR), thermal (DSC, DTA/TGA, and DMA) methods, mechanical and rheological testing, magnetic and electrical characterization, and powder characterization.

M S E 552: Scanning and Auger Electron Microscopy
(2-3) Cr. 3. F.
Prereq: PHYS 222
Characterization of materials using scanning electron microscope (SEM), electron microprobe, and auger spectrometer. Compositional determination using energy and wavelength dispersive x-ray and Auger spectroscopies. Specimen preparation. Laboratory covers SEM operation.

M S E 554: Polymer Composites and Processing
(Dual-listed with MAT E 454). (3-0) Cr. 3. S.
Prereq: MAT E 351
Basic concepts in polymer composites, blends, and block copolymers. Phase separation and miscibility, microstructures and mechanical behavior. Fiber reinforced and laminated composites. Viscosity, rheology, viscoelasticity of polymers. Polymer melt processing methods such as injection molding and extrusion; selection of suitable processing methods and their applications.

M S E 556: Biomaterials
(Dual-listed with MAT E 456). (3-0) Cr. 3. F.
Prereq: MAT E 216 or MAT E 273 or MAT E 392
Presentation of the basic chemical and physical properties of biomaterials, including metals, ceramics, and polymers, as they are related to their manipulation by the engineer for incorporation into living systems. Role of microstructure properties in the choice of biomaterials and design of artificial organs, implants, and prostheses.

M S E 557: Chemical and Physical Metallurgy of Rare Earth Metals
(Dual-listed with MAT E 457). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MAT E 311 or CHEM 325 AND CHEM 324 or PHYS 322
Electronic configuration, valence states, minerals, ores, beneficiation, extraction, separation, metal preparation and purification. Crystal structures, phase transformations and polymorphism, and thermochemical properties of rare earth metals. Chemical properties: inorganic and organometallic compounds, alloy chemistry, nature of the chemical bonding. Physical properties: mechanical and elastic properties, magnetic properties, resistivity, and superconductivity.

M S E 564: Fracture and Fatigue
(Cross-listed with AER E, E M, M E). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324 and either MAT E 216 or MAT E 273 or MAT E 392.
Undergraduates: Permission of instructor
Materials and mechanics approach to fracture and fatigue.
Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue.

M S E 569: Mechanics of Composite and Combined Materials
(Cross-listed with AER E, E M). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E M 324
Mechanics of fiber-reinforced materials. Micromechanics of lamina. Macromechanical behavior of lamina and laminates. Strength and interlaminar stresses of laminates. Failure criteria. Stress analysis of laminates. Thermal moisture and residual stresses. Joints in composites.

M S E 581: Computational Modeling of Materials
(Dual-listed with MAT E 481). (3-0) Cr. 3. F.
Prereq: Math 265 and (MatE 311 or ChE 381 or Chem 325 or Phys 304)
Introduction to the basic methods used in the computational modeling and simulation of materials, from atomistic simulations to methods at the mesoscale. Students will be expected to develop and run sample programs. Topics to be covered include, for example, electronic structure calculations, molecular dynamics, Monte Carlo, phase-field methods, etc.

M S E 588: Eddy Current Nondestructive Evaluation
(Dual-listed with MAT E 488). (Cross-listed with E E). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 265 and (MAT E 216 or MAT E 273 or E E 311 or PHYS 364)
Electromagnetic fields of various eddy current probes. Probe field interaction with conductors, cracks and other material defects. Ferromagnetic materials. Layered conductors. Elementary inversion of probe signals to characterize defects. Special techniques including remote-field, transient, potential drop nondestructive evaluation and the use of Hall sensors. Practical assignments using a 'virtual' eddy current instrument will demonstrate key concepts.

M S E 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor

M S E 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

M S E 601: Materials Seminar
(1-0) Cr. 1. Repeatable. F.S.
Prereq: MSE Graduate Student Status
Seminar course - presentations given on a weekly basis by leading U.S. and International researchers that are experts in their respective fields closely related to Materials Science. Offered on a satisfactory-fail basis only.

M S E 620: Fundamentals of Phase Transformations
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: M S E 520
Explores various advanced theoretical treatments of the energetics and kinetics of multicomponent materials. Topics include analytical and computational descriptions of thermodynamic quantities, experimental measurement of essential physical properties, analytical and computational treatments of kinetic processes, and the use of theoretical predictions of phase equilibria and evolution in materials systems.

M S E 630: Physical Properties of Solids
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: M S E 530
Advanced course in the behavior of solids within the framework of solid state physics and chemistry. Includes magnetic, dielectric, transport, and optical phenomena in solids. Influence of phase transformations and crystal symmetry on the physical properties.

M S E 651: Powder Diffraction Methods
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M S E 510
Advanced structural characterization of materials using powder diffraction. Production of X-ray and neutron radiation. Review of symmetry, group and kinematical theories of diffraction. Mathematical and computational backgrounds of powder diffraction data. Introduction to single crystal diffraction methods, origin of powder diffraction pattern, history of the technique. Modern powder diffraction methods. Indexing of powder diffraction patterns, figures of merit, precise lattice parameters. Phase problem, determining crystal structures from symmetry and geometry, Patterson, direct and Fourier methods. Rietveled method, precise crystal structures: atomic parameters, qualitative and quantitative phase identification, preferred orientation, grain size, strain, residual stress, order-disorder. Powder diffraction at non-ambient conditions. Applications of powder diffraction: data bases, phase transformations, phase diagrams, local structures, magnetism.

M S E 652: Transmission Electron Microscopy
(2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M S E 510
Theory and application of transmission electron microscopy to inorganic materials. Specimen preparation, selected area and convergent beam electron diffraction, bright field/dark field/high resolution imaging. Compositional analysis using X-ray and electron energy loss spectroscopy.

M S E 690: Advanced Topics in Materials Science
Cr. arr. Repeatable.
Prereq: Permission of instructor

M S E 697: Engineering Internship
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of department, graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

M S E 699: Research
Cr. arr. Repeatable.

Mathematics (MATH)

Courses primarily for undergraduates:

MATH 010: High School Algebra
(4-0) Cr. 0. F.S.
For students who do not have adequate facility with topics from high school algebra or do not meet the algebra admission requirement. The course is divided into tracks of one- and two-semester lengths. For most students a diagnostic exam will determine which track must be taken. Students will receive a grade in MATH 25 or MATH 30 respectively depending on the level of material covered. Satisfactory completion of MATH 30 is recommended for students planning to take MATH 140, MATH 143, MATH 145, MATH 150, or MATH 151, while MATH 25 is sufficient for MATH 104, MATH 105, MATH 195, STAT 101 or STAT 105. Students must complete MATH 30 to remove a deficiency in the algebra admission requirement. Topics include signed numbers, polynomials, rational and radical expressions, exponential and logarithmic expressions, and equations. Offered on a satisfactory-fail basis only.

MATH 025: High School Algebra
(4-0) Cr. 0. F.S.
Students should initially enroll in MATH 10. See description of MATH 10. Offered on a satisfactory-fail basis only.

MATH 030: High School Algebra
(4-0) Cr. 0. F.S.
Students should initially enroll in MATH 10. See description of MATH 10. Offered on a satisfactory-fail basis only.

MATH 101: Orientation in Mathematics
(1-0) Cr. 1. F.S.
For new majors. Campus resources and opportunities available to students. Careers and programs of study in mathematics. Mathematical reasoning, culture and resources. Description of main branches of mathematics. Offered on a satisfactory-fail basis only.

MATH 104: Introduction to Probability
(3-0) Cr. 3. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry
Permutations, combinations, probability, expected value, and applications. Either MATH 104 or MATH 150 may be counted toward graduation, but not both.

MATH 105: Introduction to Mathematical Ideas
(3-0) Cr. 3. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry.
Introduction to contemporary mathematics with an emphasis on use of mathematics to solve real world problems. Typical topics are the mathematics of voting, methods of fair division and apportionment, and elementary game theory.

MATH 106: Discovering Mathematics
(3-0) Cr. 3. F.S.
Inquiry-based approach to mathematics, emphasizing the art, history, and beauty of the subject. Typical topics are mathematics from art, music, puzzles, patterns, and reasoning.

MATH 140: College Algebra
(3-1) Cr. 3. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry; or MATH 30.
Coordinate geometry, quadratic and polynomial equations, functions, graphing, rational functions, exponential and logarithmic functions, inverse functions, quadratic inequalities, systems of linear equations. Prepares students for MATH 160. Students in the College of Liberal Arts and Sciences may not count MATH 140 toward the General Education Requirements.

MATH 143: Preparation for Calculus
(4-0) Cr. 4. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry; or MATH 140.
Preparation for MATH 160, MATH 165, and MATH 181. Functions, graphing, basic trigonometry, logarithms, exponentials. Emphasis on co-variational reasoning. Students in the College of Liberal Arts and Sciences may not count MATH 143 toward General Education Requirements. Only one of MATH 143 and MATH 145 may count toward graduation.

MATH 145: Applied Trigonometry
(3-0) Cr. 3. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry; or minimum of C- in MATH 140.
Mathematical ideas regarding the conception of space. General trigonometry, with an emphasis on the calculation of lengths, areas, and angles. The Law of Sines and the Law of Cosines. Polar, cylindrical, and spherical coordinate systems. Conic sections and quadric surfaces. Students in the College of Liberal Arts and Sciences may not count MATH 145 toward the General Education Requirements. Only one of MATH 143 and MATH 145 may count toward graduation.

MATH 150: Discrete Mathematics for Business and Social Sciences
(2-1) Cr. 3. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry
Linear equations and inequalities, matrix algebra, linear programming, discrete probability. Either MATH 104 or MATH 150 may be counted toward graduation, but not both.

MATH 151: Calculus for Business and Social Sciences
(2-1) Cr. 3. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry
Differential calculus, applications to max-min problems, integral calculus and applications. Will not serve as prerequisite for MATH 265 or MATH 266. Only one of MATH 151, MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 160: Survey of Calculus
(4-0) Cr. 4. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of geometry; or MATH 143; or MATH 140
Analytic geometry, derivatives and integrals of elementary functions, simple differential equations, and applications. Will not serve as a prerequisite for MATH 265 or MATH 266. Only one of MATH 151, MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 165: Calculus I
(4-0) Cr. 4. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of geometry, 1 semester of trigonometry; or MATH 143
Differential calculus, applications of the derivative, introduction to integral calculus. Only one of MATH 151 or MATH 160 or the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 166: Calculus II
(4-0) Cr. 4. F.S.SS.
Prereq: Minimum of C- in MATH 165 or high math placement scores
Integral calculus, applications of the integral, infinite series, parametric curves and polar coordinates. Only one of MATH 151, MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 166H: Calculus II, Honors
(4-0) Cr. 4. F.
Prereq: Permission of instructor and MATH 165 or high math placement scores
Integral calculus, applications of the integral, infinite series, parametric curves, and polar coordinates. Additional material of a theoretical, conceptual, computational, or modeling nature. Some of the work may require more ingenuity than is required for MATH 166. Preference will be given to students in the University Honors Program. Only one of MATH 151 or MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 181: Calculus and Mathematical Modeling for the Life Sciences I
(4-0) Cr. 4. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry, 1 semester of trigonometry; or MATH 143
Exponential and logarithm functions, difference equations, derivatives, and applications of the derivative. Examples taken from biology. Only one of MATH 151, MATH 160, the sequence MATH 165- MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 182: Calculus and Mathematical Modeling for the Life Sciences II
(4-0) Cr. 4. S.
Prereq: MATH 181
Integration, first and second order differential equations, applications of the definite integral, introduction to multivariable calculus. Examples taken from biology. Only one of MATH 151, MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 195: Mathematics for Elementary Education I

(2-2) Cr. 3. F.S.

Prereq: Satisfactory performance on placement assessment, 2 years high school algebra, 1 year of high school geometry, enrollment in elementary education or early childhood education

Whole number operations through analysis of properties, theoretical and hands-on models, mathematical analysis of elementary students' thinking; standard and non-standard algorithms; structure of the decimal system; linear measurement; two- and three-dimensional geometric shapes and spatial sense; number theory; algebra as it relates to elementary curricula/teaching profession. Students in the College of Liberal Arts and Sciences may not count MATH 195 toward General Education Requirements.

MATH 196: Mathematics for Elementary Education II

(2-2) Cr. 3. F.S.

Prereq: Minimum of C- in MATH 195 and enrollment in elementary education or early childhood education.

Integer, fraction and decimal operations through analysis of properties, theoretical and hands-on models, mathematical analysis of elementary students' thinking; standard and non-standard algorithms; two- and three-dimensional measurement; probability and statistics; proportional reasoning; algebra as it relates to elementary curricula/teaching profession.

MATH 201: Introduction to Proofs

(3-0) Cr. 3. F.S.

Prereq: MATH 166 or MATH 166H

Logic and techniques of proof including induction. Communicating mathematics. Writing proofs about sets, functions, real numbers, limits, sequences, infinite series and continuous functions.

MATH 207: Matrices and Linear Algebra

(3-0) Cr. 3. F.S.SS.

Prereq: 2 semesters of calculus

Systems of linear equations, determinants, vector spaces, linear transformations, orthogonality, least-squares methods, eigenvalues and eigenvectors. Emphasis on applications and techniques. Only one of MATH 207 and MATH 317 may be counted toward graduation.

MATH 265: Calculus III

(4-0) Cr. 4. F.S.SS.

Prereq: Minimum of C- in MATH 166 or MATH 166H

Analytic geometry and vectors, differential calculus of functions of several variables, multiple integrals, vector calculus.

MATH 265H: Calculus III, Honors

(4-0) Cr. 4. F.S.

Prereq: Permission of the instructor; and MATH 166 or MATH 166H

Analytic geometry and vectors, differential calculus of functions of several variables, multiple integrals, vector calculus. Additional material of a theoretical, conceptual, computational, or modeling nature. Some of the work may require more ingenuity than is required in MATH 265. Preference will be given to students in the University Honors Program.

MATH 266: Elementary Differential Equations

(3-0) Cr. 3. F.S.SS.

Prereq: Minimum of C- in MATH 166 or MATH 166H

Solution methods for ordinary differential equations. First order equations, linear equations, constant coefficient equations. Eigenvalue methods for systems of first order linear equations. Introduction to stability and phase plane analysis.

MATH 267: Elementary Differential Equations and Laplace Transforms

(4-0) Cr. 4. F.S.SS.

Prereq: Minimum of C- in MATH 166 or MATH 166H

Same as MATH 266 but also including Laplace transforms and series solutions to ordinary differential equations.

MATH 268: Laplace Transforms

(1-0) Cr. 1. F.S.SS.

Prereq: MATH 266

Laplace transforms and series solutions to ordinary differential equations. Together, MATH 266 and MATH 268 are the same as MATH 267.

MATH 269: Systems of Differential Equations

(1-0) Cr. 1. F.S.SS.

Prereq: Familiarity with ordinary differential equations of first and second order, permission of department.

Systems portion of MATH 266 and MATH 267: Eigenvalue methods for systems of first order linear equations. Introduction to stability and phase plane analysis. For students supplementing transfer courses in differential equations in order to earn credit in MATH 266 or 267. Students with credit in MATH 266 or MATH 267 may not earn credit in MATH 269.

MATH 290: Independent Study

Cr. 1-3. Repeatable.

Prereq: Permission of the instructor.

Independent study.

MATH 290H: Independent Study, Honors

Cr. 1-3. Repeatable.

Prereq: Permission of the instructor.

Independent study.

MATH 297: Intermediate Topics for School Mathematics
(2-2) Cr. 3. F.
Prereq: Enrollment in elementary education and minimum of C- in MATH 196
Mathematical reasoning and topics in Euclidean and non-Euclidean geometry, including transformations, congruence, and similarity; exploration of probability with simulations; linearity and connections to Calculus; fractals and fractal dimension.

MATH 301: Abstract Algebra I
(3-0) Cr. 3. F.S.
Prereq: MATH 166 or MATH 166H, MATH 317 or MATH 407, and grade of C- or better in MATH 201
Theory of groups. Homomorphisms. Quotient groups. Introduction to rings. Emphasis on writing proofs.

MATH 302: Abstract Algebra II
(3-0) Cr. 3. S.
Prereq: MATH 301
Theory of rings and fields. Introduction to Galois theory. Emphasis on writing proofs.

MATH 304: Combinatorics
(3-0) Cr. 3. F.
Prereq: MATH 166 or MATH 166H; MATH 201 or experience with proofs
Enumeration strategies involving permutations, combinations, partitions, binomial coefficients, inclusion-exclusion principle, recurrence relations, generating functions. Additional topics selected from probability, algebraic combinatorics, and applications.

MATH 314: Graph Theory
(3-0) Cr. 3. S.
Prereq: MATH 166 or MATH 166H; MATH 201 or experience with proofs
Structure and extremal properties of graphs. Topics are selected from: trees, networks, colorings, paths and cycles, connectivity, planarity, directed graphs, matchings, Ramsey theory, forbidden structures, enumeration, applications.

MATH 317: Theory of Linear Algebra
(4-0) Cr. 4. F.S.
Prereq: Credit or enrollment in MATH 201
Systems of linear equations, determinants, vector spaces, inner product spaces, linear transformations, eigenvalues and eigenvectors. Emphasis on writing proofs and results. Only one of MATH 207 and MATH 317 may be counted toward graduation.

MATH 331: Topology
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 301
Set theory, metric spaces, topological spaces, continuity, connectedness, homeomorphisms, compactness, and topological invariants. Examples from surfaces, knots, and various abstract objects. Emphasis on writing proofs.

MATH 341: Introduction to the Theory of Probability and Statistics I
(Cross-listed with STAT). (3-0) Cr. 3. F.S.
Prereq: MATH 265 (or MATH 265H)
Probability; distribution functions and their properties; classical discrete and continuous distribution functions; multivariate probability distributions and their properties; moment generating functions; simulation of random variables and use of the R statistical package. Credit for both STAT 341 and STAT 447 may not be applied toward graduation.

MATH 342: Introduction to the Theory of Probability and Statistics II
(Cross-listed with STAT). (3-0) Cr. 3. F.S.
Prereq: STAT 341; MATH 207 or MATH 317
Transformations of random variables; sampling distributions; confidence intervals and hypothesis testing; theory of estimation and hypothesis tests; linear model theory; use of the R statistical package for simulation and data analysis.

MATH 350: Number Theory
(Cross-listed with COM S). (3-0) Cr. 3. S.
Prereq: MATH 201 or COM S 230
Divisibility, integer representations, primes and divisors, linear diophantine equations, congruences, and multiplicative functions. Applications to cryptography.

MATH 365: Complex Variables with Applications
(3-0) Cr. 3. S.
Prereq: MATH 265
Functions of a complex variable, including differentiation, integration and series expansions, residues, evaluation of integrals, conformal mapping.

MATH 373: Introduction to Scientific Computing
(3-0) Cr. 3. F.
Prereq: MATH 265
Vector and matrix programming and graphing in MATLAB for scientific applications. Polynomial interpolation and approximation. Systems of linear equations and numerical linear algebra. Numerical differentiation and integration. Newton methods for solving nonlinear equations and optimization in one and several variables. Fast Fourier transform. Emphasis on effective use of mathematical software and understanding of its strengths and limitations.

MATH 385: Introduction to Partial Differential Equations
(3-0) Cr. 3. F.S.
Prereq: MATH 265 and one of MATH 266, MATH 267
Separation of variables methods for elliptic, parabolic, and hyperbolic partial differential equations. Topics from Fourier series, Sturm-Liouville theory, Bessel functions, spherical harmonics, and method of characteristics.

MATH 397: Teaching Secondary Mathematics Using University Mathematics
(2-2) Cr. 3. S.
Prereq: MATH 201, MATH 301
Coursework in university mathematics including calculus, abstract algebra, discrete mathematics, geometry, and other topics as it relates to teaching mathematics in grades 5-12.

MATH 398: Cooperative Education
Cr. R. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

MATH 407: Applied Linear Algebra
(Dual-listed with MATH 507). (3-0) Cr. 3. F.
Prereq: MATH 317; or MATH 207 and experience writing proofs
Advanced topics in applied linear algebra including eigenvalues, eigenvalue localization, singular value decomposition, symmetric and Hermitian matrices, nonnegative and stochastic matrices, matrix norms, canonical forms, matrix functions. Applications to mathematical and physical sciences, engineering, and other fields.

MATH 414: Analysis I
(3-0) Cr. 3. F.S.SS.
Prereq: Minimum of C- in MATH 201
A careful development of calculus of functions of one real variable: real number properties, sequences and series, limits, continuity, differentiation, and integration.

MATH 415: Analysis II
(3-0) Cr. 3. S.
Prereq: MATH 414; MATH 265; and MATH 317 or MATH 407
Sequences and series of functions of a real variable, uniform convergence, power series, metric spaces, calculus of functions of two or more real variables.

MATH 421: Logic for Mathematics and Computer Science
(Cross-listed with COM S). (3-0) Cr. 3. S.
Prereq: MATH 301 or MATH 207 or MATH 317 or COM S 230
Propositional and predicate logic. Topics selected from Horn logic, equational logic, resolution and unification, foundations of logic programming, reasoning about programs, program specification and verification, model checking and binary decision diagrams, temporal logic and modal logic.

MATH 424: Introduction to High Performance Computing
(Cross-listed with COM S, CPR E). (2-2) Cr. 3. F.
Prereq: MATH 265; MATH 207 or MATH 317
UNIX, serial programming for high performance, OpenMP for high performance, shared memory parallelization. Semester project required.

MATH 435: Geometry I
(3-0) Cr. 3. F.
Prereq: MATH 207 or MATH 317
Euclidean geometry. Points, lines, circles, triangles, congruence, similarity, properties invariant under rigid motions. Synthetic, analytic, and axiomatic methods.

MATH 436: Geometry II
(3-0) Cr. 3. S.
Prereq: MATH 435
Continuation of Euclidean geometry with topics from elliptic, projective, or hyperbolic geometry. Emphasis on analytic methods.

MATH 439: Mathematics of Fractals and Chaos
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 265 and either MATH 266 or MATH 267
Iteration of maps; classification of periodic points; bifurcation theory; chaos; Julia sets and the Mandelbrot set; fractals and fractal dimension.

MATH 474: Mathematics of Finance
(3-0) Cr. 3. S.
Prereq: MATH 265; STAT 101 or 104 or 105 or 201 or 226.
Applications of mathematical methods to problems in finance. Lagrange Multiplier Method, applications to mean-variance portfolio selection and utility maximization, binomial asset pricing model. Binary Martingales, Optional Stopping Theorem, Central Limit Theorem, applications to financial derivative pricing.

MATH 481: Numerical Methods for Differential Equations
(Cross-listed with COM S). (3-0) Cr. 3. S.
Prereq: MATH 265 and either MATH 266 or MATH 267; knowledge of a programming language
First order Euler method, high order Runge-Kutta method, and multistep method for solving ordinary differential equations. Finite difference and finite element methods for solving partial differential equations. Local truncation error, stability, and convergence for finite difference method. Numerical solution space, polynomial approximation, and error estimate for finite element method.

MATH 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: Permission of instructor.
No more than 9 credits of Math 490 or Math 490H may be counted toward graduation.

MATH 490H: Independent Study: Honors
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: Permission of the instructor.
No more than 9 credits of Math 490 or 490H may be counted toward graduation.

MATH 491: Undergraduate Thesis
Cr. 2-3.
Writing and presenting a formal mathematics paper. Upon approval by the department, the paper will satisfy the departmental advanced English requirement.

MATH 492: Undergraduate Seminar
(2-0) Cr. 2. F.S.
Prereq: MATH 317 or MATH 407
Introduction to independent mathematical thought, with emphasis on oral communication of an advanced topic. Seminar content varies.

MATH 495: Special Topics
Cr. arr. Repeatable, maximum of 9 credits.
Prereq: Permission of instructor
Topics of current interest.

MATH 497: Teaching Secondary School Mathematics
(Cross-listed with C I). (3-0) Cr. 3. F.
Prereq: 15 credits in college mathematics. If in a teacher licensure program, concurrent enrollment in C I 426 or C I 526.
Develop an understanding of instructional planning, lesson implementation, and assessment in grades 5-12 mathematics, with a focus on reform-based mathematics, equity, and conceptual understanding.

Courses primarily for graduate students, open to qualified undergraduates:

MATH 501: Introduction to Real Analysis
(3-0) Cr. 3. F.
Prereq: MATH 265 and (MATH 207 or MATH 317)
A development of the real numbers. Study of metric spaces, completeness, compactness, sequences, and continuity of functions. Differentiation and integration of real-valued functions, sequences of functions, limits and convergence, equicontinuity.

MATH 502: Topology
(3-0) Cr. 3. S.
Prereq: MATH 414 or MATH 501
Introduction to general topology. Topological spaces, continuous functions, connectedness, compactness. Topics selected from countability and separation axioms, metrization, and complete metric spaces. Topics in algebraic topology.

MATH 504: Abstract Algebra I
(3-0) Cr. 3. F.
Prereq: MATH 302
Algebraic systems and their morphisms, with emphasis on groups and rings.

MATH 505: Abstract Algebra II
(3-0) Cr. 3. S.
Prereq: MATH 504
Continuation of Math 504. Algebraic systems and their morphisms, with emphasis on modules and fields.

MATH 507: Applied Linear Algebra
(Dual-listed with MATH 407). (3-0) Cr. 3. F.
Prereq: MATH 317; or MATH 207 and experience writing proofs
Advanced topics in applied linear algebra including eigenvalues, eigenvalue localization, singular value decomposition, symmetric and Hermitian matrices, nonnegative and stochastic matrices, matrix norms, canonical forms, matrix functions. Applications to mathematical and physical sciences, engineering, and other fields.

MATH 510: Linear Algebra
(3-0) Cr. 3. F.
Prereq: MATH 317 or MATH 407 or (MATH 207 and one of MATH 301 or MATH 414)
Advanced topics in linear algebra including canonical forms; unitary, normal, Hermitian and positive-definite matrices; variational characterizations of eigenvalues.

MATH 511: Functions of a Single Complex Variable
(3-0) Cr. 3. S.
Prereq: MATH 414 or MATH 501
Theory of analytic functions, integration, topology of the extended complex plane, singularities and residue theory, maximum principle, conformal mapping, meromorphic functions, argument principle.

MATH 515: Real Analysis I
(3-0) Cr. 3. F.
Prereq: MATH 414 or MATH 501
Lebesgue measure and Lebesgue integral, one variable differentiation theory, Fubini and Tonelli theorems in R^n, Lp spaces.

MATH 516: Real Analysis II
(3-0) Cr. 3. S.
Prereq: MATH 515
Metric spaces, topological spaces, compactness, abstract theory of measure and integral, differentiation of measures, Banach spaces.

MATH 517: Finite Difference Methods
(3-0) Cr. 3. S.
Prereq: MATH 481 or MATH 561
Finite difference methods for partial differential equations. Methods for elliptic equations; explicit and implicit methods for parabolic and hyperbolic equations; stability, accuracy, and convergence theory, including von Neumann analysis, modified equations, and the Courant-Friedrichs-Lewy condition.

MATH 519: Methods of Applied Mathematics I
(3-0) Cr. 3. F.
Prereq: MATH 414 or MATH 501
Techniques of classical and functional analysis with applications to differential equations and integral equations. Vector spaces, metric spaces, Hilbert and Banach spaces, Sobolev spaces and other function spaces, contraction mapping theorem, distributions, Fourier series and Fourier transform, linear operators, spectral theory of differential and integral operators, Green's functions and boundary value problems, weak solutions of partial differential equations and variational methods, calculus in Banach spaces and applications.

MATH 520: Methods of Applied Mathematics II
(3-0) Cr. 3. S.
Prereq: MATH 519
Continuation of Math 519.

MATH 525: Numerical Analysis of High Performance Computing
(Cross-listed with COM S, CPR E). (3-0) Cr. 3. S.
Prereq: CPR E 308 or MATH 481; experience in scientific programming; knowledge of FORTRAN or C
Introduction to parallelization techniques and numerical methods for distributed memory high performance computers. A semester project in an area related to each student's research interests is required.

MATH 533: Cryptography
(Cross-listed with CPR E, INFAS). (3-0) Cr. 3. S.
Prereq: MATH 301 or CPR E 310 or COM S 330
Basic concepts of secure communication, DES and AES, public-key cryptosystems, elliptic curves, hash algorithms, digital signatures, applications. Relevant material on number theory and finite fields.

MATH 535: Steganography and Digital Image Forensics
(Cross-listed with CPR E, INFAS). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E E 524 or MATH 317 or MATH 407 or COM S 330
Basic principles of covert communication, steganalysis, and forensic analysis for digital images. Steganographic security and capacity, matrix embedding, blind attacks, image forensic detection and device identification techniques. Related material on coding theory, statistics, image processing, pattern recognition.

MATH 540: Seminar in Mathematics Education
(1-0) Cr. 1. SS.
Prereq: Enrollment in the Master of School Mathematics program or professional studies in education
Research studies in mathematics learning and teaching, exemplary practices in mathematics education, and current state and national trends in the mathematics curriculum in grades K-12. Students in MSM take each of 540A, 540B, and 540C. Topics are offered on a 3-year cycle. A. Assessment, equity, and teaching of statistics. Offered SS 2017. B. Geometry and discrete mathematics, and problem solving. Offered SS 2018. C. Teaching of analysis, algebra, and the use of technology. Offered SS 2016.

MATH 540A: Seminar in Mathematics Education: Assessment, equity, and teaching of statistics.
(1-0) Cr. 1.
Prereq: Enrollment in the Master of School Mathematics program or professional studies in education
Research studies in mathematics learning and teaching, exemplary practices in mathematics education, and current state and national trends in the mathematics curriculum in grades K-12. Topics are offered on a 3-year cycle. Offered SS 2017.

MATH 540B: Seminar in Mathematics Education: Geometry and discrete mathematics, and problem solving.
(1-0) Cr. 1.
Prereq: Enrollment in the Master of School Mathematics program or professional studies in education
Research studies in mathematics learning and teaching, exemplary practices in mathematics education, and current state and national trends in the mathematics curriculum in grades K-12. Offered on a 3-year cycle. Offered SS 2018.

MATH 540C: Seminar in Mathematics Education: Teaching of analysis, algebra, and the use of technology.
(1-0) Cr. 1.
Prereq: Enrollment in the Master of School Mathematics program or professional studies in education
Research studies in mathematics learning and teaching, exemplary practices in mathematics education, and current state and national trends in the mathematics curriculum in grades K-12. Topics are offered on a 3-year cycle. Offered SS 2016.

MATH 545: Intermediate Calculus
(4-0) Cr. 4.
Prereq: 3 semesters of calculus and enrollment in the master of school mathematics program
Offered on a 3-year cycle, offered SS. 2016. The fundamental concepts of calculus which are critical to the effective understanding of the material in first year calculus. Emphasis is on a constructivist approach to learning, cooperative groups, problem solving, and use of technology.

MATH 546: Algorithms in Analysis and Their Computer Implementation
(2-2) Cr. 3.
Prereq: 3 semesters in calculus or concurrent enrollment in 545 and enrollment in the master of school mathematics program
Offered on a 3- year cycle, offered SS. 2016. The use of technology in secondary mathematics with an emphasis on the exploration, creation, and implementation of algorithms.

MATH 547: Discrete Mathematics and Applications
(4-0) Cr. 4.
Prereq: Enrollment in the master of school mathematics program
Offered on a 3-year cycle, offered SS. 2018. Applications of graph theory, game theory, voting theory, recursion, combinatorics, and algebraic structures. Issues in integrating discrete topics into the secondary curriculum. Use of the computer to explore discrete mathematics.

MATH 549: Intermediate Geometry
(3-0) Cr. 3.
Prereq: MATH 435 or equivalent and enrollment in the master of school mathematics program
Offered on a 3-year cycle, offered SS. 2018. A study of geometry with emphasis on metrics, the group of isometries, and the group of similarities. Specific spaces studied normally include the Euclidean plane, the 2-sphere, projective 2-space, and hyperbolic geometry. Emphasis on analytical methods. Incorporation of geometry software.

MATH 554: Introduction to Stochastic Processes
(Cross-listed with STAT). (3-0) Cr. 3. F.
Prereq: STAT 542
Markov chains on discrete spaces in discrete and continuous time (random walks, Poisson processes, birth and death processes) and their long-term behavior. Optional topics may include branching processes, renewal theory, introduction to Brownian motion.

MATH 557: Ordinary Differential Equations and Dynamical Systems
(3-0) Cr. 3. F.
Prereq: MATH 415 or MATH 501
The initial-value problem, existence and uniqueness theorems, continuous dependence on parameters, linear systems, stability and asymptotic behavior of solutions, linearization, dynamical systems, bifurcations, and chaotic behavior.

MATH 561: Numerical Analysis I
(3-0) Cr. 3. F.
Prereq: MATH 414 or MATH 501
Approximation theory, including polynomial interpolation, spline interpolation and best approximation; numerical differentiation and integration; numerical methods for ordinary differential equations.

MATH 562: Numerical Analysis II
(3-0) Cr. 3. S.
Prereq: MATH 317
Numerical linear algebra including LU factorization, QR factorization, linear least squares, singular value decompositions, eigenvalue problems, and iterative methods for large linear systems.

MATH 565: Continuous Optimization
(3-0) Cr. 3. S.
Prereq: MATH 265 and one of MATH 317, 507, 510
Theory and methods for constrained and unconstrained optimization. Steepest-descent, conjugate gradient, Newton and quasi-Newton, line search and trust-region, first and second order necessary and sufficient conditions, linear, quadratic and general nonlinear programming.

MATH 566: Discrete Optimization
(3-0) Cr. 3. F.
Prereq: MATH 317 or MATH 507 or MATH 510
Algorithms for linear programming, integer and combinatorial optimization. Linear programming, duality theory, simplex algorithm; the solution of the shortest-path, minimum spanning tree, max-flow/min-cut, minimum cost flow, maximum matching, and traveling salesman problems; integer linear programming, branch-and-bound, local and global search algorithms; matroids and greedy algorithms.

MATH 577: Linear Systems
(Cross-listed with AER E, E E, M E). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or MATH 415; and MATH 207
Linear algebra review. Least square method and singular value decomposition. State space modeling of linear continuous-time systems. Solution of linear systems. Controllability and observability. Canonical description of linear equations. Stability of linear systems. State feedback and pole placements. Observer design for linear systems.

MATH 578: Nonlinear Systems
(Cross-listed with AER E, E E, M E). (3-0) Cr. 3. S.
Prereq: E E 577
Linear vs nonlinear systems. Phase plane analysis. Bifurcation and center manifold theory. Lyapunov stability. Absolute stability of feedback systems. Input-output stability. Passivity theory and feedback linearization. Nonlinear control design techniques.

MATH 590: Independent Study
Cr. arr. Repeatable.

MATH 591: Orientation for Mathematics Graduate Students I
(0.5-0) Cr. 0.5. F.
Fall semester orientation seminar. Required for graduate students in Mathematics and Applied Mathematics. Topics include teaching at the university level and communication of mathematics. Offered on a satisfactory-fail basis only.

MATH 592: Orientation for Mathematics Graduate Students II
(0.5-0) Cr. 0.5. S.
Spring semester orientation seminar. Required for graduate students in Mathematics and Applied Mathematics. Topics include teaching at the university level and communication of mathematics. Offered on a satisfactory-fail basis only.

MATH 595: Special Topics
Cr. arr. Repeatable.

MATH 599: Creative Component
Cr. arr.

Courses for graduate students:

MATH 601: Mathematical Logic
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 504
Model theory of propositional and predicate logic, the Soundness Theorem, the Compactness Theorem, the Goedel-Henkin Completeness Theorem, the Incompleteness Theorem, computability theory. As time permits: modal and temporal logic, set theory (the continuum hypothesis). Emphasis on the relationship between `provable' and `true' and the relationship between `computable' and `definable'.

MATH 605: Design Theory and Association Schemes
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 504
Combinatorial designs and Latin squares. Construction methods including finite fields. Error-correcting codes. Adjacency matrices and algebraic combinatorics.

MATH 606: Enumerative Combinatorics and Ordered Sets
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 504
Ordered sets and lattices. Generating functions. Moebius inversion and other enumeration methods.

MATH 607: Graph Theory
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 314 or MATH 504
Structural theory of graphs. Topics include basic structures (trees, paths and cycles), networks, colorings, connectivity, topological graph theory, Ramsey theory, forbidden graphs and minors, applications.

MATH 608: Extremal Graph Theory
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MATH 607
Study of extremal graph problems and methods. Topics include canonical Ramsey theory, generalizations of Turan's theorem, Szemeredi's regularity lemma, random graph theory.

MATH 610: Seminar
Cr. arr.

MATH 615: General Theory of Algebraic Structures I
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 504
First semester of full-year course. Subalgebras, homomorphisms, congruence relations, and direct products. Lattices and closure operators. Varieties and quasivarieties of algebras, free algebras, Birkhoff's theorems, clones, Mal'cev conditions. Advanced topics.

MATH 616: General Theory of Algebraic Structures II
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 615
Continuation of MATH 615.

MATH 617: Category Theory
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 504
Categories and functors and their applications.

MATH 618: Representation Theory
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MATH 504
Representations of algebraic structures. Content varies by semester.

MATH 624: Manifolds, Tensors and Differential Geometry
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 501 or MATH 515
Topics selected from: Geometry of curves and surfaces. Manifolds, coordinate systems. Tangent and cotangent vectors, vector fields. Tensors, differential forms, Riemannian metrics. Connections, covariant differentiation, curvature tensors. Applications to physics and engineering.

MATH 633: Functional Analysis
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 515
Fundamental theory of normed linear spaces and algebras, such as topology and continuity, duality and spectral theory, emphasizing aspects that provide a framework for the study of the spectrum of an operator, analytic function theory, and modern operator theory.

MATH 641: Foundations of Probability Theory
(Cross-listed with STAT). (3-0) Cr. 3. F.
Prereq: MATH 414 or MATH 501 or equivalent course.
Sequences and set theory; Lebesgue measure, measurable functions. Absolute continuity of functions, integrability and the fundamental theorem of Lebesgue integration. General measure spaces, probability measure, extension theorem and construction of Lebesgue-Stieljes measures on Euclidean spaces. Measurable transformations and random variables, induced measures and probability distributions. General integration and expectation, Lp-spaces and integral inequalities. Uniform integrability and absolute continuity of measures. Probability densities and the Radon-Nikodym theorem. Product spaces and Fubini-Tonelli theorems.

MATH 642: Advanced Probability Theory
(Cross-listed with STAT). (3-0) Cr. 3. S.
Prereq: STAT 641, or STAT 543 and MATH 515.
Probability spaces and random variables. Kolmogorov's consistency theorem. Independence, Borel-Cantelli lemmas and Kolmogorov's 0 - 1 Law. Comparing types of convergence for random variables. Sums of independent random variables, empirical distributions, weak and strong laws of large numbers. Convergence in distribution and its characterizations, tightness, characteristic functions, central limit theorems and Lindeberg-Feller conditions. Conditional probability and expectation. Discrete parameter martingales and their properties and applications.

MATH 645: Advanced Stochastic Processes
(Cross-listed with STAT). (3-0) Cr. 3. S.
Weak convergence. Random walks and Brownian motion. Martingales. Stochastic integration and Ito's Formula. Stochastic differential equations and applications.

MATH 646: Mathematical Modeling of Complex Physical Systems
(Cross-listed with PHYS). (3-0) Cr. 3. S.
Modeling of the dynamics of complex systems on multiple scales: Classical and dissipative molecular dynamics, stochastic modeling and Monte-Carlo simulation; coarse grained nonlinear dynamics, interface propagation and spatial pattern formation.

MATH 655: Partial Differential Equations I
(3-0) Cr. 3. F.
Prereq: MATH 515 or MATH 519
Study of model problems of elliptic, parabolic and hyperbolic types, first order equations, conservation laws, transform methods, introduction to linear partial differential equations of arbitrary order, fundamental solutions.

MATH 656: Partial Differential Equations II
(3-0) Cr. 3. S.
Prereq: MATH 655
Sobolev spaces, general theory of second order linear elliptic, parabolic and hyperbolic partial differential equations, first order linear hyperbolic systems, variational methods, fixed point methods.

MATH 666: Finite Element Methods
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 516 or MATH 520 or MATH 561 or MATH 656
Weak and variational formulations of elliptic problems; weak derivatives and Sobolev spaces; Lax-Milgram theorem, Bramble-Hilbert lemma; examples of finite element spaces; polynomial approximation theory; error estimates for finite element methods; implementation issues; mixed finite element methods for Stokes problems; applications.

MATH 680: Advanced Topics
Cr. 3. Repeatable.

MATH 680A: Advanced Topics: Algebra
Cr. 3. Repeatable.

MATH 680B: Advanced Topics: Analysis
Cr. 3. Repeatable.

MATH 680C: Advanced Topics: Applied Mathematics
Cr. 3. Repeatable.

MATH 680D: Advanced Topics: Combinatorics
Cr. 3. Repeatable.

MATH 680E: Advanced Topics: Differential Equations
Cr. 3. Repeatable.

MATH 680F: Advanced Topics: Linear Algebra
Cr. 3. Repeatable.

MATH 680G: Advanced Topics: Logic and Foundations
Cr. 3. Repeatable.

MATH 680H: Advanced Topics: Number Theory
Cr. 3. Repeatable.

MATH 680I: Advanced Topics: Numerical Analysis
Cr. 3. Repeatable.

MATH 680J: Advanced Topics: Optimization
Cr. 3. Repeatable.

MATH 680K: Advanced Topics: Probability
Cr. 3. Repeatable.

MATH 680L: Advanced Topics: Topology
Cr. 3. Repeatable.

MATH 699: Research
Cr. arr. Repeatable.

Mechanical Engineering (M E)

Courses primarily for undergraduates:

M E 160: Mechanical Engineering Problem Solving with Computer Applications
(2-2) Cr. 3. F.S.
Prereq: M E majors only. MATH 142 or MATH 143 or MATH 145; credit or enrollment in MATH 165.
Introduction to the field of Mechanical Engineering through problem-solving in a range of topics including statics, mechanics of materials and thermo-fluids. Techniques to professionally present and communicate solutions. Use of MATLAB computer programming to aid problem solving, including curve fitting and graphing. Only one of M E 160, ENGR 160, Aer E 160, C E 160, CPR E 185, E E 185, S E 185 and I E 148 may count towards graduation.

M E 170: Engineering Graphics and Introductory Design
(2-2) Cr. 3. F.S.
Prereq: Satisfactory scores on mathematics placement assessments; credit or enrollment in MATH 142 or MATH 143 or MATH 145
Integration of fundamental graphics, computer modeling, and engineering design. Applications of multiview drawings and dimensioning. Techniques for visualizing, analyzing, and communicating 3-D geometries. Application of the design process including written and oral reports. Freehand and computer methods.

M E 190: Learning Communities
(1-0) Cr. 1. Repeatable. F.S.
Enrollment in M E learning communities.

M E 202: Mechanical Engineering - Professional Planning
(1-0) Cr. R. F.S.
Prereq: Sophomore classification
Preparation for a career in mechanical engineering; discussion of opportunities for leadership, undergraduate research, experiential learning.

M E 220: Globalization and Sustainability
(Cross-listed with ANTHR, ENV S, GLOBE, MAT E, SOC, T SC). (3-0) Cr. 3. F.S.
An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.
Meets International Perspectives Requirement.

M E 231: Engineering Thermodynamics I
(3-0) Cr. 3. F.S.SS.
Prereq: MATH 166, CHEM 167, PHYS 221
Fundamental concepts based on zeroth, first and second laws of thermodynamics. Properties and processes for ideal gases and solid-liquid-vapor phases of pure substances. Applications to vapor power cycles. Credit for either M E 231 or 330, but not both, may be applied toward graduation.

M E 270: Introduction to Mechanical Engineering Design
(1-6) Cr. 3. F.S.
Prereq: M E 160 or equivalent, M E 170 or equivalent, PHYS 221
Overview of mechanical engineering design with applications to thermal and mechanical systems. Introduction to current design practices used in industry. Semester-long team project focused on addressing societal needs. Past projects include designing human powered charging systems and products for developing nations.

M E 324: Manufacturing Engineering
(3-0) Cr. 3. F.S.SS.
Prereq: M E 270, E M 324, MAT E 273 and M E 324L
Fundamentals of manufacturing processes including forming, machining, casting and welding with emphasis on design considerations in manufacturing. Mechanical behavior of metallic materials. Modern manufacturing practices.

M E 324L: Manufacturing Engineering Laboratory
(0-2) Cr. 1. F.S.SS.
Prereq: M E 270, MAT E 273
Laboratory exercises in metrology, mechanical testing (tensile/compression and hardness tests), computer aided design (CAD), machining operations, metal welding, metal casting, and bulk/sheet metal forming.

M E 325: Mechanical Component Design
(3-0) Cr. 3. F.S.SS.
Prereq: M E 170, E M 324, and STAT 305
Philosophy of design and design methodology. Consideration of stresses and failure models useful for static and fatigue loading. Analysis, selection and synthesis of machine elements.

M E 332: Engineering Thermodynamics II
(3-0) Cr. 3. F.S.SS.
Prereq: M E 231
Gas power cycles. Fundamentals of gas mixtures, psychrometry, and thermochemistry. Applications to one-dimensional compressible flow, refrigeration, air conditioning and combustion processes.

M E 335: Fluid Flow
(3-2) Cr. 4. F.S.SS.
Prereq: E M 345, MATH 265, MATH 266 or MATH 267, credit or enrollment in M E 332.
Incompressible and compressible fluid flow fundamentals. Dimensional analysis and similitude. Internal and external flow applications. Lab experiments emphasizing concepts in thermodynamics and fluid flow. Written reports are required.

M E 370: Engineering Measurements
(2-3) Cr. 3. F.S.SS.
Prereq: E E 442, STAT 305
Fundamentals of design, selection, and operation of components of measuring systems. Measurement processes, data acquisition systems, analysis of data, and propagation of measurement uncertainty.

M E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

M E 398: Cooperative Education (Co-op).
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

M E 410: Mechanical Engineering Applications of Mechatronics
(2-2) Cr. 3. Alt. S., offered irregularly.
Prereq: E E 442, E E 448, credit or enrollment in M E 421
Fundamentals of sensor characterization, signal conditioning and motion control, coupled with concepts of embedded computer control. Digital and analog components used for interfacing with computer controlled systems. Mechanical system analysis combined with various control approaches. Focus on automation of hydraulic actuation processes. Laboratory experiences provide hands-on development of mechanical systems.

M E 411: Automatic Controls
(2-2) Cr. 3. F.
Prereq: M E 421
Methods and principles of automatic control. Pneumatic, hydraulic, and electrical systems. Representative applications of automatic control systems. Mathematical analysis of control systems.

M E 412: Ethical Responsibilities of a Practicing Engineer
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in M E 325
The study of ethics in engineering design and the engineering profession. A comprehensive look at when ethical decisions must be made and an approach to make them. The approach takes into account moral, legal, technical, experiential, and standards to aid in ethical decision making. Each area will be studied through lectures, debates, guest speakers, class discussion, and case studies.

M E 413: Fluid Power Engineering
(Cross-listed with A B E). (2-2) Cr. 3. F.
Prereq: Credit or enrollment in E M 378 or M E 335, A B E 216 or M E 270
Properties of hydraulic fluids. Performance parameters of fixed and variable displacement pumps and motors. Hydraulic circuits and systems. Hydrostatic transmissions. Characteristics of control valves. Analysis and design of hydraulic systems for power and control functions.

M E 415: Mechanical Systems Design
(0-6) Cr. 3. F.S.
Prereq: M E 324, M E 325
Mechanical Engineering Capstone Design course. Team approach to solving design problems involving mechanical systems. Teams will use current design practices they will encounter in industry. Document decisions concerning form and function, material specification, manufacturing methods, safety, cost, and conformance with codes and standards. Solution description includes oral and written reports. Projects often worked with industry sponsors.

M E 417: Advanced Machine Design
(Dual-listed with M E 517). (3-0) Cr. 3. S.
Prereq: M E 325, MAT E 273
Stress life, strain life, and fracture mechanics approaches to fatigue life and design with metals, polymers and ceramics. Introduction to material selection in design of machine components. Thermal and structural considerations in design of machine components and hybrid materials. Course project and relevant literature review required for graduate credit.

M E 418: Mechanical Considerations in Robotics
(Dual-listed with M E 518). (3-0) Cr. 3. S.
Prereq: Credit or enrollment in M E 421
Three dimensional kinematics, dynamics, and control of robot manipulators, hardware elements and sensors. Laboratory experiments using industrial robots.

M E 419: Computer-Aided Design
(3-0) Cr. 3. F.
Prereq: M E 325
Theory and applications of computer- aided design. Computer graphics programming, solid modeling, assembly modeling, and finite element modeling. Mechanical simulation, process engineering, rapid prototyping and manufacturing integration.

M E 421: System Dynamics and Control
(3-2) Cr. 4. F.S.SS.
Prereq: E E 442, E E 448, E M 345, MATH 267
Modeling and simulation of mechanical, electrical, fluid, and/or thermal systems. Development of equations of motion and dynamic response characteristics in time and frequency domains. Fundamentals of classical control applications, including mathematical analysis and design for closed loop control systems. Introduction to computer interfacing for simulation, data acquisition, and control. Laboratory exercises for hands-on system investigation and control implementation.

M E 423: Creativity and Imagination for Engineering and Design
(Dual-listed with M E 523). (3-0) Cr. 3.
Broad exposure to the study of creativity, both in scientific research and in engineering design practice. Exploration of the subject includes readings from a variety of fields; in-class discussion and activities; and individual and team projects that enable students to develop their creativity. Graduate students also will do independent research on creativity and develop a related teaching module.

M E 425: Optimization Methods for Complex Designs
(Dual-listed with M E 525). (3-0) Cr. 3. F.
Prereq: M E 160, MATH 265
Optimization involves finding the 'best' according to specified criteria. Review of a range of optimization methods from traditional nonlinear to modern evolutionary methods such as Genetic algorithms. Examination of how these methods can be used to solve a wide variety of design problems across disciplines, including mechanical systems design, biomedical device design, biomedical imaging, and interaction with digital medical data. Students will gain knowledge of numerical optimization algorithms and sufficient understanding of the strengths and weaknesses of these algorithms to apply them appropriately in engineering design. Experience includes code writing and off-the-shelf routines. Numerous case-studies of real-world situations in which problems were modeled and solved using advanced optimization techniques.

M E 433: Alternative Energy
(3-0) Cr. 3. F.
Prereq: PHYS 221/PHYS 222 and CHEM 167
Basic principles, performance, and cost analysis of alternative energy systems including biofuels, bioenergy, wind, solar, fuel cells, storage and other alternative energy systems. Performance analysis and operating principles of systems and components, and economic analysis for system design and operation will be taught. Emphasis is on alternative energy technologies needed to meet our future energy needs at various scales ranging from household to city to national levels.

M E 436: Heat Transfer
(3-2) Cr. 4. F.S.SS.
Prereq: M E 335
Heat transfer by conduction, convection, and radiation. Similarity concepts in heat, mass, and momentum transfer. Methods for determination of heat transfer coefficients. Combined modes of heat transfer. Heat exchangers. Lab experiments emphasizing concepts in thermodynamics and heat transfer. Written reports are required.

M E 437: Introduction to Combustion Engineering
(3-0) Cr. 3. S.
Prereq: Credit in M E 332 or equivalent and credit or enrollment in M E 335 or equivalent.
Introduction to the fundamentals of combustion and the analysis of combustion systems for gaseous, liquid, and solid fuels-including biomass fuels. Combustion fundamentals are applied to the analysis of engines; turbines, biomass cookstoves; suspension, fixed-bed, and fluidized-bed furnaces; and other combustion devices.

M E 441: Fundamentals of Heating, Ventilating, and Air Conditioning
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in M E 436
Space conditioning and moist air processes. Application of thermodynamics, heat transfer, and fluid flow principles to the analysis of heating, ventilating, and air conditioning components and systems. Performance and specification of components and systems.

M E 442: Heating and Air Conditioning Design
(1-5) Cr. 3. S.
Prereq: M E 441
Design criteria and assessment of building environment and energy requirements. Design of heating, ventilating, and air conditioning systems. System control and economic analysis. Oral and written reports required.

M E 444: Elements and Performance of Power Plants
(3-0) Cr. 3. S.
Prereq: M E 332, credit or enrollment in M E 335
Basic principles, thermodynamics, engineering analysis of power plant systems. Topics include existing power plant technologies, the advanced energyplex systems of the future, societal impacts of power production, and environmental and regulatory concerns.

M E 448: Fluid Dynamics of Turbomachinery
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: AER E 311 or M E 335
Applications of principles of fluid mechanics and thermodynamics in performance analysis and design of turbomachines. Conceptual and preliminary design of axial and radial flow compressors and turbines using velocity triangles and through-flow approaches.

M E 449: Internal Combustion Engines
(3-1) Cr. 3. F.
Prereq: M E 335
Basic principles, thermodynamics, combustion, and exhaust emissions of spark-ignition and compression-ignition engines. Laboratory determination of fuel properties and engine performance. Effects of engine components and operating conditions on performance. Written reports required.

M E 451: Engineering Acoustics
(Cross-listed with E E, E M). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: PHYS 221 and MATH 266 or MATH 267
Properties of sounds waves and noise metrics (pressure, power levels, etc). Sound sources and propagation. Principles of wave propagation in one-, two-, and three-dimensions. Wave reflection and transmission. Wave propagation in rectangular, cylindrical, and annular ducts. Acoustics fields for model noise sources. Introduction to aerodynamic noise sources in aircraft, aircraft engines, and wind turbines. Selected laboratory experiments.

M E 456: Machine Vision
(Dual-listed with M E 556). Cr. 3. Repeatable. Alt. S., offered irregularly.
Prereq: MATH 317, M E 421 or permission of instructor
Broad exposure to the study of creativity, both in scientific research and in engineering design practice. Exploration of the subject includes readings from a variety of fields; in-class discussion and activities; and individual and team projects that enable students to develop their creativity. Graduate students also will do independent research on creativity and develop a related teaching module.

M E 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, AER E, B M E, CPR E, E E, ENGR, I E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

M E 467: Multidisciplinary Engineering Design II
(Cross-listed with AER E, CPR E, E E, ENGR, I E, MAT E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: Student must be within two semesters of graduation or receive permission of instructor.
Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

M E 475: Modeling and Simulation
(3-0) Cr. 3. S.
Prereq: M E 421, credit or enrollment in M E 436
Introduction to computer solution techniques required to simulate flow, thermal, and mechanical systems. Methods of solving ordinary and partial differential equations and systems of algebraic equations; interpolation, numerical integration; finite difference and finite element methods.

M E 479: Sustainability Science for Engineering Design
(3-0) Cr. 3. Alt. S., offered irregularly.
Prereq: Any engineering design course
Scientific principles and quantitative methods concerning sustainability. Analysis of environmental issues associated with engineering design and product manufacturing in an economic and social context. Heuristic and analytical methods for assessing the sustainability of existing or potential product/service designs. Application to a design problem in teams.

M E 484: Technology, Globalization and Culture
(Dual-listed with M E 584). (Cross-listed with WLC). (3-0) Cr. 3. F.
Prereq: junior or senior classification for M E 484; graduate classification for M E 584
Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists.
Meets International Perspectives Requirement.

M E 486: Appropriate Technology Design
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: M E 231,M E 270, enrollment in M E 335; or permission of instructor.
Hands-on design experience utilizing knowledge acquired in core mechanical engineering courses. Emphasis with engineering problem formulation and solution, oral and written communication, team decision-making and ethical conduct. Design projects include engineering considerations in appropriate technology which have multidisciplinary components in economics and sociology.

M E 490: Independent Study
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of students and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490H: Independent Study: Honors
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of students and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490J: Independent Study: Thermodynamics and Energy Utilization
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of students and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490M: Independent Study: Nuclear Engineering
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of students and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490O: Independent Study: Design and Optimization
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of student and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490P: Independent Study: Dynamic Systems and Controls
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of student and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490Q: Independent Study: Materials Processing and Mechanics
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of student and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490R: Independent Study: Thermo-fluids
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of student and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490S: Independent Study: Emerging Areas
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of student and faculty. Election of course and topic must be approved in advance by supervising faculty.

Courses primarily for graduate students, open to qualified undergraduates:

M E 510: Economics and Policy of Engineered Energy Systems
Cr. 3. S.
Prereq: Graduate standing.
Economics and policy for U.S. energy systems, with an emphasis on connections to engineering. Topics include: economic analysis of conventional energy commodity markets and technologies, deregulated electricity markets, and emerging energy technologies; demand forecasting; economic and environmental policy in energy; integrated assessment; and semester-specific contemporary issues. Economics majors may not apply this course towards graduation.

M E 511: Advanced Control Design
(3-0) Cr. 3. S.
Prereq: M E 411
Application of control design methods using continuous, discrete, and frequency-based models. Approaches include classical, pole assignment, model reference, internal model, and adaptive control methods. Mechanical design projects.

M E 517: Advanced Machine Design
(Dual-listed with M E 417). (3-0) Cr. 3. S.
Prereq: M E 325, MAT E 273
Stress life, strain life, and fracture mechanics approaches to fatigue life and design with metals, polymers and ceramics. Introduction to material selection in design of machine components. Thermal and structural considerations in design of machine components and hybrid materials. Course project and relevant literature review required for graduate credit.

M E 518: Mechanical Considerations in Robotics
(Dual-listed with M E 418). (3-0) Cr. 3. S.
Prereq: Credit or enrollment in M E 421
Three dimensional kinematics, dynamics, and control of robot manipulators, hardware elements and sensors. Laboratory experiments using industrial robots.

M E 520: Material and Manufacturing Considerations in Design
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: M E 324, M E 325
Integration of materials, design and manufacturing. Materials selection. Design for assembly and manufacturing (DFMA). Design and redesign to facilitate cost-effective manufacturing using material selection and DFMA software.

M E 521: Mechanical Behavior and Manufacturing of Polymers and Composites
(Cross-listed with M S E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M E 324 or MAT E 272 and E M 324
Effect of chemical structure and morphology on properties. Linear viscoelasticity, damping and stress relaxation phenomena. Structure and mechanics of filler and fiber reinforced composites. Mechanical properties and failure mechanisms. Material selection and designing with polymers. Processing of polymer and composite parts.

M E 523: Creativity and Imagination for Engineering and Design
(Dual-listed with M E 423). (3-0) Cr. 3.
Broad exposure to the study of creativity, both in scientific research and in engineering design practice. Exploration of the subject includes readings from a variety of fields; in-class discussion and activities; and individual and team projects that enable students to develop their creativity. Graduate students also will do independent research on creativity and develop a related teaching module.

M E 525: Optimization Methods for Complex Designs
(Dual-listed with M E 425). (3-0) Cr. 3. F.
Prereq: M E 160, MATH 265
Optimization involves finding the 'best' according to specified criteria. Review of a range of optimization methods from traditional nonlinear to modern evolutionary methods such as Genetic algorithms. Examination of how these methods can be used to solve a wide variety of design problems across disciplines, including mechanical systems design, biomedical device design, biomedical imaging, and interaction with digital medical data. Students will gain knowledge of numerical optimization algorithms and sufficient understanding of the strengths and weaknesses of these algorithms to apply them appropriately in engineering design. Experience includes code writing and off-the-shelf routines. Numerous case-studies of real-world situations in which problems were modeled and solved using advanced optimization techniques.

M E 527: Mechanics of Machining and Finishing Processes
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M E 324
Mechanics of material removal for ductile materials. Shear zone theory. Oblique cutting. Heat transfer in machining. Milling and grinding. Mechanics of material removal for brittle materials. Optimal selection and design of cutting parameters. Control of machining processes. Principles of precision finishing. Design considerations for machining and finishing processes.

M E 528: Micro/Nanomanufacturing
(3-0) Cr. 3. Alt. S., offered irregularly.
Prereq: M E 324
Concepts and applications of micro/nanotechnology appropriate to the manufacturing field. An overview of micro/nano-fabrication techniques including mechanical, EDM, laser and lithography. MEMS device fabrication. Scaling laws. Top down and bottom up approaches of nanomanufacturing. Experimental or theoretical project leading to potential submission of a manuscript for journal or conference.

M E 530: Advanced Thermodynamics
(3-0) Cr. 3. F.
Prereq: M E 332
Fundamentals of thermodynamics from the classical viewpoint with emphasis on the use of the first and second laws for analysis of thermal systems. Generalized thermodynamic relationships. Computer applications of thermodynamic properties and system analysis. Selected topics.

M E 531: Advanced Energy Systems and Analysis
Cr. 3. F.
Prereq: any undergraduate thermodynamics course; mathematics through differential equations
Introduction to energy systems including economic and thermodynamic principles. Various production systems will be analyzed. Application to transportation and building systems will be emphasized. Sustainability, climate change and other current energy system topics.

M E 532: Compressible Fluid Flow
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: AER E 310, 311 or equivalent
Thermodynamics of compressible flow. Viscous and inviscid compressible flow equations. One dimensional steady flow; isentropic flow, shocks, expansions. Multidimensional compressible flow aspects. Linear and nonlinear wave analysis and method of characteristics. Subsonic, transonic, supersonic and hypersonic flows.

M E 535: Thermochemical Processing of Biomass
(Cross-listed with BRT). (3-0) Cr. 3. S.
Prereq: Undergraduate course work in thermodynamics and transport phenomena
Introduction to thermal and catalytic processes for the conversion of biomass to biofuels and other biobased products. Topics include gasification, fast pyrolysis, hydrothermal processing, syngas to synfuels, and bio-oil upgrading. Application of thermodynamics, heat transfer, and fluid dynamics to bioenergy and biofuels.

M E 536: Advanced Heat Transfer
(3-0) Cr. 3. S.
Prereq: M E 436
Advanced treatment of heat transmission by conduction, convection, and radiation.

M E 538: Advanced Fluid Flow
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in M E 436
Detailed analysis of incompressible/compressible, viscous/inviscid, laminar/turbulent, and developing fluid flows on a particle/point control volume basis.

M E 539: Nanoscale Heat Transfer
Cr. 3. S.
Prereq: Any undergraduate course on thermodynamics or heat transfer or transport phenomena or solid state physics
Fundamentals of heat transfer in nanoscale systems, ballistic and diffusive transport, heat conduction due to photons and electrons. Wave and particle nature of energy transfer. Basics of nanoscale thermal radiation. Size effects and transport characteristics for solids, liquids and gases. Computational methodologies and measurement techniques for thermal properties.

M E 542: Advanced Combustion
(3-0) Cr. 3. S.
Prereq: M E 332 or CH E 381
Thermochemistry and transport theory applied to combustion. Gas phase equilibrium. Energy balances. Reaction kinetics. Flame temperatures, speed, ignition, and extinction. Premixed and diffusion flames. Combustion aerodynamics. Mechanisms of air pollution.

M E 543: Introduction to Random Vibrations and Nonlinear Dynamics
(Cross-listed with E M). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Vibrations of continuous systems. Nonlinear vibration phenomena, perturbation expansions; methods of multiple time scales and slowly-varying amplitude and phase. Characteristics of random vibrations; random processes, probability distributions, spectral density and its significance, the normal or Gaussian random process. Transmission of random vibration, response of simple single and two-degree-of-freedom systems to stationary random excitation. Fatigue failure due to random excitation.

M E 545: Thermal Systems Design
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: M E 436
Integrating thermodynamics, fluid mechanics, and heat transfer to model thermal equipment and to simulate thermal systems. Second law and parametric analysis; cost estimation, life cycle analysis and optimization. Some computer programming required.

M E 546: Computational Fluid Mechanics and Heat Transfer I
(Cross-listed with AER E). (3-0) Cr. 3. F.
Prereq: AER E 310 or M E 335, and programming experience
Basic concepts of discretization, consistency, and stability. Explicit and implicit methods for ordinary differential equations. Methods for each type of partial differential equation. Iterative solution methods; curvilinear grids. Students will program basic algorithms.

M E 547: Computational Fluid Mechanics and Heat Transfer II
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: AER E 546 or equivalent
Application of computational methods to current problems in fluid mechanics and heat transfer. Methods for solving the Navier-Stokes and reduced equation sets such as the Euler, boundary layer, and parabolized forms of the conservation equations. Introduction to relevant aspects of grid generation and turbulence modeling.

M E 552: Advanced Acoustics
(Cross-listed with E M). (3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: E M 451
Theoretical acoustics: wave propagation in fluids; acoustic radiation, diffraction and scattering; nonlinear acoustics; radiation force; cavitation; and ray acoustics.

M E 556: Machine Vision
(Dual-listed with M E 456). Cr. 3. Repeatable. Alt. S., offered irregularly.
Prereq: MATH 317, M E 421 or permission of instructor
Broad exposure to the study of creativity, both in scientific research and in engineering design practice. Exploration of the subject includes readings from a variety of fields; in-class discussion and activities; and individual and team projects that enable students to develop their creativity. Graduate students also will do independent research on creativity and develop a related teaching module.

M E 557: Computer Graphics and Geometric Modeling
(Cross-listed with COM S, CPR E). (3-0) Cr. 3. F.
Prereq: M E 421, programming experience in C
Fundamentals of computer graphics technology. Data structures. Parametric curve and surface modeling. Solid model representations. Applications in engineering design, analysis, and manufacturing.

M E 561: Scanning Probe Microscopy
(2-2) Cr. 3. Alt. F., offered irregularly.
Prereq: First year physics, chemistry
Introduction to the scanning probe microscope (SPM, also known as atomic force microscope or AFM) and associated measurement techniques. Overview or instrumentation system, basic principles of operation, probe-sample interaction and various operational modes to obtain micro/nanoscale structure and force spectroscopy of material surfaces. Examples of SPM significance and applications in science and engineering research, nanotechnology and other industries. Laboratory work involving use of a scanning probe microscope system is an integral part of the course.

M E 563: Micro and Nanoscale Mechanics
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: E M 324 and M E 325
Review of Fundamentals: (Elasticity, Electromagnetism, Mechanical response), Mechanics of thermally, electrostatically and magnetically actuated microsystems, Mechanics and design of nanostructured materials, mechanics of surface stress engineering and its implications to sensors and thin film structures.

M E 564: Fracture and Fatigue
(Cross-listed with AER E, E M, M S E). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324 and either MAT E 216 or MAT E 273 or MAT E 392. Undergraduates: Permission of instructor
Materials and mechanics approach to fracture and fatigue.
Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue.

M E 566: Phase Transformation in Elastic Materials
(Cross-listed with E M). (3-0) Cr. 3. S.
Prereq: EM 510 or EM 516 or EM 514
Continuum thermodynamics and kinetics approaches to phase transformations. Phase field approach to stress- and temperature-induced martensitic transformations and twinning at the nanoscale. Nucleation and growth. Nanostructural evaluation. Analytical and numerical solutions. Surface stresses and energy. Surface-induced phase transformations. Large Strain formulation.

M E 573: Random Signal Analysis and Kalman Filtering
(Cross-listed with AER E, E E). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or M E 370 or M E 411 or MATH 341
Elementary notions of probability. Random processes. Autocorrelation and spectral functions. Estimation of spectrum from finite data. Response of linear systems to random inputs. Discrete and continuous Kalman filter theory and applications. Smoothing and prediction. Linearization of nonlinear dynamics.

M E 574: Optimal Control
(Cross-listed with AER E, E E). (3-0) Cr. 3. S.
Prereq: E E 577
The optimal control problem. Variational approach. Pontryagin's principle, Hamilton-Jacobi equation. Dynamic programming. Time-optimal, minimum fuel, minimum energy control systems. The regulator problem. Structures and properties of optimal controls.

M E 575: Introduction to Robust Control
(Cross-listed with AER E, E E). (3-0) Cr. 3.
Prereq: E E 577
Introduction to modern robust control. Model and signal uncertainty in control systems. Uncertainty description. Stability and performance robustness to uncertainty. Solutions to the H2, Hoo, and l1 control problems. Tools for robustness analysis and synthesis.

M E 576: Digital Feedback Control Systems
(Cross-listed with AER E, E E). (3-0) Cr. 3. F.
Prereq: E E 475 or AER E 432 or M E 411 or MATH 415; and MATH 267
Sampled data, discrete data, and the z-transform. Design of digital control systems using transform methods: root locus, frequency response and direct design methods. Design using state-space methods. Controllability, observability, pole placement, state estimators. Digital filters in control systems. Microcomputer implementation of digital filters. Finite wordlength effects. Linear quadratic optimal control in digital control systems. Simulation of digital control systems.

M E 577: Linear Systems
(Cross-listed with AER E, E E, MATH). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or MATH 415; and MATH 207
Linear algebra review. Least square method and singular value decomposition. State space modeling of linear continuous-time systems. Solution of linear systems. Controllability and observability. Canonical description of linear equations. Stability of linear systems. State feedback and pole placements. Observer design for linear systems.

M E 578: Nonlinear Systems
(Cross-listed with AER E, E E, MATH). (3-0) Cr. 3. S.
Prereq: E E 577
Linear vs nonlinear systems. Phase plane analysis. Bifurcation and center manifold theory. Lyapunov stability. Absolute stability of feedback systems. Input-output stability. Passivity theory and feedback linearization. Nonlinear control design techniques.

M E 580: Virtual Environments, Virtual Worlds, and Application
(Cross-listed with HCI). (3-0) Cr. 3. F.
Prereq: Senior or Graduate status.
A systematic introduction to the underpinnings of Virtual Environments (VE), Virtual Worlds, advanced displays and immersive technologies; and an overview of some of the applications areas particularly virtual engineering.

M E 584: Technology, Globalization and Culture
(Dual-listed with M E 484). (Cross-listed with WLC). (3-0) Cr. 3. F.
Prereq: junior or senior classification for M E 484; graduate classification for M E 584
Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists.
Meets International Perspectives Requirement.

M E 590: Special Topics
Cr. 1-8. Repeatable.

M E 590Q: Special Topics: Independent Literature Investigation
Cr. 1-8. Repeatable.

M E 590T: Special Topics: Biological and Nanoscale Sciences
Cr. 1-8. Repeatable.

M E 590U: Special Topics: Complex Fluid Systems
Cr. 1-8. Repeatable.

M E 590V: Special Topics: Clean Energy Technologies
Cr. 1-8. Repeatable.

M E 590W: Special Topics: Design and Manufacturing Innovation
Cr. 1-8. Repeatable.

M E 590Z: Special Topics: Simulation and Visualization
Cr. 1-8. Repeatable.

M E 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

M E 600: Seminar
Cr. R. Repeatable.
(1-0).

M E 625: Surface Modeling
(3-0) Cr. 3. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: M E 557, programming experience in C
Theory and implementation of contemporary parametric sculptured surface modeling technology. Non-uniform rational B-spline (NURBS) curves and surfaces. Fundamental computational algorithms. Construction techniques. Advanced modeling topics. Computer projects.

M E 632: Multiphase Flow
(Cross-listed with CH E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M E 538
Single particle, mutliparticle and two-phase fluid flow phenomena (gas-solid, liquid-solid and gas-liquid mixtures); particle interactions, transport phenomena, wall effects; bubbles, equations of multiphase flow. Dense phase (fluidized and packed beds) and ducted flows; momentum, heat and mass transfer. Computer solutions.

M E 637: Convection Heat Transfer
(3-0) Cr. 3. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: M E 436
Convection heat transfer to internal or external flows under laminar or turbulent conditions. Dimensionless parameters. Classical solutions of Newtonian viscous flows. Forced and free convection. Special topics.

M E 638: Radiation Heat Transfer
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: M E 436
Techniques for analysis of radiation in enclosures. Radiative properties of surfaces. Radiative transfer in participating media. Combined modes of transfer. Approximate methods of analysis.

M E 647: Advanced Computational Fluid Dynamics
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: AER E 547
An examination of current methods in computational fluid dynamics. Differencing strategies. Advanced solution algorithms for unstructured meshes. Grid generation. Construction of higher-order CFD algorithms. Parallel computing. Current applications. Use of state of the art CFD codes.

M E 690: Advanced Topics
Cr. arr. Repeatable.
Investigation of advanced topics of special interest to graduate students in mechanical engineering.

M E 690G: Advanced Topics: Advanced Machine Design
Cr. arr. Repeatable.
Investigation of advanced topics of special interest to graduate students in mechanical engineering.

M E 690O: Advanced Topics: Engineering Computation
Cr. arr. Repeatable.
Investigation of advanced topics of special interest to graduate students in mechanical engineering.

M E 690Q: Advanced Topics: Independent Literature Investigation
Cr. arr. Repeatable.
Investigation of advanced topics of special interest to graduate students in mechanical engineering.

M E 690T: Advanced Topics: Biological and Nanoscale Sciences
Cr. arr. Repeatable. F.S.SS.
Investigation of Special Topics: Biological and Nanoscale Sciences of special interest to graduate students in mechanical engineering.

M E 690U: Advanced Topics: Complex Fluid Systems
Cr. arr. Repeatable. F.S.SS.
Investigation of Special Topics: Complex Fluid Systems of special interest to graduate students in mechanical engineering.

M E 690V: Advanced Topics: Clean Energy Technologies
Cr. arr. F.S.SS.
Investigation of Special Topics: Clean Energy Technologies of special interest to graduate students in mechanical engineering.

M E 690W: Advanced Topics: Design and Manufacturing Innovation
Cr. arr. Repeatable.
Investigation of Design & Manufacturing Innovation of special interest to graduate students in mechanical engineering.

M E 690Z: Advanced Topics: Simulation and Visualization
Cr. arr. Repeatable. F.S.SS.
Investigation of Special Topics: Simulation and Visualization of special interest to graduate students in mechanical engineering.

M E 697: Engineering Internship
Cr. R. Repeatable.
Prereq: Permission of Director of Graduate Education, graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

M E 699: Research
Cr. arr. Repeatable.
Offered on a satisfactory-fail basis only.

Meteorology (MTEOR)

Courses primarily for undergraduates:

MTEOR 107: Severe and Hazardous Weather
(2-0) Cr. 1. F.
Understanding of atmospheric processes that play a role in creating severe and hazardous weather. Focus on thunderstorms, tornadoes, hurricanes, floods, blizzards, ice storms, and temperature extremes. Impacts on lives and property.

MTEOR 111: Synoptic Applications
(1-0) Cr. 1. Repeatable. F.
Prereq: Credit or enrollment in MATH 165
Current weather discussions and introduction to synoptic-scale interpretation of meteorology. Application and use of calculus in meteorology. Course restricted to majors. Others with permission of instructor.

MTEOR 112: Geoscience Orientation
(Cross-listed with GEOL). (1-0) Cr. 1. F.
Orientation course for students enrolled in the Earth, Wind and Fire Learning Community. Provides an introduction to Iowa State University and meteorology, geology, and Earth science programs for students enrolled in the department's learning community. Activities include academic and social activities, talks and presentations on academic success, resume writing, and study abroad, as well as research talks by faculty members.

MTEOR 113: Spring Geoscience Orientation for Earth, Wind and Fire Learning Community
(Cross-listed with GEOL). (0.5-0) Cr. 0.5. S.
Spring orientation course for students enrolled in the Earth, Wind and Fire Learning Community. Students are introduced to interview strategies, the importance of creating a professional image on social media, and the basics of financial literacy. Focused on professionalism and resilience, in this course students use their individual strengths to work in teams on a research project that applies their quantitative, data analysis, management, and communication skills. Activities include academic and social events, and two field trips.

MTEOR 160: Water Resources of the World
(Cross-listed with AGRON, ENV S, GEOL). (3-0) Cr. 3. S.
Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement.

MTEOR 201: Introductory Seminar
Cr. R. F.
Prereq: Credit or enrollment in PHYS 221
An overview of the atmospheric sciences, the meteorology program at Iowa State, and the major research journals used in the discipline.

MTEOR 206: Introduction to Weather and Climate
(Cross-listed with AGRON). (3-0) Cr. 3. F.S.
Basic concepts in weather and climate, including atmospheric measurements, radiation, stability, precipitation, winds, fronts, forecasting, and severe weather. Applied topics include global warming, ozone depletion, world climates and weather safety.

MTEOR 227: Computational Meteorology I
(3-1) Cr. 3. F.
Prereq: Credit or concurrent enrollment in MTEOR 206, credit or concurrent enrollment in PHYS 221
An introduction to computer programming using FORTRAN with focus on meteorological applications. Emphasis on basics of good programming techniques and style through extensive practice in top-down design, writing, running, and debugging small programs. Topics include operations and functions, selective execution, repetitive execution, arrays, input/output, file processing, and subprograms. This course is designed for majors.

MTEOR 265: Scientific Balloon Engineering and Operations
(Cross-listed with AER E). (0-2) Cr. 1. F.
Engineering aspects of scientific balloon flights. Integration of science mission objectives with engineering requirements. Operations team certification. FAA and FCC regulations, communications, and command systems. Flight path prediction and control.

MTEOR 290: Independent Study
Cr. 1-4. Repeatable.
Prereq: Permission of instructor
Independent study for freshman and sophomore students.

MTEOR 298: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing the work period.

MTEOR 301: General Meteorology
(4-0) Cr. 4. S.
Prereq: MATH 166, credit or enrollment in PHYS 222
Global distribution of temperature, wind, and atmospheric constituents; atmospheric thermodynamics, radiative transfer, global energy balance, storms and clouds, introductory dynamics.

MTEOR 311: Introduction to Synoptic Meteorology
(1-2) Cr. 2. F.
Prereq: MTEOR 301
Concepts of weather map plotting and analysis. Introduction to forecasting and to the use of real-time UNIDATA computer products.

MTEOR 321: Meteorology Internship
Cr. 1-2. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: MTEOR 311; junior or senior standing; permission of co-op program coordinator; acceptance by sponsoring agency
Supervised practical experience in a professional meteorological agency. Experiences may include providing weather information for radio, TV, utilities, government agencies, construction, or agribusiness.

MTEOR 324: Energy and the Environment
(Cross-listed with ENSCI, ENV S, GEOL). (3-0) Cr. 3. S.
Renewable and non-renewable energy resources. Origin, occurrence, and extraction of fossil fuels. Nuclear, wind, geothermal, biomass, hydroelectric, and solar energy. Biofuels. Energy efficiency. Environmental effects of energy production and use, including air pollution, acid precipitation, coal ash, mountaintop removal mining, oil drilling, hydraulic fracturing, groundwater contamination, nuclear waste disposal, and global climate change. Carbon sequestration and geoengineering solutions for reducing atmospheric CO2 concentrations.

MTEOR 341: Atmospheric Physics I
(3-0) Cr. 3. F.
Prereq: PHYS 222, credit or enrollment in MATH 266, MTEOR 301.
Basic laws of thermodynamics, thermodynamics of water vapor, mixtures of gases, stability, hydrostatics, cloud physics.

MTEOR 342: Atmospheric Physics II
(3-0) Cr. 3. S.
Prereq: MTEOR 341
Precipitation physics, radar, atmospheric radiation, atmospheric optics, atmospheric electricity.

MTEOR 398: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing the work period.

MTEOR 402: Watershed Hydrology
(Dual-listed with MTEOR 502). (Cross-listed with ENSCI, GEOL, NREM). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

MTEOR 404: Global Change
(Dual-listed with MTEOR 504). (Cross-listed with AGRON, ENSCI, ENV S). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

MTEOR 405: Environmental Biophysics
(Dual-listed with MTEOR 505). (Cross-listed with AGRON, ENSCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)
Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

MTEOR 406: World Climates

(Cross-listed with AGRON, ENSCI). (3-0) Cr. 3. S.

Prereq: AGRON 206/MTEOR 206

Distribution and causes of different climates around the world. Effects of climate and climate variations on human activities including society, economy and agriculture. Current issues such as climate change and international efforts to assess and mitigate the consequences of a changing climate. Semester project and in-class presentation required. Meets International Perspectives Requirement.

MTEOR 407: Mesoscale Meteorology

(Dual-listed with MTEOR 507). (Cross-listed with AGRON). (3-0) Cr. 3. Alt. S., offered even-numbered years.

Prereq: Math 166 and Mteor 443

Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure.

MTEOR 411: Synoptic Meteorology

(Dual-listed with MTEOR 511). (1-4) Cr. 3. F.

Prereq: MTEOR 311, Credit or enrollment in MTEOR 454

Current weather forecasting and discussion. Applications of atmospheric physics and dynamics in real-time weather situations. Use of UNIDATA computer products.

MTEOR 416: Hydrologic Modeling and Analysis

(Dual-listed with MTEOR 516). (Cross-listed with ENSCI, GEOL). (2-3) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: Four courses in Earth science, meteorology, or engineering; junior standing

Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

MTEOR 417: Mesoscale Forecasting Laboratory

(1-5) Cr. 3. S.

Prereq: Credit or enrollment in MTEOR 411

Real-time computer analysis of current weather, with emphasis on small-scale features. Studies of severe weather, lake-effect snow, CSI, cold-air damming.

MTEOR 432: Instrumentation and Measurements

(2-2) Cr. 3. S.

Prereq: Credit or enrollment in MATH 266, PHYS 222

Principles of meteorological sensing and data analysis. Thermometry, barometry, hygrometry, anemometry, precipitation measurements, radiometry, radar, remote sensing, visibility, and cloud height. Calibration and measurement uncertainties. Digital signal processing. Field trip to the National Weather Service. Labs emphasize dataloggers and modern weather stations.

MTEOR 435: Radar Applications in Meteorology

(3-0) Cr. 3. F.

Prereq: Credit or enrollment in MTEOR 341

Fundamentals of radar meteorology with emphasis on applications. Topics presented include theory of radar, engineering principles, Doppler radar, polarimetric radar, and applications to remote sensing of clouds and precipitation.

MTEOR 443: Dynamic Meteorology I

(3-0) Cr. 3. S.

Prereq: MTEOR 341

Conservation laws, governing equations, circulation and vorticity. Development of quasi-geostrophic theory.

MTEOR 452: Climate Modeling

(Dual-listed with MTEOR 552). (3-0) Cr. 3. Alt. F., offered odd-numbered years.

Prereq: Mteor 301

Developing and working with climate models based on fundamental physical principles that govern the climate systems of the Earth and other planets. Emphasis on coupled, nonlinear-system interactions of physical processes such as circulation dynamics, radiative transfer, and cloud/precipitation physics, starting with fairly simple 0- and 1-dimensional analytical and numerical models based on energy, mass, and momentum conservation. Observational study of seasonally evolving weather patterns that form climates around the world.

MTEOR 454: Dynamic Meteorology II

(3-0) Cr. 3. F.

Prereq: MTEOR 443

Planetary boundary layer, linear perturbation theory, atmospheric wave motions, baroclinic and convective instability, mesoscale circulations.

MTEOR 471: History of Modern Meteorology

(Dual-listed with MTEOR 571). (1-0) Cr. 1. Alt. S., offered even-numbered years.

Prereq: MTEOR 341, MTEOR 342, MTEOR 411, MTEOR 443, MTEOR 452

Development of meteorological theories and numerical weather prediction, discoveries of important meteorological phenomena, and impact of weather and climate on important historical events.

MTEOR 489: Survey of Remote Sensing Technologies
(Dual-listed with MTEOR 589). (Cross-listed with E E, GEOL, NREM). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

MTEOR 489L: Satellite Remote Sensing Laboratory
(Dual-listed with MTEOR 589L). (Cross-listed with E E, GEOL, NREM). (0-3) Cr. 1. S.
Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589
Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

MTEOR 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in meteorology, permission of instructor
No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490A: Independent Study: Synoptic Meteorology.
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in meteorology, permission of instructor
No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490B: Independent Study: Dynamic Meteorology.
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in meteorology, permission of instructor
No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490C: Independent Study: Physical Meteorology.
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in meteorology, permission of instructor
No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490D: Independent Study: Instrumentation.
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in meteorology, permission of instructor
No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490E: Independent Study: Hydrology.
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in meteorology, permission of instructor
No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 498: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

MTEOR 499: Senior Research
(2-0) Cr. 2. F.
Required of all senior meteorology majors. Research projects in collaboration with faculty. Written and oral presentations of results at the end of the semester.

Courses primarily for graduate students, open to qualified undergraduates:

MTEOR 502: Watershed Hydrology
(Dual-listed with MTEOR 402). (Cross-listed with ENSCI, GEOL, NREM). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

MTEOR 504: Global Change
(Dual-listed with MTEOR 404). (Cross-listed with AGRON, ENSCI). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

MTEOR 505: Environmental Biophysics
(Dual-listed with MTEOR 405). (Cross-listed with AGRON, ENSCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)
Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

MTEOR 507: Mesoscale Meteorology
(Dual-listed with MTEOR 407). (Cross-listed with AGRON). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Math 166 and Mteor 443
Gallus. The physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Semester project and in-class presentation required.

MTEOR 511: Synoptic Meteorology
(Dual-listed with MTEOR 411). (1-4) Cr. 3. F.
Prereq: MTEOR 311, Credit or enrollment in MTEOR 454
Current weather forecasting and discussion. Applications of atmospheric physics and dynamics in real-time weather situations. Use of UNIDATA computer products.

MTEOR 516: Hydrologic Modeling and Analysis
(Dual-listed with MTEOR 416). (Cross-listed with ENSCI, GEOL). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in Earth science, meteorology, or engineering; junior standing
Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

MTEOR 518: Microwave Remote Sensing
(Cross-listed with AGRON, E E). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Math 265 or equivalent
Microwave remote sensing of Earth's surface and atmosphere using satellite-based or ground-based instruments. Specific examples include remote sensing of atmospheric temperature and water vapor, precipitation, ocean salinity, and soil moisture.

MTEOR 542: Physical Meteorology
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MTEOR 342, MATH 266, PHYS 222
Planetary atmospheres, radiative equilibrium models, radiative transfer, the upper atmosphere, remote sounding from satellites.

MTEOR 543: Advanced Dynamic Meteorology I
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MTEOR 455
The first half of a two semester sequence. Governing equations, scale analysis, simple types of wave motion in the atmosphere, instability theory.

MTEOR 544: Advanced Dynamic Meteorology II
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MTEOR 543
Continuation of 543. General circulation and dynamics of zonally symmetric circulations, atmospheric energetics, nonlinear dynamics of planetary waves.

MTEOR 552: Climate Modeling
(Dual-listed with MTEOR 452). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: Mteor 301
Developing and working with climate models based on fundamental physical principles that govern the climate systems of the Earth and other planets. Emphasis on coupled, nonlinear-system interactions of physical processes such as circulation dynamics, radiative transfer, and cloud/precipitation physics, starting with fairly simple 0- and 1-dimensional analytical and numerical models based on energy, mass, and momentum conservation. Observational study of seasonally evolving weather patterns that form climates around the world.

MTEOR 571: History of Modern Meteorology
(Dual-listed with MTEOR 471). (1-0) Cr. 1. Alt. S., offered even-numbered years.
Prereq: MTEOR 341, MTEOR 342, MTEOR 411, MTEOR 443, MTEOR 452
Development of meteorological theories and numerical weather prediction, discoveries of important meteorological phenomena, and impact of weather and climate on important historical events.

MTEOR 589: Survey of Remote Sensing Technologies
(Dual-listed with MTEOR 489). (Cross-listed with E E, GEOL, NREM). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

MTEOR 589L: Satellite Remote Sensing Laboratory
(Dual-listed with MTEOR 489L). (Cross-listed with E E, NREM). (0-3) Cr. 1. S.
Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589
Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

MTEOR 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590A: Special Topics: Boundary-layer Meteorology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590B: Special Topics: Tropical Meteorology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590C: Special Topics: Mesoscale Meteorology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590D: Special Topics: Global Climate Systems
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590E: Special Topics: Climate Modeling
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590F: Special Topics: Numerical Weather Prediction
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590G: Special Topics: Satellite Observations
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590H: Special Topics: Statistical Methods in Meteorology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590I: Special Topics: Field Observations
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590J: Special Topics: Low Frequency Modes
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590K: Special Topics: Cloud Physics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590L: Special Topics: Atmospheric Radiation
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590M: Special Topics: Hydrology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590N: Special Topics: Geophysical Fluid Dynamics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590O: Special Topics: Radar Meteorology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 595: Graduate Seminar
(Cross-listed with GEOL). Cr. 1. Repeatable. F.S.
Prereq: Senior or graduate classification
Weekly seminar on topics of current research interest. All students seeking a graduate degree in geology must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

MTEOR 595A: Graduate Seminar: Presentation Required
(Cross-listed with GEOL). (1-0) Cr. 1. Repeatable. F.S.
Prereq: Senior or graduate classification
Weekly seminar on topics of current research interest. All students seeking a graduate degree in geology must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

MTEOR 595B: Graduate Seminar: Attendance Only
(Cross-listed with GEOL). Cr. R. Repeatable. F.S.
Prereq: Senior or graduate classification
Attendance only. Weekly seminar on topics of current research interest. All students seeking a graduate degree in geology must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

Courses for graduate students:

MTEOR 605: Boundary-Layer Meteorology
(Cross-listed with AGRON). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MTEOR 443 or equivalent-level course in engineering fluids
Atmospheric boundary-layer structure and dynamics. Diurnal and seasonal variations, turbulent fluxes and turbulence kinetic energy. Measurements and empirical relations for wind and temperature near the ground. Numerical simulation and applications to wind energy.

MTEOR 699: Research
Cr. arr. Repeatable.

Microbiology (MICRO)

Courses primarily for undergraduates:

MICRO 101: Microbial World
(3-0) Cr. 3. F.
Prereq: High school biology or equivalent
Introduction to the importance of viruses, bacteria, fungi, archaea and parasites both to humans and to the biosphere. Topics include past and present microbial impact on humans and society, ecology and diversity of microbes, biotechnology and microbial impact on the biosphere.

MICRO 110: Professional and Educational Preparation in Microbiology
(1-0) Cr. 1. F.
An introduction to curriculum and research opportunities in microbiology at Iowa State. Topics include: easing the transition to life as a university student, development of specific goals, strengthening interpersonal communication, professional portfolio creation and resume building. Offered on a satisfactory-fail basis only.

MICRO 201: Introduction to Microbiology
(2-0) Cr. 2. F.S.
Prereq: One semester of college-level biology
Selected topics in microbiology with emphasis on the relationship of microorganisms to human and animal health, agricultural technology, and the environment. With written petition to the chair of the supervisory committee, students who obtain a grade of B or better may substitute 201 for Micro 302 in advanced courses.

MICRO 201L: Introductory Microbiology Laboratory
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in MICRO 201 or MICRO 302
Basic microbiology laboratory techniques for non-microbiology majors. Credit for either Micro 201L or 302L, but not both, may be applied toward graduation.

MICRO 302: Biology of Microorganisms
(3-0) Cr. 3. F.S.SS.
Prereq: BIOL 211, credit or enrollment in BIOL 212; 1 semester of chemistry
Basic cell biology, physiology, metabolism, genetics and ecology of microorganisms, with an emphasis on prokaryotes and viruses, as well as the roles of microorganisms in the environment, disease, agriculture, and industry.

MICRO 302L: Microbiology Laboratory
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in MICRO 302
Basic microbiology laboratory techniques for majors in microbiology, biological sciences and related fields. Credit for either Micro 201L or 302L, but not both, may be applied toward graduation.

MICRO 310: Medical Microbiology
(3-0) Cr. 3. F.
Prereq: MICRO 302 (or MICRO 201 if a B or better was obtained)
Study of infection by bacterial and viral pathogenic agents of humans with an overview of immune responses in controlling disease.

MICRO 310L: Medical Microbiology Laboratory
(0-3) Cr. 1. F.
Prereq: MICRO 201 or MICRO 302; MICRO 201L or MICRO 302L; credit or enrollment in MICRO 310
Microbiological tools and techniques to isolate, identify, and characterize medically significant microorganisms in relation to human diseases. Emphasis on the virulence factors of pathogenic organisms as compared to the normal flora.

MICRO 320: Molecular and Cellular Bacteriology
(4-0) Cr. 4. S.
Prereq: MICRO 302, BIOL 313, credit or enrollment in CHEM 332
A systems perspective of bacterial growth, survival, and cellular differentiation by integrating physiological and genetic principles. Emphasis is on prokaryotes although unicellular eukaryotes are also discussed. Topics include the structure, function, and assembly of cell components, molecular and genomic techniques, bioenergetics and metabolism, regulation of gene expression, genetic adaptation, stress tolerance, biofilms, and cell-cell interactions and communications.

MICRO 353: Introductory Parasitology
(Cross-listed with BIOL, V PTH). (3-0) Cr. 3. S.
Prereq: BIOL 212
Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites.

MICRO 374: Insects and Our Health
(Cross-listed with ENT). (3-0) Cr. 3. S.
Prereq: 3 credits in biological sciences
Identification, biology, and significance of insects and arthropods that affect the health of humans and animals, particularly those that are vectors of disease.
Meets International Perspectives Requirement.

MICRO 374L: Insects and Our Health Laboratory
(Cross-listed with ENT). (0-3) Cr. 1. Alt. S., offered even-numbered years.
Prereq: Credit or enrollment in ENT 374
Laboratory and field techniques for studying medical or public health entomology, including: collection, identification and maintenance of medically significant arthropods and experimental design and execution related to the biology of arthropods or arthropod-pathogen interactions.

MICRO 381: Environmental Systems I: Introduction to Environmental Systems
(Cross-listed with BIOL, ENSCI, ENV S). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

MICRO 402: Microbial Genetics and Genomics
(Dual-listed with MICRO 502). (Cross-listed with GEN). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MICRO 302, Biol 313
The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics.

MICRO 407: Microbiological Safety of Foods of Animal Origins
(Dual-listed with MICRO 507). (Cross-listed with FS HN). (3-0) Cr. 3. S.
Prereq: MICRO 420
Examination of the various factors in the production of foods of animal origin, from animal production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. The two modules of this course will be 1) the procedures and processes which can affect the overall microbiological safety of the food, and 2) the Hazard Analysis Critical Control Point (HACCP) system.

MICRO 408: Virology
(3-0) Cr. 3. F.
Prereq: BIOL 313 or BBMB 301. BIOL 314 recommended
The molecular virology and epidemiology of human, animal, plant and insect viruses.

MICRO 410: Insect-Virus Interactions: a Molecular Perspective
(Dual-listed with MICRO 510). (Cross-listed with ENT). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: Permission of an instructor.
Overview of insect-virus interactions including insect immunity to viruses, genetic enhancement of viral insecticides, transgenic mosquitoes, disruption of virus transmission, and the role of insect and virus genomics in combating viral disease of both human and agricultural importance.

MICRO 419: Foodborne Hazards
(Cross-listed with FS HN, TOX). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MICRO 201 or MICRO 302, a course in biochemistry
Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

MICRO 420: Food Microbiology
(Cross-listed with FS HN, TOX). (3-0) Cr. 3.
Prereq: MICRO 201 or MICRO 302
Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications.

MICRO 421: Food Microbiology Laboratory
(Cross-listed with FS HN). (0-6) Cr. 3.
Prereq: MICRO 201 or MICRO 302; MICRO 201L or MICRO 302L. Credit or enrollment in FS HN/MICRO 420
Standard techniques used for the microbiological examination of foods. Independent and group projects on student-generated questions in food microbiology. Emphasis on oral and written communication and group interaction.

MICRO 430: Procaryotic Diversity and Ecology
(Dual-listed with MICRO 530). (Cross-listed with BBMB). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MICRO 302, MICRO 302L
Survey of the diverse groups of procaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

MICRO 440: Laboratory in Microbial Physiology, Diversity, and Genetics
(Cross-listed with BBMB). (2-6) Cr. 4. F.
Prereq: MICRO 302, MICRO 302L, CHEM 332, BIOL 313L
Fundamental techniques and theory for studying the cellular mechanisms, genetic processes and diversity of microbial life. Experimental techniques will include isolation and physiological characterization of bacteria that inhabit different environments as well as an emphasis on genetic and molecular techniques to understand antibiotic resistance processes and mechanisms. Also included are techniques for phylogenetic characterization, measuring gene expression, and genetic manipulation of bacteria. Essential components for the effective communication of scientific results are also emphasized.

MICRO 450: Undergraduate Capstone Colloquium
(2-0) Cr. 2. S.
Prereq: SP CM 212 and senior standing in Microbiology
Required of all undergraduate majors in microbiology. Students demonstrate mastery of core courses in microbiology through discussion of current literature in microbiology and immunology, issues in scientific conduct, and bioethics in microbiology. Students present current papers in a journal club format and gain experience in writing and reviewing grant proposals.

MICRO 451: Senior Survey in Microbiology
Cr. R. F.
Prereq: Junior or Senior standing in Microbiology
Preparations for graduation. Topics include job search strategies, career information, mock interviews, graduate and professional school application processes and guidelines as well as outcomes assessment activities.

MICRO 456: Principles of Mycology
(Cross-listed with BIOL). (2-3) Cr. 3. F.
Prereq: 10 credits in biological sciences
Morphology, diversity, and ecology of fungi; their relation to agriculture, industry, and human health.

MICRO 475: Immunology
(Dual-listed with MICRO 575). (3-0) Cr. 3. S.
Prereq: MICRO 310
An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. Micro 475L optional. Credit for either Micro 475 or V MPM 520, but not both, may be applied to graduation.

MICRO 475L: Immunology Laboratory
(1-4) Cr. 1. S.
Prereq: Credit or enrollment in MICRO 310 or MICRO 475 or MICRO 575
Techniques in primary culture and tumor cell growth, measures of lymphocyte function, serological techniques and flow cytometry. Half semester course.

MICRO 477: Bacterial-Plant Interactions
(Dual-listed with MICRO 577). (Cross-listed with PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 3 credits in microbiology or plant pathology
Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves.

MICRO 485: Soil and Environmental Microbiology
(Dual-listed with MICRO 585). (Cross-listed with AGRON, ENSCI). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

MICRO 487: Microbial Ecology
(Dual-listed with MICRO 587). (Cross-listed with BIOL, ENSCI). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

MICRO 490: Independent Study
Cr. 1-5. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490A: Independent Study: Laboratory Research
Cr. arr. Repeatable. F.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490B: Independent Study: Literature Review
Cr. arr. Repeatable. F.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490C: Independent Study: Instructional Assistant
Cr. arr. Repeatable. F.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490G: Independent Study: General
Cr. arr. Repeatable. F.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490H: Independent Study, Honors
Cr. 1-5. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 495: Internship
Cr. 1-2. F.S.
Prereq: At least 6 credits of 300-level or above coursework in microbiology, approval of academic adviser
Participation in the Cooperative Extension Intern Program or an equivalent work experience. Written report of activities required. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

MICRO 502: Microbial Genetics and Genomics
(Dual-listed with MICRO 402). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MICRO 302, Biol 313
The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics.

MICRO 507: Microbiological Safety of Foods of Animal Origins
(Dual-listed with MICRO 407). (Cross-listed with FS HN). (3-0) Cr. 3. S.
Prereq: MICRO 420
Examination of the various factors in the production of foods of animal origin, from animal production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. The two modules of this course will be 1) the procedures and processes which can affect the overall microbiological safety of the food, and 2) the Hazard Analysis Critical Control Point (HACCP) system.

MICRO 510: Insect-Virus Interactions: a Molecular Perspective
(Dual-listed with MICRO 410). (Cross-listed with ENT). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: Permission of an instructor.
Overview of insect-virus interactions including insect immunity to viruses, genetic enhancement of viral insecticides, transgenic mosquitoes, disruption of virus transmission, and the role of insect and virus genomics in combating viral disease of both human and agricultural importance.

MICRO 525: Intestinal Microbiology
(Cross-listed with V MPM). Cr. 3. Alt. S., offered even-numbered years.
Prereq: Micro 302, BIOL 313
Overview of commensal microbiota in the health and well-being of vertebrates. Topics include diversity of intestinal structure, microbial diversity/function, innate immune development, community interactions and metabolic diseases associated with alterations of the intestinal microbiome.

MICRO 530: Procaryotic Diversity and Ecology
(Dual-listed with MICRO 430). (Cross-listed with BBMB). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MICRO 302, MICRO 302L
Survey of the diverse groups of procaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

MICRO 540: Livestock Immunogenetics
(Cross-listed with AN S, V MPM). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: AN S 561 or MICRO 575 or V MPM 520
Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance.

MICRO 551: Microbial Diversity and Phylogeny
(1-0) Cr. 1. F.
Prereq: MICRO 302, BIOL 313
Comparisons among the three kingdoms of life (Bacterica, Archaea, and Eukarya). Topics will include metabolism, adaptation, methods of phylogenetic analysis, and comparative genomics.

MICRO 552: Bacterial Molecular Genetics and Physiology
(1-0) Cr. 1. F.
Prereq: MICRO 302, BIOL 313
Review of genetics and selected physiological topics of model bacteria.

MICRO 553: Pathogenic Microorganisms
(1-0) Cr. 1. F.
Prereq: MICRO 302, BIOL 313
Review and contrast/comparison of common bacterial pathogens of plants and animals and their mechanisms of virulence, including toxins, protein secretion, host invasion and iron acquisition strategies. An overview of eukaryotic cell biology that is relevant to pathogenesis will also be included.

MICRO 554: Virology
(1-0) Cr. 1. S.
Prereq: MICRO 302, BIOL 313
Introduction to virus life cycles including entry, gene expression strategies, replication, and mechanisms to modify and overcome host defenses. The roles of specific viruses and sub-viral agents in animal and plant disease will also be included.

MICRO 555: Fungal Biology
(1-0) Cr. 1. S.
Prereq: GEN 313 or GEN 320 or equivalent.
Ecology, genetics, physiology and diversity of fungi, from yeasts to mushrooms, and their importance in human affairs.

MICRO 556: Ecology of Microorganisms
(1-0) Cr. 1. S.
Prereq: MICRO 302, BIOL 313
The study of microorganisms in their natural environments, with a focus on terrestrial and aquatic ecosystems, including eukaryotic hosts; interactions within biofilms and communities, including intercellular communication and symbioses; microbial adaptations to extreme environments; and metagemomic, genomic, molecular and microscopy techniques for the study of microbes in natural systems.

MICRO 575: Immunology
(Dual-listed with MICRO 475). (Cross-listed with V MPM). (3-0) Cr. 3. S.
Prereq: MICRO 310
An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. Micro 475L optional. Credit for either Micro 575 or V MPM 520, but not both, may be applied toward graduation.

MICRO 577: Bacterial-Plant Interactions
(Dual-listed with MICRO 477). (Cross-listed with PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 3 credits in microbiology or plant pathology
Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves.

MICRO 585: Soil and Environmental Microbiology
(Dual-listed with MICRO 485). (Cross-listed with AGRON, ENSCI). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

MICRO 586: Medical Bacteriology
(Cross-listed with V MPM). (4-0) Cr. 4. F.
Prereq: 310
Bacteria associated with diseases of vertebrates, including virulence factors and interaction of host responses.

MICRO 587: Microbial Ecology
(Dual-listed with MICRO 487). (Cross-listed with EEOB, ENSCI). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

MICRO 590: Special Topics
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

Courses for graduate students:

MICRO 604: Seminar
(1-0) Cr. 1. Repeatable. F.S.
Course will expose students to the breadth of subdisciplines within microbiology, offer opportunities for direct interaction between the students and the faculty members within the Interdepartmental Microbiology Graduate Program, and promote interactions among the students within the program. Offered on a satisfactory-fail basis only.

MICRO 608: Molecular Virology
(Cross-listed with PL P, V MPM). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or GDCB 511
Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis.

MICRO 615: Molecular Immunology
(Cross-listed with BBMB, V MPM). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function.

MICRO 625: Mechanisms of Bacterial Pathogenesis
(Cross-listed with V MPM). (4-0) Cr. 4. Alt. S., offered odd-numbered years.
Prereq: Credit in Biochemistry and Microbiology
Review of current concepts in specific areas of microbial pathogenesis including the genetic basis for bacterial disease, genetic regulation and control of virulence factors and their mechanisms of action, and host-pathogen interactions at the cellular and molecular levels. The application of microbial genetics to understanding pathogenesis will be included.

MICRO 626: Advanced Food Microbiology
(Cross-listed with FS HN, TOX). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials.

MICRO 627: Rapid Methods in Food Microbiology
(Cross-listed with FS HN, TOX). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Provides an overview of rapid microbial detection methods for use in foods. Topics include historical aspects of rapid microbial detection, basic categories of rapid tests (phenotypic, genotypic, whole cell, etc.), existing commercial test formats and kits, automation in testing, sample preparation and "next generation" testing formats now in development.

MICRO 685: Advanced Soil Biochemistry
(Cross-listed with AGRON, ENSCI). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: AGRON 585
Chemistry of soil organic matter and biochemical transformations brought about by microorganisms and enzymes in soils.

MICRO 690: Current Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

MICRO 690A: Current Topics: Microbiology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

MICRO 690B: Current Topics: Immunology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

MICRO 690C: Current Topics: Infectious Diseases
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

MICRO 692: Molecular Biology of Plant-Pathogen Interactions
(Cross-listed with PL P). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: PL P 506 or BBMB 405 or GEN 411 or MICRO 402 or strong background in molecular biology
Seminal and current research in molecular and physiological aspects of plant interactions with pathogens, including mechanisms of pathogenesis, host-pathogen recognition and host defense, with an emphasis on critical evaluation of primary literature. Students also complete a research proposal writing and peer review exercise.

MICRO 697: Graduate Research Rotation
Cr. arr. Repeatable. F.S.
Graduate research projects performed under the supervision of selected faculty members in the Interdepartmental Microbiology major.

MICRO 698: Seminar in Molecular, Cellular, and Developmental Biology
(Cross-listed with BBMB, GDCB, MCDB, V MPM). (2-0) Cr. 1-2. Repeatable. F.S.
Student and faculty presentations.

MICRO 699: Research
Cr. arr. Repeatable.

Military Science (M S)

Courses primarily for undergraduates:

M S 101: Introduction to Military Science
(1-0) Cr. 1. F.
Prereq: Concurrent enrollment in M S 101L required
Examines the role of a Cadet in the Army Reserve Officer Training Corps and a Lieutenant in the United States Army. The course explores a military culture whose ultimate success is determined by the character and proficiency of its' leaders. Instruction introduces students to the cultural heritage and history of the U.S. Army. Students will begin to understand the structure of the U.S. Army and how it functions as an organization and institution. The curriculum promotes the development of students' communication skills to enhance their ability to transmit ideas. The class examines how the Army's cultural values drive the development of leadership in the Officer Corps. Hands-on activities enable students to gain insight on the skills and abilities required of cadets and officers interacting with civilians and soldiers.

M S 101L: Basic Leadership Laboratory I
(0-2) Cr. 1. F.
Prereq: Concurrent enrollment in M S 101 required
Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Students observe and participate in the rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. This concept provides a constant learning environment as they learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Marching, rifle firing, and tactical patrolling; students gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility.

M S 102: Structure and Function of the U.S. Army
(1-0) Cr. 1. S.
Prereq: Concurrent enrollment in M S 102L required
Instructs students on the fundamental skills and proficiencies required of Cadets in the Army Reserve Officer Training Corps and Officers in the United States Army. Allows students to explore the Army culture whose ultimate success is determined by the character and proficiency of its' leaders. Students will gain an insight to the effects of human behavior and communication on the function of the Army's basic unit structures. Special focus is given to the emphasis the Army puts on the development and character of the leader and how that affects the culture and operation of the Army as an institution. Students will develop an understanding of the role that morals and ethics play in becoming an Army Officer and leading American Soldiers. Introduction to basic officer/soldier skills will elucidate the complex role of the Officer in the modern Army.

M S 102L: Basic Leadership Laboratory II
(0-2) Cr. 1. S.
Prereq: Concurrent enrollment in M S 102 required
Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. Provides a constant learning environment as they learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Students also learn various military tasks such as marching, rifle firing, and tactical patrolling; gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility.

M S 150: Army Physical Readiness
(0-3) Cr. 1. Repeatable. F.S.
This lab is designed to use basic military skills and instruction to develop confidence, leadership, and physical fitness. The team approach is utilized in the instruction and application of Army physical fitness requirements. Students will learn various Army physical fitness techniques as well as how to conduct physical fitness sessions. Teaching locations include Lied Recreation Center, Beyer Hall, State Gym as well as around campus. Full participation in all events will be determined based on students physical and medical eligibility.

M S 201: Principles of Leadership and Communication Skills
(2-0) Cr. 2. F.
Prereq: Concurrent enrollment in M S 201L required
Explores the development of leadership and communication skills by understanding and studying the principles, traits, and dynamics of leadership and effective communication techniques. These include; leadership dimensions, human behavior, time management skills, stress management, values and ethics, decision making process, problem solving skills, team building exercises, communication techniques, briefing skills, delegating, nutrition, fitness, and counseling. Leadership assessment programs, role playing, active class participation, speeches, country briefs, and video clips are used to enhance and reinforce the instruction.

M S 201L: Basic Leadership Laboratory III
(0-2) Cr. 1. F.
Prereq: Concurrent enrollment in M S 201 required
Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Students observe and participate in the rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. Learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Students also learn various military tasks such as marching, rifle firing, and tactical patrolling; gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility.

M S 202: Map Reading and Land Navigation
(2-0) Cr. 2. S.
Prereq: Concurrent enrollment in M S 202L required
Class focuses on the characteristics and features of the earth's land mass and how to apply different methods of conducting navigation on land. These methods include; by use of topographical maps, compasses, aerial photographs, military maps, symbols, and all their practical application. These navigation techniques are used in class in conjunction with patrolling techniques and squad movement exercises. Students will utilize verbal and non-verbal communication, communication techniques, and briefing techniques during this class. Students are also assigned to read one professional book from the Army Reading List and complete a written review of the book in the Army writing style.

M S 202L: Basic Leadership Laboratory IV
(0-2) Cr. 1. S.
Prereq: Concurrent enrollment in M S 202 required
Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Students observe and participate in the rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. Learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Students also learn various military tasks such as marching, rifle firing, and tactical patrolling; gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility.

M S 250: Advanced Army Physical Readiness I
(0-5) Cr. 2. F.
Prereq: Successfully complete M S 150 and permission of Department Chair
Students learn to plan and conduct physical fitness sessions, following Army physical fitness readiness requirements. Development of physical fitness plan and leadership of training sessions. Participation determined by students' physical and medical eligibility.

M S 251: Advanced Army Physical Readiness II
(0-5) Cr. 2. S.
Prereq: Successfully complete M S 150 and M S 250
Students learn to plan and conduct physical fitness sessions, following Army physical fitness readiness requirements. Development of physical fitness plan, and leadership of training sessions. Participation determined by students' physical and medical eligibility.

M S 283: The U.S. Army in American Society to 1917
(3-0) Cr. 3. F.
Survey of U.S. Army history focused on the Army's social and cultural interactions from colonial wars up to the First World War. Examines the roles of race and culture in Army structure and operations.

M S 290: Independent Study: Basic Military Study
Cr. 1-3. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission of the Chair of Military Science Department
Investigation of an approved topic. Must result in a professional journal-worthy paper on ethics, current military issues, interpersonal communications, or leadership development.

M S 301: Methods of Instructing Military Skills

(3-0) Cr. 3. F.

Prereq: Completion of the basic Military Science program, concurrent enrollment in M S 301L, and permission of the Chair of the Military Science Department

Develops student's proficiency in analyzing, planning, and executing complex operations within a military organizational structure. Students are given situational opportunities and then measured on their leadership abilities through systematic feedback. Student's evaluations are based on sixteen leadership dimensions within the realms of values, attributes, skills, and actions. Students develop an understanding of human cultural heritage and history, as it pertains to the armed forces.

M S 301L: Advanced Leadership Laboratory I

(0-4) Cr. 1. F.

Prereq: Completion of the basic program, concurrent enrollment in M S 301 and permission of the Chair of the Military Science Department

The lab compliments M S 301 by providing opportunities to practice the lessons from class. On-the-job training and evaluation provided by the ROTC cadre. Developing training programs, structuring laboratories, presenting classes, planning various events, and accepting responsibility for the leadership labs. Participating in the Water Survival test, Army Physical Fitness test and the Land Navigation test are required.

M S 302: Applied Leadership

(3-0) Cr. 3. S.

Prereq: Completion of the basic Military Science program, concurrent enrollment in M S 302L and permission of the Chair of the Military Science Department

Prepares students to attend the Leadership Develop and Assessment Course at Fort Lewis, Washington in which they will be assigned specific and situational tasks to accomplish by providing purpose, motivation, and direction to fellow students across the nation. Students will learn how to identify sixteen leadership dimensions in the under classmen and provide specific feedback on their leadership behaviors. Students will develop their oral communication skills about the plans developed by the class, through small group presentation settings. Students will develop methods of studying human behavior.

M S 302L: Advanced Leadership Laboratory II

(0-4) Cr. 1. S.

Prereq: Completion of the basic program, concurrent enrollment in M S 302 and permission of the Chair of the Military Science Department

The lab compliments M S 302 by providing opportunities to practice the lessons from class. On-the-job training and evaluation provided by the ROTC cadre. Developing training programs, structuring laboratories, presenting classes, planning various events, and accepting responsibility for the leadership labs. Participating in the Water Survial Test, Army Physical Fitness Test and the Land Navigation test required.

M S 401: Seminar: The Military Team

(3-0) Cr. 3. F.

Prereq: Completion of the basic program, concurrent enrollment in M S 401L and permission of the Chair of the Military Science Department

Develops student proficiency in analyzing and evaluating leadership behaviors, such as values, attributes, skills, and actions. Students are given situational opportunities to assess leadership and provide feedback to other students placed in leadership roles. Students will be measured by their ability to both give and receive systematic and specific feedback on leadership behaviors. Students will develop their ability to communicate thoughts and ideas orally through small group presentations and group discussions. Students will supervise and evaluate the planning and execution of complex operations within a military organizational structure.

M S 401L: Advanced Leadership Laboratory III

(0-4) Cr. 1. F.

Prereq: Completion of the basic program, concurrent enrollment in M S 401 and permission of the Chair of the Military Science Department

The lab compliments the instruction from class by demonstrating the indelible link between personal values and successful leadership. On-the-job training and evaluation provided by the ROTC cadre. Developing training programs, structuring laboratories, presenting classes, planning various events, and accepting responsibility for the leadership labs.

M S 402: Seminar: The Professional Military Officer

(3-0) Cr. 3. S.

Prereq: Completion of the basic program, concurrent enrollment in M S 402L and permission of the Chair of the Military Science Department

Explores the dynamics of leading in the complex situations of current military operations in a contemporary world. Students will examine the differences in customs, courtesies and operational principles in the face of international terrorism. Students will also explore aspects of interaction with nongovernmental organizations, civilians and media in a war zone and foreign national governments. The course uses case studies, scenarios, and practical exercises, which prepare the student to face complex ethical and practical demands of leading soldiers within a multifaceted military organizational structure.

M S 402L: Advanced Leadership Laboratory IV

(0-4) Cr. 1. S.

Prereq: Completion of the basic program, concurrent enrollment in M S 402 and permission of the Chair of the Military Science Department

The lab compliments the instruction from class by demonstrating the indelible link between personal values and successful leadership. On-the-job training and evaluation provided by the ROTC cadre. Developing training programs, structuring laboratories, presenting classes, planning various events, and accepting responsibility for the leadership labs.

M S 490: Independent Study: Advanced Military Study
(1-0) Cr. 1. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: M S 301, M S 302, M S 401 and M S 402 and permission of the Chair of the Military Science Department
Investigation of an approved topic. Must result in a professional journal-worthy paper on ethics, current military issues, interpersonal communications, or leadership development.

Molecular, Cellular and Developmental Biology (MCDB)

Courses primarily for graduate students, open to qualified undergraduates:

MCDB 511: Advanced Molecular Genetics
(Cross-listed with GDCB). (3-0) Cr. 3. S.
Prereq: BIOL 313 and BBMB 405
Mechanisms of molecular genetic processes in eukaryotes and prokaryotes, including DNA replication and repair, transcription, translation and regulation of gene expression. Critical evaluation and discussion of current primary literature, methodologies and experimental data.

MCDB 528: Advances in Molecular Cell Biology
(Cross-listed with GDCB). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Courses in general cell biology and biochemistry
Cell biological processes including cell signaling, cell division, intracellular trafficking, biogenesis of organelles, cell adhesion and motility.

MCDB 533: Advances in Developmental Biology
(Cross-listed with GDCB). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 314 or Biol 423
Fundamental principles in multicellular development. Emphasis on cellular and molecular regulation of developmental processes, and experimental approaches as illustrated in the current literature.

MCDB 545: Plant Molecular, Cell and Developmental Biology
(Cross-listed with GDCB, PLBIO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: Biol 313, BIOL 314, BIOL 330 or BBMB 405
Plant nuclear and organelle genomes; regulation of gene expression; hormone signaling; organization, function, and development of plant cells and subcellular structures; regulation of plant growth and development.

MCDB 590: Special Topics
Cr. arr. Repeatable.

Courses for graduate students:

MCDB 676: Biochemistry of Gene Expression in Eucaryotes
(Cross-listed with BBMB). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: BBMB 404 and BBMB 504; and BBMB 506 and BBMB 507; or BBMB 405 or BBMB 505 and or GDCB 511
Analysis of the biochemical processes involved in expression of eucaryotic genes and the regulation thereof, including RNA polymerase, transcriptional regulatory proteins, enhancers and silencers, chromosome structure, termination, RNA processing, RNA transport, RNA turnover, small RNAs, translational regulation, protein turnover.

MCDB 697: Graduate Research Rotation
Cr. 1-6. Repeatable. F.S.
Graduate research projects performed under the supervision of selected faculty members in the molecular, cellular, and developmental biology program.

MCDB 698: Seminar in Molecular, Cellular, and Developmental Biology
(Cross-listed with BBMB, GDCB, MICRO, V MPM). (2-0) Cr. 1-2. Repeatable. F.S.
Student and faculty presentations.

MCDB 699: Research
Cr. arr. Repeatable.

Music (MUSIC)

Courses primarily for undergraduates:

MUSIC 101: Fundamentals of Music
(1-2) Cr. 2. F.S.
Prereq: Ability to read elementary musical notation
Notation, recognition, execution and analysis of scales, intervals, triads, and rhythm; key signatures; time signatures; transposition. Open to non-majors only.

MUSIC 102: Introduction to Music Listening
(3-0) Cr. 3. F.S.SS.
Expansion of the music listening experiences for the general student through greater awareness of differences in techniques of listening, performance media, and materials of the art. The course focuses on the elements of music: rhythm, melody, harmony, form, and style, and how these elements are used in musics of different cultures and time periods. Ability to read or perform music not required.
Meets International Perspectives Requirement.

MUSIC 105: Basic Musicianship
(1-4) Cr. 3. F.S.
Prereq: Performing arts major status or permission of instructor.
Beginning keyboard techniques, sight-reading, and ear training. Basic materials of music: notation, scales, intervals, key signatures, time signatures, rhythm, and harmony.

MUSIC 111: Wind Ensemble
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Emphasis on significant extended compositions for wind and percussion instruments. Performances include formal concerts on campus and the annual tour.

MUSIC 112: Concert Band
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Open to all students who have performed on a wind or percussion instrument in high school band or orchestra
Repertoire includes the broad spectrum of band music. Two concerts are presented each semester.

MUSIC 113: Jazz Ensemble
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Designed to explore various styles and trends in contemporary jazz.

MUSIC 114: Marching and Pep Bands
(0-5) Cr. 1. Repeatable.
Performances at athletic events.

MUSIC 114A: Marching and Pep Bands: Marching Band
(0-5) Cr. 1. Repeatable. F.
Membership determined by audition and band application. Auditions held for woodwind, brass, percussion, flag, and twirler positions. Presentation of pre-game and half time shows at each home football game; additional performances are also scheduled on and off campus. Audition information is listed on the band website (www.music.iastate.edu/org/marching). Students may not be concurrently enrolled in MUSIC 114A and 114C.

MUSIC 114B: Marching and Pep Bands: Pep Band
(0-5) Cr. 1. Repeatable. S.
Prereq: Students selected by audition from members of MUSIC 114A.
Performances at basketball games.

MUSIC 114C: Marching and Pep Bands: Pep Band for Wrestling and Soccer
(0-5) Cr. 1. Repeatable. F.
Prereq: Students selected by audition.
Performances at wrestling and women's soccer games. Students may not be concurrently enrolled in MUSIC 114A and 114C.

MUSIC 115: Symphonic Band
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Stresses high quality wind literature. Performances include formal concerts on campus.

MUSIC 118: Applied Music: Non-majors
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
Applied music for the general student.

MUSIC 118A: Applied Music: Non-majors: Voice
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118B: Applied Music: Non-majors: Piano
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118C: Applied Music: Non-majors: Organ
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118D: Applied Music: Non-majors: Strings
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118E: Applied Music: Non-majors: Carillon
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118F: Applied Music: Non-majors: Woodwinds
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118G: Applied Music: Non-majors: Brass
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118I: Applied Music: Non-majors: Percussion
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118K: Applied Music: Non-majors: Harpsichord
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 119: Applied Music for Majors
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
Applied music for music majors.

MUSIC 119A: Applied Music for Majors: Voice
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119B: Applied Music for Majors: Piano
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119C: Applied Music for Majors: Organ
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119D: Applied Music for Majors: Strings
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119E: Applied Music for Majors: Carillon
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119F: Applied Music for Majors: Woodwinds
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119G: Applied Music for Majors: Brass
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119I: Applied Music for Majors: Percussion
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119K: Applied Music for Majors: Harpsichord
(0.5-2) Cr. 1-3. Repeatable. F.S.SS.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 120: Introduction to Music Literature and Styles
(3-0) Cr. 3. S.
Prereq: MUSIC 224; music major status or permission of instructor
Directed studies via aural analysis for music majors with emphasis on the materials of music, form and aesthetic issues. Introduction to style and literature of the major performance media in context of historical chronology. Fundamentals of score reading and performance terminology. Only one of Music 120 and 302 can count toward graduation.

MUSIC 127: Class Study in Piano I
(0-2) Cr. 1. F.S.
Prereq: Music major status or permission of instructor
Beginning keyboard technique, transposition, harmonization, ensemble and solo repertory, and sight-reading skills.

MUSIC 128: Class Study in Piano II
(0-2) Cr. 1. F.S.
Prereq: MUSIC 127 or permission of instructor
Continuation of beginning keyboard technique, transposition, harmonization, ensemble and solo repertory, and sight-reading skills.

MUSIC 141: Lyrica Women's Choir
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all female students by audition
Large chorus; emphasis on fundamental vocal and choral skills, wide variety of literature. Campus concerts each semester.

MUSIC 151: Oratorio Chorus
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Advanced skills required, high quality literature. Campus concerts each semester, some concerts in conjunction with orchestras. Men's and women's choirs separately and in combination.

MUSIC 151A: Oratorio Chorus: Cantamus Women's Choir
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Advanced skills required, high quality literature. Campus concerts each semester, some concerts in conjunction with orchestras. Men's and women's choirs separately and in combination.

MUSIC 151B: Oratorio Chorus: Statesmen Men's Choir
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Advanced skills required, high quality literature. Campus concerts each semester, some concerts in conjunction with orchestras. Men's and women's choirs separately and in combination.

MUSIC 161: Iowa State Singers
(0-5) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Concert choir specializing in performance of advanced music literature, Renaissance through contemporary. Campus concerts, annual spring tour.

MUSIC 181: Symphony Orchestra
(0-4) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Reading, preparation, and performance of standard repertoire. Five or six concerts annually plus occasional off-campus appearances.

MUSIC 219: Applied Music: Majors
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
Applied music for music majors.

MUSIC 219A: Applied Music: Majors: Voice
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219B: Applied Music: Majors: Piano
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219C: Applied Music: Majors: Organ
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219D: Applied Music: Majors: Strings
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219E: Applied Music: Majors: Carillon
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219F: Applied Music: Majors: Woodwinds
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219G: Applied Music: Majors: Brass
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219I: Applied Music: Majors: Percussion
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219K: Applied Music: Majors: Harpsichord
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 224: Music Theory I

(3-0) Cr. 3. F.

Prereq: Music major status or permission of instructor; concurrent enrollment in MUSIC 225 recommended

Brief review of music fundamentals including keys, modes, rhythm and meter. Two-voice species counterpoint as an introduction to voice-leading principles in diatonic harmony. Application of these materials in analysis and four-part writing. Introduction to Finale notation software and other technology used in the study of music.

MUSIC 225: Aural Theory I

(0-4) Cr. 2. F.

Prereq: Music major status or permission of instructor; credit or enrollment in MUSIC 224

Aural discrimination of intervals, rhythms and patterns, as demonstrated by proficiency in ear training, sight singing, and related musicianship skills.

MUSIC 227: Class Study in Piano III

(0-2) Cr. 1. F.S.

Prereq: MUSIC 128 or permission of instructor

Intermediate keyboard technique, transposition, harmonization, improvisation, repertory, and sight-reading skills. Introduction to score reading, hymn playing, and accompanying at the piano.

MUSIC 228: Class Study in Piano IV

(0-2) Cr. 1. F.S.

Prereq: MUSIC 227 or permission of instructor

Continuation of intermediate keyboard technique, transposition, harmonization, improvisation, repertory, score reading, hymn playing, and accompanying at the piano.

MUSIC 234: Music Theory II

(3-0) Cr. 3. S.

Prereq: MUSIC 224; concurrent enrollment in MUSIC 235 recommended

Harmonic and melodic materials of tonal music with an emphasis on diatonic harmony. Application of these materials in analysis and writing. Techniques of melodic construction, formal design, and harmonization.

MUSIC 235: Aural Theory II

(0-3) Cr. 1. S.

Prereq: MUSIC 225; credit or enrollment in MUSIC 234

Development of sight singing, ear training, and related musicianship skills with emphasis on diatonic harmonic and melodic materials as well as rhythm.

MUSIC 246: Introduction to Creative Digital Music

(2-0) Cr. 2. F.S.

Prereq: MUSIC 101, MUSIC 105, or MUSIC 224, or permission of instructor

Introduction to audio and MIDI software used in creating digital music. Includes fundamentals of audio waveform editing, processing, and mixing, MIDI data structures, practical projects in musical composition using a digital audio workstation.

MUSIC 248: Technology in Music Instruction

(2-0) Cr. 2. S.

Prereq: MUSIC 224 and MUSIC 225

Introduction to computer software applications used in musical arrangements and presentations, practical introduction to audio and MIDI technologies in lab-based music instruction, basic recording/sound reinforcement and music website management. Intended for Music Education Majors.

MUSIC 265: Music in Elementary Education

(2-0) Cr. 2. F.S.

Prereq: HD FS 102 or PSYCH 230

Experiencing and understanding the fundamentals of music through singing, playing classroom instruments, body movement, reading notation, listening, and creative activities. Developing lesson plan strategies and sequence, exploring multicultural musics, integrating music with other subjects in the elementary classroom, and evaluating aspects of musical learning.

MUSIC 266: Introduction to Music Education

(1-2) Cr. 2. S.

Prereq: Concurrent enrollment in MUSIC 280K

Required for first-year majors in music education. Historical, philosophical, and social foundations of music education; music curricula overview including goals of the music program, and contemporary and international curriculum development; psychology of teaching music including discipline techniques. Preparation for required observations in area schools.

MUSIC 280K: Pre-Student Teaching Experience I: Music

(Cross-listed with C I). Cr. 0.5. Repeatable. S.

Pre-student teaching experience in music in school settings. Permission of Music coordinator required prior to enrollment. Clinical Experience Level 1. Offered on a satisfactory-fail basis only.

MUSIC 290: Special Problems

Cr. arr. Repeatable. F.S.

Prereq: Permission of instructor; 12 credits in music, approval of department head

Independent study.

MUSIC 290A: Special Problems: Education
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in music education.

MUSIC 290B: Special Problems: Theory
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent stud in music theory.

MUSIC 290C: Special Problems: Composition
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in music composition.

MUSIC 290D: Special Problems: History
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in music history.

MUSIC 290E: Special Problems: Literature
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in music literature.

MUSIC 290F: Special Problems: Applied Music
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in applied music.

MUSIC 290G: Special Problems: Conducting
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in conducting.

MUSIC 290H: Special Problems, Honors
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent honors project in music.

MUSIC 290J: Special Problems: Business
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in music business.

MUSIC 301: Opera Studio
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Study of selected opera scenes, chamber operas, and works from contemporary and classical music theater. Basic stagecraft, role interpretation, production.

MUSIC 301A: Opera Studio: Opera/Operetta
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Study of selected opera scenes and chamber operas. Basic stagecraft, role interpretation, production.

MUSIC 301B: Opera Studio: Music Theater
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Study of selected works from contemporary and classical music theater. Basic stagecraft, role interpretation, production.

MUSIC 302: Masterpieces of Music and Art in Western Culture.
(3-0) Cr. 3. S.
Prereq: MUSIC 102
Exploration of several great works of classical music in light of the artistic culture in which they were composed; and trends in musical styles as well as individual composers' personalities over history through listening and discussion. Some concert attendance is required outside of class. An ability to read music is not required, but is recommended. Non-majors only. Only one of Music 120 and 302 can count toward graduation.

MUSIC 304: History of American Rock 'n' Roll
(3-0) Cr. 3. S.
Prereq: MUSIC 101, MUSIC 102, MUSIC 221, or MUSIC 222
Rock 'n' Roll from the mid 1950s through the 1990s, focusing on the development of rock styles from its roots in blues, folk, country, and pop. Expansion of listening experience through study of song forms, musical instruments of rock, and the socio-political significance of song lyrics. Examinations, research paper or in class presentation required. Ability to read or perform music not required.
Meets U.S. Diversity Requirement

MUSIC 318: Applied Music: Non-majors
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
Applied music for students other than music majors.

MUSIC 318A: Applied Music: Non-majors: Voice
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318B: Applied Music: Non-majors: Piano
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318C: Applied Music: Non-majors: Organ
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318D: Applied Music: Non-majors: Strings
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318E: Applied Music: Non-majors: Carillon
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318F: Applied Music: Non-majors: Woodwinds
(0.5-0) Cr. 1-2. Repeatable. F.S.SS.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318G: Applied Music: Non-majors: Brass
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318I: Applied Music: Non-majors: Percussion
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318K: Applied Music: Non-majors: Harpsichord
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 319: Applied Music: Majors
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
Applied music for music majors.

MUSIC 319A: Applied Music: Majors: Voice
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319B: Applied Music: Majors: Piano
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319C: Applied Music: Majors: Organ
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319D: Applied Music: Majors: Strings
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319E: Applied Music: Majors: Carillon
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319F: Applied Music: Majors: Woodwinds
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319G: Applied Music: Majors: Brass
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319I: Applied Music: Majors: Percussion
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319K: Applied Music: Majors: Harpsichord
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 321: Advanced Ensemble
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in chamber music ensembles that demand high proficiency.

MUSIC 321A: Advanced Ensemble: Voice
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321B: Advanced Ensemble: Piano
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321C: Advanced Ensemble: Organ
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321D: Advanced Ensemble: Strings
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321F: Advanced Ensemble: Woodwinds
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321G: Advanced Ensemble: Brass
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321I: Advanced Ensemble: Percussion
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321J: Advanced Ensemble: Mixed instruments/voice
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 324: English and Italian Diction for Singing
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: Credit or enrollment in MUSIC 118A or MUSIC 119A
The international phonetic alphabet and its application to correct pronunciation of English and Italian in singing.

MUSIC 325: French and German Diction for Singing
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Credit or enrollment in MUSIC 118A or MUSIC 119A
The international phonetic alphabet and its application to correct pronunciation of French and German in singing.

MUSIC 327: Functional Piano
(0-3) Cr. 2.
Emphasis on sight reading, three and four-part score reading, improvisation, accompanying, and advanced harmonization.

MUSIC 327A: Functional Piano: Keyboard majors.
(0-3) Cr. 2.
Prereq: MUSIC 228 or permission of instructor
Emphasis on sight reading, three and four-part score reading, improvisation, accompanying, and advanced harmonization.

MUSIC 327B: Functional Piano: Voice Majors
(0-3) Cr. 2. S.
Prereq: MUSIC 228 or permission of instructor
Emphasis on sight reading, three and four-part score reading, improvisation, accompanying, and advanced harmonization.

MUSIC 334: Music Theory III
(3-0) Cr. 3. F.
Prereq: MUSIC 234; concurrent enrollment in 335 recommended
Harmonic and melodic materials of tonal music with an emphasis on chromatic harmony. Application of these materials in analysis and writing. Techniques of melodic construction, formal design, and harmonization.

MUSIC 335: Aural Theory III
(0-2) Cr. 1. F.
Prereq: MUSIC 235; credit or enrollment in 334
Development of sight singing, ear training, and related musical skills with emphasis on melodic, harmonic and rhythmic materials from the eighteenth and nineteenth centuries.

MUSIC 344: Music Theory IV
(3-0) Cr. 3. S.
Prereq: MUSIC 334; concurrent enrollment in MUSIC 345 recommended
Writing and analysis based on musical styles since 1900.

MUSIC 345: Aural Theory IV
(0-2) Cr. 1. S.
Prereq: MUSIC 335; credit or enrollment in MUSIC 344
Development of sight singing, ear training, and related musical skills with emphasis on melodic, harmonic and rhythmic materials from the nineteenth and twentieth centuries.

MUSIC 346: Computer Music Programming Design
(3-0) Cr. 3. S.
Prereq: MUSIC 246 or permission of instructor
Programming and interface design for creative musical applications. Includes computer generation of music data, advanced MIDI data processing, practical projects in musical composition and performance using a visual programming language.

MUSIC 350: Instrumental Techniques: Strings
(0-2) Cr. 1. F.
Prereq: Instrumental music education majors: concurrent enrollment in MUSIC 358B. Limited to music majors
Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students.

MUSIC 351: Instrumental Techniques: Clarinet, Flute, Saxophone
(1-2) Cr. 2. S.
Prereq: Instrumental music education majors: concurrent enrollment in MUSIC 358B. Limited to music majors
Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students.

MUSIC 352: Instrumental Techniques: Oboe, Bassoon
(0-2) Cr. 1. F.
Prereq: MUSIC 351 or permission of instructor. Instrumental music education majors: concurrent enrollment in MUSIC 358B. Limited to music majors
Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students.

MUSIC 353: Instrumental Techniques: Trumpet, Horn
(0-2) Cr. 1. F.
Prereq: Instrumental music education majors: concurrent enrollment in MUSIC 358B. Limited to music majors
Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students.

MUSIC 354: Instrumental Techniques: Trombone, Baritone, Tuba
(0-2) Cr. 1. S.
Prereq: MUSIC 353 or permission of instructor. Instrumental music education majors: concurrent enrollment in MUSIC 358B. Limited to music majors
Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students.

MUSIC 355: Instrumental Techniques: Percussion
(0-2) Cr. 1. S.
Prereq: Instrumental music education majors: concurrent enrollment in MUSIC 358B. Limited to music majors
Techniques and skills required to teach percussion instruments in the schools. Techniques for performing and teaching snare drum, keyboard percussion instruments, timpani, band and orchestral hand instruments, drum set, and Latin percussion. Intended for instrumental music education students.

MUSIC 358: Lab Ensemble

Cr. R. Repeatable.

Review and selection of appropriate literature for ensembles of differing levels and abilities; conducting and rehearsal experience. Intended for music education students.

MUSIC 358A: Lab Ensemble: Choral

Cr. R. Repeatable. F.Alt. S., offered odd-numbered years.

Sight singing, conducting, and accompanying experience in conjunction with 362A. Required of all vocal music education majors every semester offered.

MUSIC 358B: Lab Ensemble: Instrumental

Cr. R. Repeatable. F.S.

Performance on secondary instruments. Includes experiences with singing and vocal techniques. Required of all instrumental music education majors in those semesters when enrolled in 350, 351, 352, 353, 354, 355, or 362B. Offered on a satisfactory-fail basis only.

MUSIC 360: Voice Pedagogy

(2-0) Cr. 2. Alt. S., offered even-numbered years.

Prereq: MUSIC 319A or vocal proficiency examination

Physical, acoustical, and musical properties of the vocal instrument, including a survey of important texts and articles on singing and voice production.

MUSIC 361: Conducting I

(1-2) Cr. 2. F.

Prereq: MUSIC 234, MUSIC 235, Music major status or permission of instructor

Introduction to conducting; score reading and analysis. Conveying musical ideas through appropriate gestures. Leadership role of the conductor.

MUSIC 362: Conducting II

(1-2) Cr. 2.

MUSIC 362A: Conducting II: Choral Conducting Techniques

(1-2) Cr. 2. Alt. S., offered odd-numbered years.

Prereq: Music major status or permission of instructor; MUSIC 361; concurrent enrollment in MUSIC 358A and MUSIC 141, MUSIC 151, or MUSIC 161.

Advanced baton technique, score preparation and interpretation of choral repertoire.

MUSIC 362B: Conducting II: Instrumental Conducting Techniques

(1-2) Cr. 2. S.

Prereq: Music major status or permission of instructor; MUSIC 361; concurrent enrollment in MUSIC 358B

Advanced baton technique. Score preparation. Specific problems of large instrumental ensembles.

MUSIC 366: Methods of Music Education

(2-0) Cr. 2. F.

Prereq: Concurrent enrollment (1 cr.) in MUSIC 480K and SP ED 401; MUSIC 266 and admission into teacher education.

Music education strategies and materials including development of appropriate objectives and plans for general music classes utilizing traditional and multicultural musics, evaluating musical learning; overview of Orff Schulwerk, Kodaly, and Dalcroze approaches; music in special education; required teaching in lab settings and observations in area schools.

MUSIC 367: Choral Literature

(2-0) Cr. 2. Alt. S., offered even-numbered years.

Prereq: MUSIC 361 recommended

Overview of choral repertoire from the sixteenth century to the present, including accessible works for the young conductor.

MUSIC 368: Marching Band and Jazz Ensemble Techniques

(2-0) Cr. 2. Alt. S., offered odd-numbered years.

Prereq: Credit or enrollment in MUSIC 362B recommended

Techniques and materials for teaching marching band in the high school; philosophy, computer assisted drill design, music analysis, band set up, and other related skills. Jazz style, articulation, phrasing, materials and teaching techniques for secondary school jazz ensembles.

MUSIC 374: Instrumental Methods for Vocalists

(1-0) Cr. 1. Repeatable, maximum of 15 credits. F.

Prereq: Music major status, MUSIC 280K, MUSIC 266 and admission into teacher education.

Techniques and skills required to teach instrumental music in K-12 schools. Introduction of instruments, score reading and transposition, rehearsal techniques, literature, resources and other related skills. Intended for vocal music education majors and required for Iowa teaching license.

MUSIC 375: Choral Methods for Instrumentalists

(1-0) Cr. 1. S.

Prereq: Music major status, MUSIC 280K, MUSIC 266 and admission into teacher education.

Techniques and skills required to teach vocal/choral music in K-12 schools. Vocal production and health, rehearsal techniques, repertoire, resources and other related skills. Intended for instrumental music education majors and required for Iowa teaching license.

MUSIC 383: History of Music I

(3-0) Cr. 3. F.

Prereq: MUSIC 120; music major status or permission of instructor

History of the stylistic and cultural development of music: Middle Ages through Baroque.

Meets International Perspectives Requirement.

MUSIC 384: History of Music II
(3-0) Cr. 3. S.
Prereq: MUSIC 383; music major status or permission of instructor
History of the stylistic and cultural development of music: Classical through contemporary music.
Meets International Perspectives Requirement.

MUSIC 415: Literature and Pedagogy in Applied Music
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415A: Literature and Pedagogy in Applied Music: Voice
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415B: Literature and Pedagogy in Applied Music: Piano
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415C: Literature and Pedagogy in Applied Music: Organ
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415D: Literature and Pedagogy in Applied Music: Strings
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415E: Literature and Pedagogy in Applied Music: Carillon
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415F: Literature and Pedagogy in Applied Music: Woodwinds
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415G: Literature and Pedagogy in Applied Music: Brass
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415I: Literature and Pedagogy in Applied Music: Percussion
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415J: Literature and Pedagogy in Applied Music: Jazz Pedagogy and Performance
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 417: Student Teaching
Cr. 8-12. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

MUSIC 417R: Student Teaching: Music-Elementary
(Dual-listed with MUSIC 517R). (Cross-listed with C I). Cr. arr. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

MUSIC 417S: Student Teaching: Music-Secondary
(Dual-listed with MUSIC 517S). (Cross-listed with C I). Cr. arr. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

MUSIC 419: Applied Music: Majors
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
Applied music for music majors.

MUSIC 419A: Applied Music: Voice
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419B: Applied Music: Piano
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419C: Applied Music: Organ
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419D: Applied Music: Strings
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419E: Applied Music: Carillon
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419F: Applied Music: Woodwinds
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419G: Applied Music: Brass
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419I: Applied Music: Percussion
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419K: Applied Music: Harpsichord
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 420: Junior/Senior Recital
Cr. R. Repeatable. F.S.SS.
Prereq: Advanced performing ability, permission of instructor, concurrent registration in Music 319 or 419.
Performance of advanced repertory in a public concert. Preparation of program notes. Offered on a satisfactory-fail basis only.

MUSIC 434: Applied Theory: Improvising and Arranging
(3-0) Cr. 3. S.
Prereq: MUSIC 344 and MUSIC 345
Practical uses for music theory. Emphasis on arranging for vocal and instrumental ensembles and creating improvisations on existing materials in a variety of styles.

MUSIC 440: Seminar in Music Theory
(3-0) Cr. 3. Repeatable. Alt. S., offered even-numbered years.
Prereq: MUSIC 344, MUSIC 345
Various topics in music theory including analysis, counterpoint, arranging, pedagogy, and psychology of music. Content will vary. Contact the Department of Music for the current year offering.

MUSIC 446: Sound Synthesis Design for Electronic Music
(3-0) Cr. 3. F.
Prereq: MUSIC 246 or permission of instructor
Digital sound synthesis structures for creative musical applications. Includes modular sound synthesis techniques, software synthesizer design, and practical projects in electronic music composition.

MUSIC 464: Instrumental Administration, Materials, and Methods
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: Credit or enrollment in MUSIC 362B recommended
Instructional materials and methods appropriate for teaching instrumental music in elementary, middle school, and high school music programs. Required observations in area schools. Intended for instrumental music education students.

MUSIC 465: Choral Materials and Methods
(2-0) Cr. 2. F.
Prereq: Concurrent enrollment in MUSIC 358A and MUSIC 141, MUSIC 151, or MUSIC 161
Instructional materials and methods appropriate for teaching choral music in the secondary school. Emphasis on pedagogy and rehearsal techniques. Required observations in area schools. Intended for vocal music education students.

MUSIC 466: Program Development and Evaluation in Music Education
(2-1) Cr. 2. F.
Prereq: Continuation Examination passed; MUSIC 362, MUSIC 366, concurrent enrollment (1 cr.) in MUSIC 480K
Developing a rationale for music education; music program development; evaluation of music curricula, programs and facilities; professional growth of the teacher; preparation for student teaching and the job market. Required observations in area schools.

MUSIC 472: History of American Music
(3-0) Cr. 3.
Prereq: Ability to read music; 9 credits from music, American literature, American history, art history
History and development of the sacred and secular music in North America from approximately 1600 to the present, exploring the diverse cultural backgrounds that have contributed to the variety of contemporary musical styles.
Meets U.S. Diversity Requirement

MUSIC 473: Music of the Baroque and Classical Eras
(3-0) Cr. 3.
Prereq: MUSIC 383, MUSIC 384
Offered F. 2011. Detailed survey of instrumental, vocal, choral, and keyboard music from 1600 to 1825.

MUSIC 475: Music of the Romantic Era
(3-0) Cr. 3.
Prereq: MUSIC 383, MUSIC 384
Offered F. 2012. Detailed survey of instrumental, vocal, choral, and keyboard music from 1825 to 1910.

MUSIC 476: Music of the Twentieth Century
(3-0) Cr. 3.
Prereq: MUSIC 383, MUSIC 384
Offered S 2013. Detailed survey of instrumental, vocal, choral, and keyboard music from 1900 to the present.

MUSIC 480: Pre-Student Teaching Experience III
(Cross-listed with C I). Cr. 0.5-2. Repeatable. F.S.
Prereq: Admission to Teacher Education
Observation and participation in a variety of school settings after admission to the teacher education program. Permission of area coordinator required prior to enrollment. (S/F grading may be used in some offerings of some sections.).

MUSIC 480K: Pre-Student Teaching Experience III: Music
(Cross-listed with C I). Cr. 1. Repeatable. F.S.
Prereq: Admission to teacher education
Participation in a K-12 school setting. Permission of Music coordinator required prior to enrollment. Clinical Experience Level 2. Offered on a satisfactory-fail basis only.

MUSIC 490: Independent Study
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490A: Independent Study: Education
(Cross-listed with C I). Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490B: Independent Study: Theory
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490C: Independent Study: Composition
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490D: Independent Study: History
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490E: Independent Study: Literature
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490F: Independent Study: Applied Music
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490G: Independent Study: Conducting
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490H: Independent Study: Honors
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490I: Independent Study: Electronic Music
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor; 12 credits in music, approval of department head

Courses primarily for graduate students, open to qualified undergraduates:

MUSIC 517R: Student Teaching: Music-Elementary
(Dual-listed with MUSIC 417R). (Cross-listed with C I). Cr. arr. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

MUSIC 517S: Student Teaching: Music-Secondary
(Dual-listed with MUSIC 417S). (Cross-listed with C I). Cr. arr. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

MUSIC 590: Special Topics
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590A: Special Topics: Education
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590B: Special Topics: Theory
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590C: Special Topics: Composition
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590D: Special Topics: History
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590E: Special Topics: Literature
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590F: Special Topics: Applied Music
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590G: Special Topics: Conducting
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590I: Special Topics: Electronic Music
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

Natural Resource Ecology and Management (NREM)

Courses primarily for undergraduates:

NREM 104: Practical Work Experience
Cr. R.
Three months of relevant work experience in natural resources, animal ecology, or forestry. Study at a summer biological station may be applicable. See adviser for specific requirements and approval process.

NREM 110: Orientation in Natural Resource Ecology and Management
Cr. 1. F.
Orientation to the University and to the Department of Natural Resource Ecology and Management. Discussion of departmental learning outcomes, strategies for academic success and academic planning. Offered on a satisfactory-fail basis only.

NREM 111: NREM Transitions Learning Community Seminar
(1-0) Cr. 1. Repeatable. F.S.
Enrollment limited to members of the NREM Transitions Learning Community. Designed to assist new transfer students and continuing sophomore students with their transition to the academic expectations and professional development aspects of the natural resource program. Offered on a satisfactory-fail basis only.

NREM 120: Introduction to Renewable Resources
(Cross-listed with AGRON, ENV S). (3-0) Cr. 3. F.S.
Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management.

NREM 130: Natural Resources and Agriculture
(Cross-listed with ENV S). (3-0) Cr. 3. S.
Survey of the ecology and management of fish, forest, and wildlife resources in areas of intensive agriculture, with emphasis on Iowa. Conservation and management practices for private agricultural lands. Designed for nonmajors.

NREM 181: Artistry in Wood
(1-0) Cr. 1. Alt. S., offered even-numbered years.
A survey of the artistry of wood as appreciated in spatial scale from microscopic anatomy to engineered wood structures. Anatomical and physical properties that render wood as a medium for artistic expression. The works of local artists, designers and engineers will be featured. The University Museums collection and Art on Campus will be explored.

NREM 207: Natural Resource Management under the North American Model of Conservation
(1-0) Cr. 1. F.
Introduction to North American model of conservation, current funding for natural resource management, role of hunting and angling in the North American model, critique and refinement of the model for the 21st century, and introduction to natural resource leadership, and outdoor skills and recreation. Offered on a satisfactory-fail basis only.

NREM 211: Careers in Natural Resources
Cr. 1. F.S.
Prereq: Sophomore classification
Career planning exploration in natural resources. Discussion of the job application process, including techniques for successful interviewing and development of an effective resume. Offered on a satisfactory-fail basis only.

NREM 270: Foundations in Natural Resource Policy and History
(Cross-listed with ENV S, L A). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
The development of natural resource conservation philosophy and policy from the Colonial Era to the present. North American wildlife, forestry, and environmental policy; national parks and other protected lands; federal and state agencies. Relationship to cultural contexts, including urban reform and American planning movement. Discussion of common pool resources, public and private lands.

NREM 301: Natural Resource Ecology and Soils
(Cross-listed with ENSCI). (3-3) Cr. 4. F.
Prereq: BIOL 211, BIOL 211L; FOR 201 or a second course in biology
Effects of environmental factors on ecosystem structure and function using forest, prairie and agricultural ecosystems as models. Special emphasis is given to soil-forming factors and the role of soil in nutrient and water cycling and ecosystem dynamics. Additional emphasis is given to human influences on natural ecosystems and the role of perennial plant communities in agricultural landscapes.

NREM 303: Internship
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of department mentor and sophomore standing
Placement with county conservation boards, camps, zoos, parks, etc., for experience as interpreters, rangers, and technicians.

NREM 303I: Undergraduate Internships
(Cross-listed with IA LL). Cr. 1-5. Repeatable. SS.
Prereq: Permission of instructor and sophomore standing
Placement with county conservation boards, camps, parks, etc. for experience as interpreters, rangers, and technicians.

NREM 305: Seminar
(2-0) Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Current topics in natural resources or related issues.

NREM 315: Genetics for Natural Resource Managers.
(3-0) Cr. 3. F.
Prereq: Prereq: Biol 211 and 212.
Introduction into how genetic techniques and technologies can aid the management of the earth's biotic resources. Topics include an overview of DNA structure, function and inheritance; tools and techniques for measuring genetic diversity; genetic management of wild and captive populations: DNA forensics as management tool. The goal of this course is to prepare managers/biologists to interpret genetic data as they relate to natural resource conservation.

NREM 330: Principles of Interpretation
(2-3) Cr. 3. S.
Prereq: 6 credits in biological sciences
History, objectives, forms, and techniques of interpretation in the settings of county, state, national parks, and zoos. Principles of effective communication as they apply to natural resource fields including wildlife management, forestry, and wildlife rehabilitation. Planning and use of effective communications and outreach campaigns to manage and conserve natural resources.

NREM 333: Fisheries Techniques
(Cross-listed with A ECL). (1-3) Cr. 2. F.
Prereq: BIOL 212
Introduction to techniques used in the collection and interpretation of fish population data in the field and in the lab. Course objectives include an understanding of population survey methodology and improving student critical thinking and teamwork skills. Laboratory focuses on field trips and hands-on sampling experience.

NREM 345: Natural Resource Photogrammetry and Geographic Information Systems
(Cross-listed with ENSCI). (2-3) Cr. 3. S.
Prereq: Junior classification
Measurement and interpretation of aerial photos in resource management. Introduction to Geographic Information Systems (GIS) using ArcGIS including digitizing, development and query of attribute tables, georeferencing, and use of multiple GIS layers in simple spatial analyses.

NREM 357: Midwestern Prairie Plants
(1-2) Cr. 1. F.
Offered 1st half semester only. Survey of the major plant families, genera, and representative species of Midwestern prairies with emphasis on plant identification. Prairie management for multiple species of plants and wildlife.

NREM 358: Forest Herbaceous Layer: Ecology and Identification.
(Cross-listed with FOR). (0.5-1) Cr. 1. S.
Prereq: BIOL 212
Survey of the major plant families, general, and representative species of the forest herbaceous layer. Functional ecology and restoration.

NREM 385: Natural Resource Policy
(Dual-listed with NREM 585). (3-0) Cr. 3. S.
Prereq: Junior classification
Development, theory and practice of natural resource policy. Integrative approach with topical policy studies in North American wildlife, forestry, and water. Policy formation, the role of science, introduction to federal law compliance. Readings, lectures, projects.

NREM 390: Fire Ecology and Management
(3-0) Cr. 3. F.
Characteristics and role of fire in forest ecosystems. Major topics covered include fuels, fire weather, fire behavior, fire danger rating systems, fire control, prescribed burning, and fire dynamics in major ecosystem types.

NREM 402: Watershed Hydrology
(Dual-listed with NREM 502). (Cross-listed with ENSCI, GEOL, MTEOR). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

NREM 407: Watershed Management
(Dual-listed with NREM 507). (Cross-listed with ENSCI, ENV S). (3-3) Cr. 4. S.
Prereq: A course in general biology
Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers.

NREM 408I: Aquatic Ecology
(Dual-listed with NREM 508I NREM 408I). (Cross-listed with IA LL). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

NREM 446: Integrating GPS and GIS for Natural Resource Management
(Dual-listed with NREM 546). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: 12 credits in student's major at 300 level or above, NREM 345 or equivalent experience with ArcGIS
Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation.

NREM 452: Ecosystem Management
(Dual-listed with NREM 552). (Cross-listed with FOR). (2-3) Cr. 3. S.
Prereq: Senior classification, and NREM 120 or its equivalent
Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints.

NREM 460: Controversies in Natural Resource Management
(Cross-listed with ENV S). (3-0) Cr. 3. F.S.
Prereq: NREM 120, and A ECL 312 or NREM 301, and Junior classification
Analysis of controversial natural resource issues using a case approach that considers uncertainty and adequacy of information and scientific understanding. Ecological, social, political, economic, and ethical implications of issues will be analyzed.

NREM 465: Landscape Change and Conservation
(Dual-listed with NREM 565). (Cross-listed with L A). (3-0) Cr. 3. F.
Prereq: L A 202
Exploration of issues in landscape ecology and conservation biology relevant to landscape change, design, and planning. Examination of foundational principles and their applications across a continuum of land uses, from wilderness to urban areas.

NREM 466: Ecosystem Service Management
(Dual-listed with NREM 566). (Cross-listed with ENSCI, ENT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

NREM 471: Agroforestry Systems; Local and Global Perspectives
(Dual-listed with NREM 571). (2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in biological science at 300 level or above
Concepts of sustainable land use, agroecological dynamics, and component interactions of agroforestry systems. Agroforestry systems in temperate and tropical regions. Design and evaluation techniques for agroforestry systems. Ecological, socioeconomic and political aspects of agroforestry.
Meets International Perspectives Requirement.

NREM 485: Undergraduate Seminar
Cr. 1. Repeatable, maximum of 2 times. F.S.
Prereq: Junior or Senior classification in Animal Ecology or Forestry majors (instructor may grant permission for students in other majors to register for course)
Weekly seminars on current research topics in natural resource ecology and management. Style and best practice in oral research communication. Skills and principles for evaluating research merit and quality of technical communication. Offered on a satisfactory-fail basis only.

NREM 489: Survey of Remote Sensing Technologies
(Dual-listed with NREM 589). (Cross-listed with E E, GEOL, MTEOR). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

NREM 489L: Satellite Remote Sensing Laboratory
(Dual-listed with NREM 589L). (Cross-listed with E E, GEOL, MTEOR). (0-3) Cr. 1. S.
Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589
Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

NREM 490: Independent Study
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Junior or senior classification, permission of instructor

NREM 490A: Independent Study: Animal Ecology
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Junior or senior classification, permission of instructor

NREM 490B: Independent Study: Forestry
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Junior or senior classification, permission of instructor

NREM 490E: Independent Study: Entrepreneurship
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Junior or senior classification, permission of instructor

NREM 490H: Independent Study: Honors Program
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Junior or senior classification, permission of instructor

NREM 490I: Iowa Lakeside Laboratory
(Cross-listed with ANTHR, IA LL). Cr. 1-6. Repeatable, maximum of 9 credits.
Prereq: 8 credits in biology and permission of instructor
Research opportunities for undergraduate students in the biological sciences. No more than 9 credits in Biol 490 may be counted toward graduation and of those, only 6 credits may be applied to the major.

NREM 496: Travel Course
(Dual-listed with NREM 596). Cr. 1-5. Repeatable, maximum of 3 times.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 496A: Travel Course: International
(Dual-listed with NREM 596A). Cr. 1-5. Repeatable, maximum of 3 times.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.
Meets International Perspectives Requirement.

NREM 496B: Travel Course: Domestic
(Dual-listed with NREM 596B). Cr. 1-5. Repeatable, maximum of 3 times.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 498: Cooperative Education
Cr. 1-3.
Prereq: Permission of departmental chair
Required of all cooperative education students. Students must register prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

NREM 502: Watershed Hydrology
(Dual-listed with NREM 402). (Cross-listed with ENSCI, GEOL, MTEOR). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

NREM 504: Forest Landscapes, Wildlife, and Silviculture
(2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Desired forest habitat conditions for fish and wildlife. Silvicultural approaches to protecting/improving such habitats. Focus on key forest elements related to animal species, groups and overall diversity. The lab focuses on team observations and discussions of diverse habitats including one weekend field trip.

NREM 505: Seminar
(2-0) Cr. 1-3. Repeatable, maximum of 3 times. F.S.
Prereq: Permission of instructor or graduate classification
Current topics in natural resources research and management.

NREM 507: Watershed Management
(Dual-listed with NREM 407). (Cross-listed with ENSCI). (3-3) Cr. 4. S.
Prereq: A course in general biology
Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers.

NREM 508I: Aquatic Ecology
(Cross-listed with ENSCI, IA LL). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

NREM 533: Erosion and Sediment Transport
(Cross-listed with A B E, ENSCI). (2-3) Cr. 3. F.
Prereq: C E 372 or GEOL/ENSCI/MTEOR 402, MATH 166 or equivalent
Soil erosion processes, soil loss equations and their application to conservation planning, sediment properties, initiation of sediment motion and over land flow, flow in alluvial channels and theory of sediment transport, channel stability, reservoir sedimentation, wind erosion, BMPs for controlling erosion.

NREM 535: Restoration Ecology
(Cross-listed with EEOB, ENSCI). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 366 or BIOL 474 or graduate standing
Theory and practice of restoring animal and plant diversity, structure and function of disturbed ecosystems. Restored freshwater wetlands, forests, prairies and reintroduced species populations will be used as case studies.

NREM 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

NREM 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

NREM 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

NREM 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

NREM 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

NREM 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

NREM 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

NREM 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

NREM 546: Integrating GPS and GIS for Natural Resource Management
(Dual-listed with NREM 446). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: 12 credits in student's major at 300 level or above, NREM 345 or equivalent experience with ArcGIS
Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation.

NREM 552: Ecosystem Management
(Dual-listed with NREM 452). (Cross-listed with FOR). (2-3) Cr. 3. S.
Prereq: Senior classification, and NREM 120 or its equivalent
Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints.

NREM 565: Landscape Change and Conservation
(Dual-listed with NREM 465). (Cross-listed with L A). (3-0) Cr. 3. F.
Prereq: L A 202
Exploration of issues in landscape ecology and conservation biology relevant to landscape change, design, and planning. Examination of foundational principles and their applications across a continuum of land uses, from wilderness to urban areas.

NREM 566: Ecosystem Service Management
(Dual-listed with NREM 466). (Cross-listed with ENSCI, ENT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

NREM 570: Advanced Decision-making in Natural Resource Allocation
(2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: FOR 451 or two courses in economics
Analytical approach to economic aspects of forest resource management problems. Theory and application of economic decision-making criteria to traditional and modern forest resource management issues. Current problems in the allocation of forest resources.

NREM 571: Agroforestry Systems
(Dual-listed with NREM 471). (Cross-listed with SUSAG). (2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in biological science at 300 level or above
Concepts of sustainable land use, agroecological dynamics, and component interactions of agroforestry systems. Agroforestry systems in temperate and tropical regions. Design and evaluation techniques for agroforestry systems. Ecological, socioeconomic and political aspects of agroforestry.
Meets International Perspectives Requirement.

NREM 580: Research Orientation
(2-0) Cr. 2. F.
Prereq: 20 credits in biological sciences and a course in statistics
Research design, proposal preparation, and technical writing.

NREM 585: Natural Resource Policy
(Dual-listed with NREM 385). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Graduate classification or permission of instructor
Development, theory and practice of natural resource policy. Integrative approach with topical policy studies in North American wildlife, forestry, and water. Policy formation, the role of science, introduction to federal law compliance.

NREM 589: Survey of Remote Sensing Technologies
(Dual-listed with NREM 489). (Cross-listed with E E, GEOL, MTEOR). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

NREM 589L: Satellite Remote Sensing Laboratory
(Dual-listed with NREM 489L). (Cross-listed with E E, MTEOR). (0-3) Cr. 1. S.
Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589
Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

NREM 590: Special Topics
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Permission of instructor

NREM 590A: Special Topics: Animal Ecology
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Permission of instructor

NREM 590B: Special Topics: Forestry
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Permission of instructor

NREM 593: Workshop
Cr. 1-3. Repeatable.
Prereq: Graduate classification

NREM 596: Travel Course
(Dual-listed with NREM 496). Cr. 1-5. Repeatable, maximum of 3 times.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study ecological topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 596A: Travel Course: International
(Dual-listed with NREM 496A). Cr. 1-5. Repeatable, maximum of 3 times.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students. Meets International Perspectives Requirement.

NREM 596B: Travel Course: Domestic
(Dual-listed with NREM 496B). Cr. 1-5. Repeatable, maximum of 3 times.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 598: Natural Resource Ecology and Management Teaching Practicum
Cr. 1. F.S.SS.
Prereq: Graduate classification as M.S. candidate in a NREM major and permission of instructor.
Graduate student experience in teaching. Student must plan and present at least one unit of subject matter in a course or extension workshop. Teaching practicum must be documented by the student and approved by the student's POS committee. Offered on a satisfactory-fail basis only.

NREM 599: Creative Component
Cr. arr.

Courses for graduate students:

NREM 600: Seminar
Cr. 1. Repeatable. F.S.
Current topics in natural resources research and management.

NREM 698: Natural Resource Ecology and Management Teaching Practicum
Cr. 1. F.S.
Prereq: Graduate classification as a Ph.D. candidate in a NREM major and permission of instructor.
Graduate student experience in teaching. Student must plan and present substantive subject matter for a minimum of three weeks in lecture and/or laboratory formats, or a series of extension seminars/workshops. Teaching practicum must be documented by the student and approved by the student's POS committee. Offered on a satisfactory-fail basis only.

NREM 699: Research
Cr. 1-12. Repeatable, maximum of 12 credits.

Naval Science (N S)

Courses primarily for undergraduates:

N S 111: Introduction to Naval Science
(3-0) Cr. 3. F.
Introduction to the organization, regulations, and capabilities of the US Navy, with emphasis on mission and principal warfare components.

N S 212: Seapower and Maritime Affairs

(3-0) Cr. 3. S.

An historical survey of sea power in terms of national domestic environments, foreign policy, and the evolution of maritime forces with trends in technology, doctrine, and tactics. The student will develop an understanding of the role the US Navy has played in the nation's history, both in peace and war. Naval events, forces and policies will be studied as elements in the shaping of the national consciousness and sense of purpose. Course content will include the development of the concept of sea power, the role of various warfare components of the Navy, the implementation of sea power as an instrument of national policy, the evolution of naval tactics, and the influence of maritime affairs around the world.

N S 220: Leadership and Management

(3-0) Cr. 3. F.

Introduction to the basic concepts of management and organization, their application to operations and personnel management. Experiential approach to learning principles of leadership and management by examining various management theories and their applications. Skills are developed in the areas of communication, counseling, control, direction, management, and leadership through active guided participation.

N S 230: Navigation

(3-0) Cr. 3. S.

Prereq: Sophomore classification

Study of the fundamentals of marine navigation used by ships at sea; includes practical exercises in piloting using visual and electronic means. In-depth discussion of laws that govern conduct of vessels in national and international waters. Course is supplemented with review and analysis of case studies involving actual navigation incidents.

N S 240: Fundamentals of Maneuver Warfare

(3-0) Cr. 3. Alt. S., offered odd-numbered years.

Concepts, definition, and need for maneuver warfare and expeditionary operations. US Marine Corps case studies of specific battles, development, and implementation. Structure, operation and capabilities of the Marine expeditionary unit, Marine air-ground task force and expeditionary strike group, Discussion and incorporation of leadership traits and principles.

N S 320: Naval Ship Systems I (Engineering)

(3-0) Cr. 3. F.

Prereq: PHYS 221, sophomore classification

An introduction to naval engineering with emphasis on the equipment and machinery involved in the conversion of energy for propulsion and other purposes aboard the major ship types of the U.S. fleet. Basic concepts of the theory and design of steam, gas turbine, diesel, and nuclear propulsion. Introduction to ship design, stability, hydrodynamic forces, compartmentalization, electrical and auxiliary systems.

N S 321: Evolution of Warfare

(3-0) Cr. 3. S.

Prereq: Sophomore classification

Evolution of warfare from 3500 B.C. to contemporary times; analysis of the impact of historical precedents on modern military thought and action; emphasis on the historical development of military tactics, strategy, and technology.

N S 330: Naval Ship Systems II (Weapons)

(3-0) Cr. 3. S.

Prereq: PHYS 221, sophomore classification

Introduction to the theory and principles of operation of naval weapon systems. Included coverage of types of weapons and fire control systems, capabilities and limitations; theory of target acquisition, identification and tracking; basics of naval ordnance.

N S 410: Naval Operations and Seamanship

(3-0) Cr. 3. F.

Prereq: N S 230; senior classification

Study of tactical naval operations; employs practical use of maneuvering boards together with shiphandling principles to arrive at tactical shipboard maneuvering solutions. Study also of naval command and control, communications, and the Naval Warfare Doctrine.

N S 412: Leadership and Ethics

(3-0) Cr. 3. S.

Prereq: Requirements for NROTC students - N S 111, N S 212 or HIST 389, N S 220, N S 230, N S 320, N S 330 and N S 410

Basic background concerning the duties and responsibilities of the junior naval officer and division officer in the areas of integrity and ethics, human resources management, personnel management, material management, and the administration of discipline. Preparation for responsibilities encountered immediately upon commissioning.

N S 440: Senior Naval Science Seminar

(1-0) Cr. 1. F.S.

Prereq: Senior classification

Current leadership issues in the US Navy which will challenge the newly commissioned officer. Opportunities to analyze, provide solutions, and discuss actions related to a variety of real world situations.

N S 490: Independent Study

Cr. 1-3. Repeatable, maximum of 9 credits.

Prereq: Senior classification and prior approval of Naval Science Department Chair, 6 credits in Naval Science

No more than 9 credits of N S 490 may be counted toward graduation.

Neuroscience (NEURO)

Courses primarily for graduate students, open to qualified undergraduates:

NEURO 556: Cellular, Molecular and Developmental Neuroscience
(Cross-listed with B M S, GDCB). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 335 or BIOL 436; physics recommended
Fundamental principles of neuroscience including cellular and molecular neuroscience, nervous system development, sensory, motor and regulatory systems.

NEURO 557: Advanced Neuroscience Techniques
(Cross-listed with GDCB). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Neuro 556 or equivalent course
Research methods and techniques; lectures, laboratory exercises and/or demonstrations representing individual faculty specialties.

Courses for graduate students:

NEURO 661: Current Topics in Neuroscience
(Cross-listed with BBMB, GDCB). (2-0) Cr. 2-3. Repeatable. Alt. S., offered even-numbered years.
Prereq: NEURO 556 (or comparable course) or permission of instructor
Topics may include molecular and cellular neuroscience, neurodevelopment, neuroplasticity, neurodegenerative diseases, cognitive neuroscience, sensory biology, neural integration, membrane biophysics, neuroethology, techniques in neurobiology and behavior.

NEURO 690: Journal Club in Neuroscience
(1-0) Cr. 1. Repeatable. F.S.
Prereq: NEURO 556
Students are required to attend and make at least one presentation at a weekly journal club focusing on current topics.

NEURO 696: Neuroscience Seminar
(1-0) Cr. 1. Repeatable. F.S.
Prereq: NEURO 556
Presentations and discussion of research by students, faculty, and visiting scholars.

NEURO 699: Research
Cr. arr. Repeatable.

Nuclear Engineering (NUC E)

Courses primarily for undergraduates:

NUC E 401: Nuclear Radiation Theory and Engineering
(3-0) Cr. 3. F.
Prereq: PHYS 222, MATH 266 or MATH 267
Atomic and nuclear physics. Radioactivity and reaction rates. Cross sections. Introduction to neutron diffusion theory. Engineering applications of radiation theory.

NUC E 402: Nuclear Reactor Engineering
(3-0) Cr. 3. S.
Prereq: NUC E 401, permission of Nuclear Engineering program director
WWW only. Fission and chain reactions. Neutron diffusion and moderation. Reactor equations. Fermi Age theory. Multigroup and multiregional analysis. Contact Nuclear Engineering program director for enrollment information.

NUC E 405: Radiation Protection and Shielding
(3-0) Cr. 3.
Prereq: NUC E 401, permission of Nuclear Engineering program director
WWW only. Basic principles and concepts of radiation protection and design: dosimetric units and response functions, hazards of radiation dose, radiation sources, basic methods for dose evaluation, and shielding design techniques for photons and neurons.

NUC E 410: Nuclear Reactor Theory
(3-0) Cr. 3. F.
Prereq: NUC E 401, permission of Nuclear Engineering program director
WWW only. An introduction to neutron diffusion theory, neutron moderation, conditions for criticality of nuclear reactors.

NUC E 421: Nuclear Criticality Safety
Cr. 3. F.
Prereq: NUC E 401
Nomenclature, theory, and practice of nuclear criticality safety. Review of nuclear criticality accidents, analytical methods used in criticality analysis, review of standards and regulations, and developing criticality safety evaluations.

NUC E 430: Nuclear Energy and Society
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: NUC E 401
The relationship between nuclear energy and society is examined from the perspective of significant events in the commercial nuclear power industry. Event analysis includes differences and similarities of technologies along with environmental impact. Political, social, media and regulatory responses for each event are discussed along with the impact on future plant design.

NUC E 441: Probabilistic Risk Assessment
(3-0) Cr. 3. S.
Prereq: STAT 305 or equivalent
Methods for analysis of nuclear power systems. Fault tree and event tree analysis methods. Mathematical basics for dealing with reliability data, theory, and analysis. Case studies of accidents in nuclear power systems.

NUC E 461: Radiation Detection, Measurement and Simulation
(3-0) Cr. 3. S.
Prereq: NUC E 401
Principles of nuclear radiation safety and detection. Radiation energy spectroscopy. Counting statistics and error analysis. Monte Carlo simulation of radiation transport. Detection system performance parameters. Design projects.

NUC E 490: Independent Study
Cr. 1-3. Repeatable, maximum of 3 credits.
Prereq: Junior Classification
Investigation of nuclear engineering topics. Election of course and topic must be approved in advance by supervising faculty.

Nutritional Sciences (NUTRS)

Courses primarily for graduate students, open to qualified undergraduates:

NUTRS 501: Biochemical and Physiological Basis of Nutrition: Macronutrients and Micronutrients
(4-0) Cr. 4. F.
Prereq: Credit or enrollment in BBMB 404 or BBMB 420
Integration of the molecular, cellular, and physiologic aspects of energy, macronutrient, and micronutrient metabolism in mammalian systems. Survey course that includes interactions among nutrients (dietary carbohydrate, fiber, lipid, protein, vitamins, and minerals) and non-nutrients, metabolic consequences of nutrient deficiencies or excesses, relevant polymorphisms, and major research methodologies.

NUTRS 503: Biology of Adipose Tissue
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Undergraduate: consent of instructor; Graduate: NutrS 501
Principles regarding the development of adipose tissue and its role in energy balance, and will focus considerably on endocrine and immune actions of the adipocyte. Course material will be in lecture format, including handouts and selected journal articles. Students will be asked to lead critical discussions of key research findings as summary material for a given topic. Species differences will be highlighted, particularly as they relate to research models.

NUTRS 504: Nutrition and Epigenetic Regulation of Gene Expression
(1-0) Cr. 1. Alt. S., offered even-numbered years.
Prereq: graduate standing; undergraduate with consent of instructor
Discussion of epigenetic regulation of gene expression and the role that nutrition plays in this process. Examination of current research literature to understand how different nutrients and physiological states influence epigenetics, as well as, the research methodology used to address these relations.

NUTRS 505: Short Course
(1-0) Cr. 1. SS.
Prereq: Permission of instructor

NUTRS 506: Diet and Cancer Prevention
(Cross-listed with TOX). (1-0) Cr. 1. Alt. F., offered even-numbered years.
Prereq: BBMB 404 and BBMB 405 or BBMB 420
Principles of cancer biology and cancer etiology will be integrated with the impacts of diet on cancer development and prevention. Contributions of research with humans, animals, cultured cells and cell free systems will be included. The importance of dietary contaminants, macronutrients and micronutrients will be examined with an emphasis on the strength of the evidence and mechanisms of action.

NUTRS 518: Digestive Physiology and Metabolism of Non Ruminants
(Cross-listed with AN S). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: AN S 419 or NUTRS 501
Digestion and metabolism of nutrients. Nutritional requirements and current research and feeding programs for poultry and swine.

NUTRS 519: Food Toxicology
(Cross-listed with FS HN, TOX). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A course in biochemistry
Basic principles of toxicology. Toxicants in the food supply: modes of action, toxicant defense systems, toxicant and nutrient interactions, risk assessment. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

NUTRS 520: Digestive Physiology and Metabolism of Ruminants
(Cross-listed with AN S). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: AN S 419 or NUTRS 501
Digestive physiology and nutrient metabolism in ruminant and preruminant animals.

NUTRS 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

NUTRS 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

NUTRS 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

NUTRS 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

NUTRS 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

NUTRS 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

NUTRS 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

NUTRS 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

NUTRS 549: Advanced Vertebrate Physiology I
(Cross-listed with AN S, KIN). (4-0) Cr. 4. F.
Prereq: Biol 335; credit or enrollment in BBMB 404 or BBMB 420
Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems.

NUTRS 552: Advanced Vertebrate Physiology II
(Cross-listed with AN S, KIN). (3-0) Cr. 3. S.
Prereq: BIOL 335; credit or enrollment in BBMB 404 or BBMB 420
Cardiovascular, renal, respiratory, and digestive physiology.

NUTRS 561: Medical Nutrition and Disease I
(4-0) Cr. 4. F.
Prereq: FS HN 360, FS HN 361, FS HN 367, BIOL 256 and 256L or BIOL 306 or BIOL 335
(Dual listed with FS HN 461.) Pathophysiology of selected chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state.

NUTRS 562: Assessment of Nutritional Status
(3-0) Cr. 3.
Prereq: FS HN 461/NUTRS 561 or NUTRS 501
Overview and practical applications of methods for assessing nutritional status, including: theoretical framework of nutritional health and disease, dietary intake, biochemical indices, clinical examination, and body composition.

NUTRS 563: Community Nutrition
(3-0) Cr. 3. F.
Prereq: FS HN 265 or FS HN 360; FS HN 366 recommended
Dual listed with FS HN 463. Survey of current public health nutrition problems among nutritionally vulnerable individuals and groups. Discussion of the multidimensional nature of those problems and of community programs addressing them. Grant writing as a means for funding community nutrition program development. Significant emphasis on written and oral communication at the lay and professional level. Field trip.

NUTRS 564: Medical Nutrition and Disease II
(3-0) Cr. 3-4. S.
Prereq: FS HN 360, FS HN 461, or NUTRS 561.
(Dual listed with FS HN 464.) Pathophysiology of selected acute and chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state.

NUTRS 597: Nutritional Aspects of Oncology
(Cross-listed with DIET, FS HN). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: B.S. in nutrition, dietetics, biology, or related discipline.
Understanding of basic cancer biology and methodology used to study nutrition and cancer relationships. Using current research as a basis, the role of nutrition in specific cancers will be explored. Students will learn about sources of information for cancer prevention programs, and how to apply this information to clinical patient management.

Courses for graduate students:

NUTRS 618: Vitamins and Minerals
(Cross-listed with AN S). Cr. 2. Alt. S., offered even-numbered years.
Prereq: Biochemistry, physiology, basic nutrition
Understanding molecular aspects of vitamin and mineral metabolism and homeostasis in humans and animals. An in-depth examination of the chemistry of vitamins and minerals, including genetic mutations, proteins involved in absorption and excretion, and their necessity in biological processes.

NUTRS 619: Advanced Nutrition and Metabolism - Protein
(Cross-listed with AN S). (2-0) Cr. 2.
Prereq: BBMB 405
Digestion, absorption, and intermediary metabolism of amino acids and protein. Regulation of protein synthesis and degradation. Integration of cellular biochemistry and physiology of mammalian protein metabolism.

NUTRS 620: Advanced Nutrition and Metabolism - Energy
(Cross-listed with AN S). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: BBMB 405
Energy constituents of feedstuffs and energy needs of animals as related to cellular biochemistry and physiology. Interpretations of classical and current research.

NUTRS 680: Modern Views of Nutrition
Cr. R. Repeatable. F.
Current concepts in nutrition and related fields. Required for all graduate students in nutrition.

NUTRS 690: Special Problems
Cr. arr. Repeatable. F.S.SS.

NUTRS 695: Grant Proposal Writing
(Cross-listed with FS HN). (1-0) Cr. 1. F.
Prereq: 3 credits of graduate course work in food science and/or nutrition
Grant proposal preparation experiences including writing and critiquing of proposals and budget planning. Formation of grant writing teams in food science and/or nutrition. Offered on a satisfactory-fail basis only.

NUTRS 699: Research in Nutritional Sciences
Cr. arr. F.S.SS.
Offered on a satisfactory-fail basis only.

Organization for Tropical Studies (OTS)

Courses primarily for graduate students, open to qualified undergraduates:

OTS 510: Tropical Biology: An Ecological Approach
Cr. 8.
This course is designed for students in the early stages of graduate study in biology or a related field, with the goal of training graduate students in research methods by providing intensive field experience in diverse tropical ecosystems.

OTS 515: Topics in Tropical Biology
Cr. 1-8.
This course is designated for students enrolled in graduate course offerings through OTS (excluding OTS 510). Examples of graduate courses offered by OTS include Tropical Plant Systematics, Tropical Ecology and Conservation, Molecular Methods in Tropical Ecology, and Tropical Agroecology.

Organizational Learning and Human Resource Development (OLHRD)

Performing Arts (PERF)

Courses primarily for undergraduates:

PERF 105: Issues in the Performing Arts
(1-0) Cr. R. F.S.
Cross-disciplinary analysis and discussion of topics in the performing arts. Six semesters required of performing arts majors.

PERF 310: Performing Arts Internship
Cr. R. Repeatable. F.S.SS.
Required of performing arts majors. A job or internship with a professional or semi-professional performing arts organization. Offered on a satisfactory-fail basis only.

PERF 401: Performing Arts Seminar
(2-0) Cr. 2. S.
Intensive collaborative study and practice of topics in music, dance and theatre. Required of performing arts majors.

Philosophy (PHIL)

Courses primarily for undergraduates:

PHIL 201: Introduction to Philosophy
(3-0) Cr. 3. F.S.SS.
It has been rumored that the unexamined life is not worth living. Philosophy is an attempt to begin examining life by considering such questions as: What makes us human? What is the world ultimately like? How should we relate to other people? Is there a god? How can we know anything about these questions? Understanding questions of this kind and proposed answers to them is what this course is all about.

PHIL 206: Introduction to Logic and Scientific Reasoning
(3-0) Cr. 3. F.S.SS.
Basic principles of critical reasoning and argument evaluation. A consideration of basic forms of argumentation in science and everyday life. Application to contemporary issues and controversies.

PHIL 207: Introduction to Symbolic Logic
(Cross-listed with LING). (3-0) Cr. 3. S.
Introduction to fundamental logical concepts and logical symbolism. Development of natural deduction through first order predicate logic with identity. Applications to arguments in ordinary English and to philosophical issues. Linguistics majors should take LING/PHIL 207 as early as possible.

PHIL 230: Moral Theory and Practice
(3-0) Cr. 3. F.S.SS.
Investigation of moral issues in the context of major ethical theories of value and obligation; e.g., punishment, abortion, economic justice, job discrimination, world hunger, and sexual morality. Emphasis on critical reasoning and argument analysis.

PHIL 235: Ethical Issues in A Diverse Society
(3-0) Cr. 3. S.
This course will examine a range of arguments on diversity issues. Topics will include: the social status of women, the moral status of sexuality and homosexuality, the nature and role of racism in contemporary society, the relationship between biology, gender roles and social status, and various proposals for change from a variety of political perspectives.
Meets U.S. Diversity Requirement

PHIL 310: Ancient Philosophy
(Cross-listed with CL ST). (3-0) Cr. 3. F.
Prereq: PHIL 201
Survey of ancient Greek philosophy, focusing on the pre-Socratics, Plato, and Aristotle. Questions concerning being, knowledge, language, and the good life are treated in depth.

PHIL 314: 17th Century Philosophy
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: PHIL 201
Readings from philosophers such as Hobbes, Descartes, Spinoza, Leibniz, and Locke. Changing conceptions of knowledge, self, and deities in response to Galileo's new science and post-reformation challenge to ecclesiastical authority.

PHIL 315: 18th Century Philosophy
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PHIL 201
Readings from philosophers such as Berkeley, Hume, and Kant. Development of Enlightenment thought. Issues include idealism, causation, freedom, and knowledge regarding science, ethics, and deities.

PHIL 316: 19th Century Continental Philosophy
(3-0) Cr. 3. F.
Prereq: PHIL 201
The thought of Hegel, Marx, Nietzsche, and their contemporaries. Various perspectives on the philosophy of history, the nature of reason and subjectivity, the contrast between dialectical and nondialectical philosophy, and the relationship between philosophy and society.

PHIL 317: 20th and 21st Century Continental Philosophy
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: PHIL 201
Major movements of 20th and 21st century thought, such as Phenomenology, Critical Theory, Post-structuralism, Postmodernism, and Feminism. Issues include the assumptions and limits of Western metaphysics, the nature of reason, the relationship between language and power.

PHIL 318: 20th and 21st Century Anglo-American Philosophy
(3-0) Cr. 3. S.
Prereq: 6 credits in philosophy, including PHIL 201.
Major movements in recent and contemporary philosophy such as realism, logical positivism, ordinary language philosophy, and naturalism. Russell, Wittgenstein, Quine and other leading figures. Topics include knowledge of the material world, mind, language, values, and philosophical method.

PHIL 320: Existentialism and Its Critics
(3-0) Cr. 3. F.
Prereq: PHIL 201
An investigation of Existentialism and its critics in historical and cultural context. Emphasis on existential phenomenology and French existentialism, and on criticisms. Existential Marxism and Heidegger's later philosophy.

PHIL 330: Ethical Theory
(3-0) Cr. 3. F.
Prereq: PHIL 201 or PHIL 230
Study of major theories of morality and the good life. Includes such topics as moral psychology, practical reasoning, and virtue theory.

PHIL 331: Moral Problems in Medicine
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PHIL 230 or junior classification
In-depth study of some of the central moral problems arising in medicine, e.g., abortion, euthanasia, patients' rights, health care professionals' duties and responsibilities, allocation of medical resources. Major moral theories will be examined and applied.

PHIL 332: Philosophy of Law
(Cross-listed with CJ ST). (3-0) Cr. 3. F.S.
Prereq: PHIL 201 or PHIL 230
Extent of our obligation to obey the law; what constitutes just punishment; how much of the immoral should be made illegal? Relation of these questions to major theories of law and the state. Discussion of such concepts as coercion, equality, and responsibility.

PHIL 334: Environmental Ethics
(Cross-listed with ENV S). (3-0) Cr. 3. F.
Prereq: 3 credits in philosophy or junior classification
Thorough study of some of the central moral issues arising in connection with human impact on the environment, e.g., human overpopulation, species extinction, forest and wilderness management, pollution. Several world views of the proper relationship between human beings and nature will be explored.

PHIL 335: Social and Political Philosophy
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: PHIL 201 or PHIL 230
Foundations of social and political life. The basis of political organization, the nature of social and political institutions, rights and authority, justice. Original texts.

PHIL 336: Bioethics and Biotechnology
(3-0) Cr. 3.
Prereq: PHIL 201 or PHIL 230 or PHIL 235
In-depth study of some central moral issues in the life sciences, e.g., genetic screening and testing, genetically engineered plants and animals, risk analysis, biotechnology patents, research ethics, biodiversity, the impact of biotechnology on society and the environment. Major moral theories will be discussed and applied. (Phil 336 contains almost no similarities to Phil 331.).

PHIL 338: Feminist Philosophy
(Cross-listed with W S). (3-0) Cr. 3. F.
Prereq: 3 credits in philosophy or women's studies recommended
A critical, theoretical examination of the oppression of women, especially as it relates to issues of race, class, and sexual orientation. How concepts such as sex and gender, self and other, nature and nurture, complicate our understanding of what it means to be a woman. Historical and contemporary feminist philosophers addressing topics such as violence, sexuality, pornography, political power, family structure and women's paid and unpaid labor.
Meets U.S. Diversity Requirement

PHIL 339: Liberty and Law in America
(Cross-listed with CJ ST, POL S). Cr. 3.
Prereq: Sophomore status
An exploration of competing conceptions of liberty in American political thought and debates about how liberty should be protected by the law. Contemporary debates about topics such as health care, drugs, property, speech, religion, and sex.

PHIL 340: Aesthetics
(3-0) Cr. 3. F.
Prereq: PHIL 201 or PHIL 230
Is liking all there is to appreciating works of art or natural beauty? We will examine our appreciative experiences, talk about such experiences (e.g., art criticism), and what makes them valuable. Do the different arts have common values? How are their differences important?.

PHIL 343: Philosophy of Technology
(Cross-listed with T SC). (3-0) Cr. 3. F.S.
Prereq: 6 credits of social science or T SC 341 and 3 credits of social science
Moral and other philosophical problems related to developments in technology. Topics may include conditions under which technological innovations contribute to human emancipation, relationship of technology and democracy, utility and limits of technical rationality, and problems of ensuring that benefits of technological advance are communally shared. Topics discussed with reference to such issues as contemporary developments in microelectronics, technology transfer to the Third World, etc.

PHIL 350: Philosophy of Religion
(Cross-listed with RELIG). (3-0) Cr. 3. F.
Prereq: 6 credits in philosophy
The value and truth of religious life and belief. Mystical experience; religious faith and language; arguments for God's existence; the problem of evil; miracles; and religion and morality. Historical and contemporary readings.

PHIL 364: Metaphysics: God, Minds, and Matter

(3-0) Cr. 3. S.

Prereq: 6 credits in philosophy, including Phil 201.

A survey of classical and contemporary views on some basic metaphysical issues. Issues discussed include: Does God exist? Do you have a mind and, if so, how does it relate to your body? What is the nature of cause and effect? Do objects have any essential properties? How can we account for properties objects have in common?.

PHIL 366: Truth, Belief and Reason

(3-0) Cr. 3. F.

Prereq: 6 credits in philosophy including PHIL 201, or instructor permission.

This course focuses on significant topics in theory of knowledge, including the value of true beliefs, the role of sense experience in supporting our theoretical views, and the place of reason in human nature. Historical and contemporary views will be considered.

PHIL 380: Philosophy of Science

(3-0) Cr. 3. F.

Prereq: PHIL 201 or 6 credits in a science

Introduction to the philosophy of science. A variety of basic problems common to the natural and social sciences: the nature of explanation, the structure of theories, the unity of science, and the distinction between science and nonscience.

PHIL 382: History and Philosophy of the Scientific Revolution.

(Cross-listed with HIST). (3-0) Cr. 3. S.

The emergence of empirical science as the authoritative methodology for production of knowledge about the natural world in the period between Copernicus and Kant. Scientific progress achieved during the period, including the work of Galileo, Descartes, and Newton. The re-shaping of epistemology in the Western intellectual tradition. Implications for philosophy and historiography.

PHIL 398: Cooperative Education

Cr. R. F.S.SS.

Prereq: Permission of the department cooperative education coordinator; junior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

PHIL 430: Value Theory

(3-0) Cr. 3. Repeatable, maximum of 6 credits. S.

Prereq: PHIL 230

Theoretical and normative issues in ethics, aesthetics, religious thought, or political philosophy. Topics vary each time offered.

PHIL 450: Agency and Free Will

(3-0) Cr. 3. Repeatable, maximum of 1 times. F.

Prereq: 3 credits in philosophy; PHIL 207 strongly encouraged

Personal identity, agency, free will, moral responsibility, causation, future contingents, and time will be discussed. What makes a person the same person over time? Do humans have free will? Are we not morally responsible if our actions are inevitable consequences of the past and the laws of nature? What distinguishes causes from non-causes? Are there facts about the future?.

PHIL 465: Brains, Minds, and Computers

(3-0) Cr. 3. F.

Prereq: 6 credits in philosophy

Examination of concepts such as computability, intelligence, programming, and free will; and of arguments about whether any human capacity is forever beyond realization in a machine.

PHIL 466: Topics in Epistemology

(3-0) Cr. 3. Repeatable, maximum of 6 credits. S.

Prereq: 6 credits in philosophy

Topics in epistemology. Possible topics include skepticism about the external world, the extent of a priori knowledge, rival accounts of moral knowledge, feminist perspectives on the theory of knowledge, and the value of true belief. Topics vary each time offered.

PHIL 485: Philosophy of Physics

(3-0) Cr. 3.

Prereq: 3 credits in Philosophy or 3 credits in Physics

S. Conceptual and philosophical issues relating to the interpretation of theories in classical and modern physics. May include one or more of the following topics: the relationship between mathematics and the physical world; Newtonian physics (determinism and predictability); thermodynamics and statistical physics (the nature of probability; entropy and the direction of time); relativistic physics (indeterminism; realism and nonlocality; consciousness and the role of the observer).

PHIL 490: Independent Study

Cr. 1-4. Repeatable, maximum of 9 credits.

Prereq: 6 credits in philosophy; permission of instructor, approval of chair.

Guided reading and research on special topics selected to meet needs of advanced students. No more than 9 credits of Phil 490 may be counted toward graduation.

PHIL 490H: Independent Study, Honors

Cr. 1-4. Repeatable, maximum of 9 credits.

Prereq: 6 credits in philosophy; permission of instructor, approval of chair.

Guided reading and research on special topics selected to meet needs of advanced students. No more than 9 credits of Phil 490 may be counted toward graduation.

PHIL 492: Graduating Senior Survey
Cr. R. F.S.
Prereq: Graduating senior
Final presentation for graduation and the future. Outcomes assessment activities. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

PHIL 535: Contemporary Political Philosophy
(Cross-listed with POL S). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 6 credits of philosophy or political science
Examination of theories of justice proposed by contemporary political philosophers. Analysis of the philosophical foundations of perspectives such as liberalism, libertarianism, communitarianism, socialism, feminism. Normative assessments of socio-political institutions.

PHIL 590: Special Topics in Philosophy
Cr. 2-4. Repeatable.
Prereq: Permission of instructor, 9 credits in philosophy

PHIL 590A: Special Topics in Philosophy: History of Philosophy
Cr. 2-4. Repeatable.
Prereq: Permission of instructor, 9 credits in philosophy

PHIL 590B: Special Topics in Philosophy: Epistemology and Metaphysics
Cr. 2-4. Repeatable.
Prereq: Permission of instructor, 9 credits in philosophy

PHIL 590C: Special Topics in Philosophy: Value Theory
Cr. 2-4. Repeatable.
Prereq: Permission of instructor, 9 credits in philosophy

PHIL 590D: Special Topics in Philosophy: Logic and Philosophy of Science
Cr. 2-4. Repeatable.
Prereq: Permission of instructor, 9 credits in philosophy

PHIL 593: Summer Bioethics Workshop for Teachers
(2-0) Cr. 2. SS.
Topics include moral theory, pedagogical issues in teaching bioethics, and substantive current issues in bioethics.

Physics (PHYS)

Courses primarily for undergraduates:

PHYS 101: Physics for the Nonscientist
(3-0) Cr. 3. F.S.
Survey of the principal areas of both classical and modern physics. Emphasis on the nature of the physical universe and the application of physical principles to life in the modern world. Not suitable to meet a general physics requirement for natural science majors.

PHYS 102L: Physical Sciences for Elementary Education
(Cross-listed with CHEM). (1-4) Cr. 3. F.S.
Prereq: MATH 195 or MATH 140
Physical science principles for future elementary teachers. Emphasis on experiments that address current elementary science education standards and that are appropriate for their future students to do, such as measurements of mass, length, time, light from atoms, charge and current, motion due to forces, energy and work, heat, waves, optics, building bridges and making musical instruments, studying states of matter and chemical reactions.

PHYS 111: General Physics
(4-2) Cr. 5. F.S.SS.
Prereq: 1 1/2 years of high school algebra, 1 year of geometry, 1 semester of trigonometry
General background in physical concepts, principles, and methods for those who do not plan advanced study in physics or engineering. Mechanics, fluids, heat and thermodynamics, vibrations, waves, sound.

PHYS 112: General Physics
(4-2) Cr. 5. F.S.SS.
Prereq: PHYS 111
General background in physical concepts, principles, and methods for those who do not plan advanced study in physics or engineering. Electricity and magnetism, ray and wave optics, topics in modern physics.

PHYS 115: Physics for the Life Sciences
(4-0) Cr. 4. F.S.
Prereq: high school: 1 1/2 yr. algebra, 1 yr. geometry, 1 semester trigonometry
Emphasis on basic physics principles applied to biological problems. Topics include mechanics, fluids, thermodynamics, heat, light, sound, electricity and magnetism. A coordinated laboratory, Physics 115 laboratory is available.

PHYS 115L: Laboratory in Physics for the Life Sciences
(0-2) Cr. 1. F.S.
Experiments related to the elementary topics of physics for the life sciences. Mechanics, fluids, thermodynamics, heat, light, sound, electricity and magnetism.

PHYS 198: Physics of Music

(2-2) Cr. 3. F.

Introductory level course on sound for nonphysics majors. Properties of pure tones and harmonics; human perception of sound; room acoustics; scales; production, and analysis of musical by voice, string, woodwind, brass, and percussion instruments. Not suitable to meet a general physics requirement for natural science majors

PHYS 199: Introductory Seminar

Cr. R. F.

(1-1) Gain experience in key skills that physicists/astronomers use routinely, but are rarely explicitly taught in formal courses. Participate in faculty-led discussions on frontier areas and careers. Offered on a satisfactory-fail basis only.

PHYS 221: Introduction to Classical Physics I

(4.5-1) Cr. 5. F.S.SS.

Prereq: Proficiency in algebra, trigonometry, vector manipulation, and topics covered in Math 165, and credit or enrollment in MATH 166.

For engineering and science majors. 3 hours of lecture each week plus 3 recitations and 1 laboratory every 2 weeks. Elementary mechanics including kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation. Heat, thermodynamics, kinetic theory of gases; waves and sound.

PHYS 221H: Introduction to Classical Physics I: Honors

(4.5-1) Cr. 5. F.S.

Prereq: Proficiency in algebra, trigonometry, vector manipulation, and topics covered in Math 165, and credit or enrollment in MATH 166.

For engineering and science majors. 3 hours of lecture each week plus 3 recitations and 1 laboratory every 2 weeks. Elementary mechanics including kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation. Heat, thermodynamics, kinetic theory of gases; waves and sound.

PHYS 222: Introduction to Classical Physics II

(4-2) Cr. 5. F.S.SS.

Prereq: PHYS 221 OR PHYS 241, MATH 166

3 hours of lecture each week plus 1 recitation and 1 laboratory each week. Electric forces and fields. Electrical currents; DC circuits. Magnetic forces and fields: LR, LC, LCR circuits; Maxwell's equations; ray optics and image formation; wave optics; topics in modern physics.

PHYS 222H: Introduction to Classical Physics II: Honors

(4-2) Cr. 5. F.S.

Prereq: PHYS 221 OR PHYS 241, MATH 166

3 hours of lecture each week plus 1 recitation and 1 laboratory each week. Electric forces and fields. Electrical currents; DC circuits. Magnetic forces and fields: LR, LC, LCR circuits; Maxwell's equations; ray optics and image formation; wave optics; topics in modern physics.

PHYS 241: Principles and Symmetries in Classical Physics I

(4.5-1) Cr. 5. F.

Prereq: Proficiency in algebra, trigonometry, vector manipulation, and topics covered in MATH 165, and credit or enrollment in MATH 166.

Covers all of mechanics; Kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation, and extremum principles. Topics in kinetic theory, thermodynamics, waves and sound.

PHYS 241H: Principles and Symmetries in Classical Physics I, Honors.

(4.5-1) Cr. 5. F.

Prereq: Proficiency in algebra, trigonometry, vector manipulation, and topics covered in MATH 165, and credit or enrollment in MATH 166.

Covers all of mechanics; Kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation, and extremum principles. Topics in kinetic theory, thermodynamics, waves and sound.

PHYS 242: Principles and Symmetries in Classical Physics II

(4-2) Cr. 5. S.

Prereq: PHYS 221 or PHYS 241, credit or enrollment in MATH 166

Electrostatics, potentials and fields, currents, fields of moving charges, the magnetic field, electromagnetic induction, DC and AC circuits, Maxwell's equations and electromagnetic waves, electric and magnetic fields in matter. Topics in optics, special relativity and modern physics.

PHYS 242H: Principles and Symmetries in Classical Physics II, Honors (Spring).

(4-2) Cr. 5. S.

Prereq: PHYS 221 or PHYS 241, credit or enrollment in MATH 166

Electrostatics, potentials and fields, currents, fields of moving charges, the magnetic field, electromagnetic induction, DC and AC circuits, Maxwell's equations and electromagnetic waves, electric and magnetic fields in matter. Topics in optics, special relativity and modern physics.

PHYS 290: Independent Study

Cr. 1-4. Repeatable.

Prereq: Permission of instructor

PHYS 298: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

PHYS 302: The Challenge of Contemporary Physics
(3-0) Cr. 3. S.
Prereq: Sophomore classification
A largely nonmathematical but intellectually challenging exploration of physics, which assumes no previous work in the field. Selected material from classical and modern physics establishes the conceptual framework for the study of major areas of contemporary physics, culminating in the discussion of topics at the frontier of present knowledge. Topics vary yearly and may include quarks, lasers, superconductivity, fission and fusion, solid state devices, gravitational waves, string theory, facilities, left handed materials, and quantum computing. Not suitable to meet a general physics requirement for natural science majors.

PHYS 304: Thermal Physics
(3-0) Cr. 3. F.
Prereq: PHYS 222, MATH 266
Concepts of temperature, entropy, and other characteristic thermodynamic functions, with application to macroscopic properties of matter. The laws of thermodynamics. Introduction to statistical mechanics, including quantum statistics. Application to black body radiation, crystalline vibrations, magnetic ions in solids, electronic heat capacity of metals. Phase transformations and chemical reactions.

PHYS 306: Physics of Wave Motion
(3-0) Cr. 3. S.
Prereq: PHYS 222, credit or enrollment in MATH 267
Oscillating systems including damped and forced oscillations; fluids, geometric optics, water waves, the wave equation, Fourier and Laplace transforms, non-uniform media, cylindrical and spherical waves, polarization, interference and diffraction, transmission lines, non-linear waves.

PHYS 310: Electronic Instrumentation for Experimental Physics
(2-4) Cr. 4. F.
Prereq: PHYS 222; MATH 166
Common electrical instruments; power supplies; transducers; passive and active devices, analog integrated circuits, including filters and amplifiers; digital integrated circuits; signal transmission and enhancement.

PHYS 311: Intermediate Laboratory
Cr. 1-2. Repeatable. S.
Prereq: PHYS 322
Experiments in classical and modern physics performed independently by each student.

PHYS 311T: Intermediate Laboratory for Secondary Physics Teachers
(0-6) Cr. 3. Repeatable. S.
Prereq: PHYS 112 or PHYS 222
Experiments in classical and modern physics performed independently by each student. For students preparing for a career in high school teaching.

PHYS 321: Introduction to Modern Physics I
(3-0) Cr. 3. F.
Prereq: PHYS 222, credit or enrollment in MATH 266
Quantum nature of matter: photons, de Broglie's postulate: wave-like properties of matter; Bohr's model of hydrogen atom; Schrodinger equations in one dimension: energy quantization; detailed solutions for potential steps, barriers and wells; one-electron atoms, spin and magnetic interactions; ground states, optical and x-ray excitations of multi-electron atoms.

PHYS 321L: Introductory Laboratory in Modern Physics I
(0-2) Cr. 1. F.
Prereq: Credit or enrollment in PHYS 321
Experiments related to the foundations of modern physics. The dual wave and particle character of electrons and photons, statistics, interferometry and x-ray spectroscopy.

PHYS 322: Introduction to Modern Physics II
(3-0) Cr. 3. S.
Prereq: PHYS 321
Quantum statistics; lasers; physics of molecules. Properties of solids, including electron band structure, superconductivity and magnetism. Nuclear physics, including nuclear sizes and masses, stability, decay modes, reactions, fission and fusion. Elementary particles, including strangeness, charm, and quarks. Fundamental forces of nature.

PHYS 322L: Introductory Laboratory in Modern Physics II
(0-2) Cr. 1. S.
Prereq: Credit or enrollment in PHYS 322
Experiments related to the foundations of modern physics. Radioactive decay, elementary particles, Hall effect, quantization, spectroscopy, statistics and instrumentation.

PHYS 361: Classical Mechanics
(3-0) Cr. 3. S.
Prereq: PHYS 222, MATH 265, credit or enrollment in MATH 266 or 267
Newtonian mechanics including forced oscillations, central forces and orbital motion, collisions, moving frames of reference, Lagrange's equations.

PHYS 362: Intermediate Mechanics
(3-0) Cr. 3. F.
Prereq: PHYS 361
Rigid body motion; small oscillations, normal modes. Special relativity including length contraction, time dilation, simultaneity, Lorentz transformation, 4-vector covariant formalism, relativistic mechanics.

PHYS 364: Electricity and Magnetism I
(3-0) Cr. 3. F.
Prereq: PHYS 222
Static electric and magnetic fields, potential theory; electromagnetism, Maxwell's equations.

PHYS 365: Electricity and Magnetism II
(3-0) Cr. 3. S.
Prereq: PHYS 364, MATH 385
Relativistic electromagnetic theory; radiation and propagation of electromagnetic waves; interaction with matter.

PHYS 389: Junior Seminar
Cr. R. S.
Recommended for all junior physics majors. Career opportunities: graduate school programs and application, job placement, alternative careers, basic skills needed for the job market competition. Offered on a satisfactory-fail basis only.

PHYS 398: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

PHYS 399: Seminar on Secondary School Physics
Cr. 1-2. Repeatable, maximum of 2 credits. F.
Prereq: Permission of instructor
Review of materials and curricula for secondary school physics presented and discussed by members of the class. Required for approval to teach physics in secondary schools.

PHYS 421: Ultrafast Laser Science and Spectroscopy
(Dual-listed with PHYS 521). (3-0) Cr. 3. F.
Prereq: PHYS 321, PHYS 365, or equivalent with permission of instructor
Introduction to ultrafast lasers, nonlinear optics, and their applications. Topics selected from: basic optics, atom-photon interactions, electrodynamics of condensed matter, laser physics, ultrafast and nonlinear optics, ultrashort pulse generation, broadband pulse generation, time-resolved spectroscopy and instrumentation.

PHYS 432: Molecular and Cell Biophysics
(Dual-listed with PHYS 532). (3-0) Cr. 3. S.
Prereq: PHYS 304 or CHEM 325.
Quantitative description of biological systems using basic physical laws, including a brief discussion of a variety of biophysical techniques. Topics include: thermodynamics, chemical equilibrium, gene expression, structure and physical properties of nucleic acids and proteins, folding of nucleic acids and proteins, chemical kinetics, catalysis, allosteric enzymes, cell membrane structure and physical properties, and machines in cell membranes.

PHYS 450: Undergraduate Research
Cr. 1-6. Repeatable. F.S.SS.
Prereq: Permission of instructor
Theoretical research under supervision of physics faculty.

PHYS 450L: Undergraduate Research
Cr. 1-6. Repeatable. F.S.SS.
Prereq: PHYS 311, permission of instructor
Laboratory project under supervision of physics faculty.

PHYS 461: Physics of Biomolecules
(Dual-listed with PHYS 561). (3-0) Cr. 3. F.
Prereq: PHYS 304 or CHEM 325, BBMB 301, or permission of instructor
Cell and Molecular Biophysics. Physical techniques used to characterize the structure, dynamics and properties of biomolecules with emphasis on single molecule techniques.

PHYS 470L: Applied Physics Laboratory
Cr. 2-5. Repeatable. F.S.SS.
Prereq: PHYS 322 and permission of instructor
Studies in modern experimental techniques via experimentation and simulation in various areas of applied physics, e.g. superconductivity, optical spectroscopy, nuclear magnetic resonance, electron spin resonance, x-ray diffraction, and computation of electronic and structural properties of matter.

PHYS 480: Quantum Mechanics I
(3-0) Cr. 3. F.
Prereq: PHYS 322, MATH 385
First semester of a full-year course. A systematic development of the formalism and applications of quantum mechanics. Solutions to the time independent Schrodinger equation for various one-dimensional potentials including the harmonic oscillator; operator methods; Heisenberg picture; angular momentum; the hydrogen atom; spin; symmetry properties.

PHYS 481: Quantum Mechanics II
(3-0) Cr. 3. S.
Prereq: PHYS 480
Continuation of 480. Addition of angular momentum; charged particles in electromagnetic fields; time-independent perturbation theory; variational principles; WKB approximation; interaction picture; time-dependent perturbation theory; adiabatic approximation; scattering; selected topics in radiation theory; quantum paradoxes.

PHYS 490: Independent Study
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: 6 credits in physics, permission of instructor
No more than 9 credits of Phys 490 may be counted toward graduation.

PHYS 490H: Independent Study, Honors
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: 6 credits in physics, permission of instructor
No more than 9 credits of Phys 490 may be counted toward graduation.

PHYS 496: Modern Optics
(Cross-listed with E E). (3-0) Cr. 3. S.
Prereq: Credit or enrollment in PHYS 322, PHYS 365, and PHYS 480
Review of wave and electromagnetic theory; topics selected from: reflection/refraction, interference, geometrical optics, Fourier analysis, dispersion, coherence, Fraunhofer and Fresnel diffraction, holography, quantum optics, nonlinear optics.

PHYS 498: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

PHYS 501: Oral Communication of Physics Seminar
(2-0) Cr. 1. Repeatable. F.
A practical introduction to communication methods in physics and astronomy classrooms and professional settings. For graduate physics majors only. Offered on a satisfactory-fail basis only.

PHYS 502: Introductory Research Seminar
Cr. R. F.
(1-1) Discussion by research staff of their research areas, expected thesis research work, and opportunities in the field. For graduate physics majors only. Offered on a satisfactory-fail basis only.

PHYS 511: Condensed Matter Physics I
(3-0) Cr. 3. F.
Prereq: PHYS 304, credit or enrollment in PHYS 481
First semester of a full-year course. Free electron model; crystal symmetry; band theory of solids; transport properties; Fermi surface; phonons; semiconductors; crystal surfaces; magnetism; superconductivity.

PHYS 512: Condensed Matter Physics II
(3-0) Cr. 3. S.
Prereq: PHYS 511
Continuation of 511. Free electron model; crystal symmetry; band theory of solids; transport properties; Fermi surface; phonons; semiconductors; crystal surfaces; magnetism; superconductivity.

PHYS 521: Ultrafast Laser Science and Spectroscopy
(Dual-listed with PHYS 421). (3-0) Cr. 3. F.
Prereq: PHYS 321, PHYS 365, or equivalent with permission of instructor
Introduction to ultrafast lasers, nonlinear optics, and their applications. Topics selected from: basic optics, atom-photon interactions, electrodynamics of condensed matter, laser physics, ultrafast and nonlinear optics, ultrashort pulse generation, broadband pulse generation, time-resolved spectroscopy and instrumentation.

PHYS 526: Particle and Nuclear Physics
(4-0) Cr. 4. F.
Prereq: Credit or enrollment in PHYS 481
Basic properties and structures of nuclei, hadrons, and elementary particles; weak and strong interactions; the Standard Model; accelerators and detectors; nuclear models; nuclear decay and stability; nuclear astrophysics; the Higgs mechanism; the CKM matrix; running coupling constants; relativistic heavy-ion collisions; selected topics beyond the standard model such as SUSY and grand unification.

PHYS 528: Mathematical Methods for the Physical Sciences
(3-0) Cr. 3. F.
Prereq: MATH 266 or MATH 267
Fast-paced coverage of mathematical techniques needed for advanced analysis in the physical sciences, particularly for quantum mechanics and electrodynamics. Linear vector spaces and operators. Linear differential equations for time-evolution and steady-state problems, Green's functions and propagators, Sturm-Liouville problems. Functions of a complex variable, calculus of residues, series expansions, integral transforms and applications.

PHYS 531: Statistical Mechanics
(3-0) Cr. 3. S.
Prereq: PHYS 304 and credit or enrollment in PHYS 481, MATH 465, credit or enrollment in MATH 365 or MATH 426
Thermodynamic properties of systems of many particles obeying Boltzmann, Fermi-Dirac, and Bose-Einstein statistics; microcanonical, canonical, and grand canonical ensembles and their application to physical problems; density matrices; introduction to phase transitions; renormalization group theory; kinetic theory and fluctuations.

PHYS 532: Molecular and Cell Biophysics
(Dual-listed with PHYS 432). (3-0) Cr. 3. S.
Prereq: PHYS 304 or CHEM 325.
Quantitative description of biological systems using basic physical laws, including a brief discussion of a variety of biophysical techniques. Topics include: thermodynamics, chemical equilibrium, gene expression, structure and physical properties of nucleic acids and proteins, folding of nucleic acids and proteins, chemical kinetics, catalysis, allosteric enzymes, cell membrane structure and physical properties, and machines in cell membranes.

PHYS 534: Symmetry and Group Theory in Physics
(3-0) Cr. 3. S.
Prereq: Credit or enrollment in PHYS 481
Theory of groups and group representations; introduction to both point and continuous groups, and their applications in physics.

PHYS 535: Physics of Semiconductors
(Cross-listed with E E). (3-3) Cr. 4.
Prereq: E E 311 and E E 332
Basic elements of quantum theory, Fermi statistics, motion of electrons in periodic structures, crystal structure, energy bands, equilibrium carrier concentration and doping, excess carriers and recombination, carrier transport at low and high fields, space charge limited current, photo-conductivity in solids, phonons, optical properties, amorphous semiconductors, heterostructures, and surface effects. Laboratory experiments on optical properties, carrier lifetimes, mobility, defect density, doping density, photo-conductivity, diffusion length of carriers.

PHYS 536: Physics of Semiconductor Devices
(Cross-listed with E E). (3-0) Cr. 3.
Prereq: E E 535
P-n junctions, band-bending theory, tunneling phenomena, Schottky barriers, heterojunctions, bipolar transistors, field-effect transistors, negative-resistance devices and optoelectronic devices.

PHYS 541: General Relativity
(3-0) Cr. 3. F.
Prereq: PHYS 362, MATH 307 or MATH 317
Tensor analysis and differential geometry developed and used to formulate Einstein field equations. Schwarzschild and Kerr solutions. Other advanced topics may include gravitational radiation, particle production by gravitational fields, alternate gravitational theories, attempts at unified field theories, cosmology.

PHYS 551: Computational Physics
(0-4) Cr. 2. S.
Prereq: PHYS 365, credit or enrollment in PHYS 481
Use of modern computational techniques to analyze topics in classical and modern physics. Offered on a satisfactory-fail basis only.

PHYS 561: Physics of Biomolecules
(Dual-listed with PHYS 461). (3-0) Cr. 3. F.
Prereq: PHYS 304 or CHEM 325, BBMB 301, or permission of instructor
Cell and Molecular Biophysics. Physical techniques used to characterize the structure, dynamics and properties of biomolecules with emphasis on single molecule techniques.

PHYS 564: Advanced Classical Mechanics
(3-0) Cr. 3. S.
Prereq: PHYS 362, MATH 426, MATH 465
Variational principles, Lagrange's equations, Hamilton's canonical equations, canonical transformations, Hamilton-Jacobi theory, infinitesimal transformations, classical field theory, canonical perturbation theory, classical chaos.

PHYS 571: Electricity and Magnetism I
(3-0) Cr. 3. F.
Prereq: PHYS 365, MATH 426
Electrostatics, magnetostatics, boundary value problems, Maxwell's equations, wave phenomena in macroscopic media, wave guides.

PHYS 572: Electricity and Magnetism II
(3-0) Cr. 3. S.
Prereq: PHYS 571
Special theory of relativity, least action and motion of charged particles in electromagnetic fields, radiation, collisions between charged particles, multipole fields, radiation damping.

PHYS 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 590A: Nuclear Physics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 590B: Condensed Matter Physics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 590C: High Energy Physics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 590D: Physics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 590E: Applied Physics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 590F: Biophysics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 591: Quantum Physics I
(4-0) Cr. 4. F.
Prereq: PHYS 481
First semester of a full-year course. Postulates of quantum mechanics; time-dependent and time-independent Schrodinger equations for one-,two-, and three-dimensional systems; theory of angular momentum; Rayleigh-Schrodinger time-independent perturbation theory.

PHYS 592: Quantum Physics II
(4-0) Cr. 4. S.
Prereq: PHYS 591
Continuation of 591. Variational theorem and WKB method; time-dependent perturbation theory and 2nd quantization of the EM field in Coulomb gauge; method of partial waves and Born approximation for scattering by central potentials; identical particles and symmetry; Dirac and Klein-Gordon equation for free particles; path integral formalism.

PHYS 599: Creative Component
Cr. arr.
Prereq: Permission of instructor
Individually directed study of research-level problems for students electing the nonthesis M.S. degree option.

Courses for graduate students:

PHYS 611: Quantum Theory of Condensed Matter
(3-0) Cr. 3. S.
Prereq: PHYS 512 and PHYS 681 or permission of instructor.
Quasiparticles in condensed matter: phonons, magnons, photons, electrons. Quantum theory of interacting many body systems: Green's functions and diagrammatic techniques.

PHYS 624: Advanced Nuclear Physics
(3-0) Cr. 3.
Prereq: PHYS 526 and PHYS 592
Microscopic few-body and many-body theory; theory of effective Hamiltonians; relativistic nuclear physics; nuclear effects in hadron-nucleus, lepton-nucleus, and nucleus-nucleus reactions.

PHYS 625: Physics of Strong Interactions
(3-0) Cr. 3.
Prereq: PHYS 681
Quark model; Quantum Chromodynamics IQCD); perturbation methods for QCD; effective field theories for pions and nucleons; finite temperature field theories; quark-gluon plasma; phase transitions in QCD.

PHYS 637: Elementary Particle Physics I
(3-0) Cr. 3. S.
Prereq: PHYS 526 and PHYS 592
First semester of a full year course. Properties of leptons, bosons, and quarks and their interactions; quantum chromodynamics, Glashow-Weinberg-Salam model, grand unification theories, supersymmetry; modern theoretical techniques and tests of the Standard Model.

PHYS 638: Elementary Particle Physics II
(3-0) Cr. 3.
Prereq: PHYS 637
Continuation of 637. Properties of leptons, bosons, and quarks and their interactions; quantum chromodynamics, Glashow-Weinberg-Salam model, grand unification theories, supersymmetry, and superstring theory; modern theoretical techniques.

PHYS 646: Mathematical Modeling of Complex Physical Systems
(Cross-listed with MATH). (3-0) Cr. 3. S.
Modeling of the dynamics of complex systems on multiple scales: Classical and dissipative molecular dynamics, stochastic modeling and Monte-Carlo simulation; coarse grained nonlinear dynamics, interface propagation and spatial pattern formation.

PHYS 650: Advanced Seminar
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 650A: Nuclear Physics
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 650B: Condensed Matter Physics
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 650C: High Energy Physics
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 650D: Physics
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 650E: Applied Physics
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 650F: Biophysics
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 660: Advanced Topics in Physics
Cr. 1-3. Repeatable. F.S.
Courses on advanced topics and recent developments.

PHYS 660B: Condensed Matter Physics
Cr. 1-3. Repeatable. F.S.
Courses on advanced topics and recent developments.

PHYS 660C: High Energy Physics
Cr. 1-3. Repeatable. F.S.
Courses on advanced topics and recent developments.

PHYS 660D: Physics
Cr. 1-3. Repeatable. F.S.
Courses on advanced topics and recent developments.

PHYS 660E: Applied Physics
Cr. 1-3. Repeatable. F.S.
Courses on advanced topics and recent developments.

PHYS 660F: Biophysics
Cr. 1-3. Repeatable. F.S.
Courses on advanced topics and recent developments.

PHYS 681: Quantum Field Theory I
(3-0) Cr. 3. F.
Prereq: PHYS 564, PHYS 572, PHYS 592
Quantization of fields (canonical and path integral); Feynman rules; introduction to gauge theories; Quantum Electrodynamics; radiative corrections; renormalization and renormalization group.

PHYS 682: Quantum Field Theory II
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: PHYS 681
Continuation of 681. Systematics of renormalization; renormalization group methods; symmetries; spontaneous symmetry breaking; non-abelian gauge theories; the Standard Model and beyond; special topics.

PHYS 699: Research
Cr. arr. Repeatable.
Prereq: Instructor permission required.
Graduate research.

Plant Biology (PLBIO)

Courses primarily for graduate students, open to qualified undergraduates:

PLBIO 513: Plant Metabolism
(Cross-listed with GDCB). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BIOL 330, PHYS 111, CHEM 331; one semester of biochemistry recommended
Photosynthesis, respiration, and other aspects of plant metabolism.

PLBIO 545: Plant Molecular, Cell and Developmental Biology
(Cross-listed with GDCB, MCDB). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: Biol 313, BIOL 314, BIOL 330 or BBMB 405
Plant nuclear and organelle genomes; regulation of gene expression; hormone signaling; organization, function, and development of plant cells and subcellular structures; regulation of plant growth and development.

Courses for graduate students:

PLBIO 696: Research Seminar
(Cross-listed with AGRON, BBMB, FOR, GDCB, HORT). Cr. 1. Repeatable. F.S.
Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

PLBIO 699: Research
Cr. arr. Repeatable.

Plant Pathology (PL P)

Courses primarily for undergraduates:

PL P 408: Principles of Plant Pathology
(Dual-listed with PL P 508). (2-2) Cr. 3. F.S.
Prereq: 8 credits in life sciences, including BIOL 211 or 212.
Braun. Principles underlying the nature, diagnosis, and management of plant diseases. Laboratory complements lecture topics and provides experience in plant disease diagnosis.

PL P 416: Forest Insects and Diseases
(Cross-listed with FOR). (3-0) Cr. 3. F.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent.
Nature of insects and pathogens of forest and shade trees; their role in the dynamics of natural and managed forest ecosystems; and the management of indigenous and exotic pests.

PL P 416L: Forest Insects and Diseases Laboratory
(Cross-listed with FOR). (0-3) Cr. 1. F.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent. Credit or enrollment in Pl P 416.
Laboratory experience working with insect and fungal pests of trees.

PL P 452: Integrated Management of Diseases and Insect Pests of Turfgrasses
(Dual-listed with PL P 552). (Cross-listed with ENT, HORT). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HORT 351
Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

PL P 477: Bacterial-Plant Interactions
(Dual-listed with PL P 577). (Cross-listed with MICRO). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 3 credits in microbiology or plant pathology
Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves.

PL P 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, 7 credits in biological sciences, permission of instructor
A maximum of 6 credits of Pl P 490 may be used toward the total of 128 credits required for graduation.

PL P 490A: Independent Study: Plant Pathology
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, 7 credits in biological sciences, permission of instructor
A maximum of 6 credits of Pl P 490 may be used toward the total of 128 credits required for graduation.

PL P 490H: Independent Study: Honors
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, 7 credits in biological sciences, permission of instructor
A maximum of 6 credits of Pl P 490 may be used toward the total of 128 credits required for graduation.

PL P 494: Seed Pathology
(Dual-listed with PL P 594). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: PL P 408
Significance of biotic and abiotic diseases that affect the production and utilization of seeds, during each phase of the seed life cycle: growing, harvesting, conditioning, storing, and planting seed. Mechanisms of seed infection and seed-to-seedling transmission are considered for fungi, bacteria, viruses/viroids, and nematodes. Aspects of epidemiology, management, and host-pathogen relationships are discussed. Emphases include the role of seed health testing in the global seed industry for quality control and phytosanitary certification, as well as the use of seed treatments to manage seedborne and soilborne pathogens and pests. Concurrent enrollment in Pl P 494L/594L (Seed Pathology Laboratory) is strongly encouraged (on-campus students only). Credit may not be obtained for both Pl P 494/594 and STB/Pl P 592.

PL P 494L: Seed Pathology Laboratory
(Dual-listed with PL P 594L). (0-3) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: PL P 408
Laboratory in seed pathology. Seed health testing methods; effects of seed treatments and seed conditioning on seedborne pathogens.

Courses primarily for graduate students, open to qualified undergraduates:

PL P 506: Plant-Pathogen Interactions
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: PL P 408 or PL P 416, BIOL 313
Baum, Whitham. Introduction to mechanisms of plant-parasite interaction. Genetics and molecular genetics of plant disease resistance and pathogenicity.

PL P 508: Principles of Plant Pathology
(Dual-listed with PL P 408). (2-2) Cr. 3. F.S.
Prereq: 8 credits in life sciences, including BIOL 211 or 212.
Braun. Principles underlying the nature, diagnosis, and management of plant diseases. Laboratory complements lecture topics and provides experience in plant disease diagnosis.

PL P 510: Plant Virology
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: BIOL 313 or BBMB 301. BIOL 314 recommended.
Taxonomy, molecular mechanisms, host-interactions, vector transmission, epidemiology, detection, control and exploitation of plant viruses. Course will consist of a mixture of lectures, and student-led presentations using primary literature.

PL P 511: Integrated Management of Tropical Crops
(Cross-listed with ENT, HORT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PL P 408 or PL P 416 or ENT 370 or ENT 376 or HORT 221
Applications of Integrated Crop Management principles (including plant pathology, entomology, and horticulture) to tropical cropping systems. Familiarization with a variety of tropical agroecosystems and Costa Rican culture is followed by 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects.
Meets International Perspectives Requirement.

PL P 512: Lifestyles of plant pathogenic fungi and oomycetes.
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Pl P 408 or MICRO 456 or equivalent.
Exploration of the major groups of plant pathogenic fungi and oomycetes, focusing on the diseases they cause as well as pathogen ecology, diagnosis, crop resistance, and fungicide resistance.

PL P 530: Ecologically Based Pest Management Strategies
(Cross-listed with AGRON, ENT, SUSAG). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes.

PL P 543: Ecology and Epidemiology of Plant Diseases
(2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: PL P 408 or PL P 416
Nutter. Theory and practice related to the ecology and epidemiology of plant disease epidemics. Interactions among host and pathogen populations as affected by the environment are quantified with respect to time and space. Analysis of ecological and host and pathogen genetic factors that alter the course of plant disease epidemics. Risk assessment theory, disease forecasting, and modeling the impact of biotic plant stresses on yield and quality are also emphasized.

PL P 552: Integrated Management of Diseases and Insect Pests of Turfgrasses
(Dual-listed with PL P 452). (Cross-listed with ENT, HORT). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HORT 351
Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

PL P 574: Plant Nematology
(2-0) Cr. 2. Alt. SS., offered odd-numbered years.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent
Morphology, anatomy, identification, management, and life cycles of common plant-parasitic nematodes; host parasite interactions; recent advances in plant nematology.

PL P 574L: Laboratory Techniques in Plant Nematology
(0-3) Cr. 1. Alt. SS., offered odd-numbered years.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent. Must also be registered for Pl P 574.
Practical skills of sample collection, processing, extraction, and identification of plant-parasitic nematodes from soil and roots; other techniques will be discussed.

PL P 577: Bacterial-Plant Interactions
(Dual-listed with PL P 477). (Cross-listed with MICRO). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 3 credits in microbiology or plant pathology
Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves.

PL P 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 10 credits in biological sciences, permission of instructor

PL P 592: Seed Health Management
(Cross-listed with STB). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: Admission to the Graduate Program in Seed Technology and Business/Consent of instructor
Munkvold. Occurrence and management of diseases during seed production, harvest, conditioning, storage, and planting. Emphasis on epidemiology, disease management in the field, seed treatment, effects of conditioning on seed health, and seed health testing. Credit may not be obtained for both Pl P/STB 592 and Pl P 594.

PL P 594: Seed Pathology
(Dual-listed with PL P 494). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: PL P 408
Significance of biotic and abiotic diseases that affect the production and utilization of seeds, during each phase of the seed life cycle: growing, harvesting, conditioning, storing, and planting seed. Mechanisms of seed infection and seed-to-seedling transmission are considered for fungi, bacteria, viruses/viroids, and nematodes. Aspects of epidemiology, management, and host-pathogen relationships are discussed. Emphases include the role of seed health testing in the global seed industry for quality control and phytosanitary certification, as well as the use of seed treatments to manage seedborne and soilborne pathogens and pests. Concurrent enrollment in Pl P 494L/594L (Seed Pathology Laboratory) is strongly encouraged (on-campus students only). Credit may not be obtained for both Pl P 494/594 and STB/Pl P 592.

PL P 594L: Seed Pathology Laboratory
(Dual-listed with PL P 494L). (0-3) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: PL P 408
Laboratory in seed pathology. Seed health testing methods; effects of seed treatments and seed conditioning on seedborne pathogens.

Courses for graduate students:

PL P 608: Molecular Virology
(Cross-listed with MICRO, V MPM). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or GDCB 511
Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis.

PL P 628: Improving Professional Presentation Skills
(2-0) Cr. 2. F.
Prereq: Graduate student status.
Skill building to improve oral presentation fundamentals for graduate students in biological sciences. Principles and guidance in both personal speaking style and maximizing impact of presentation software. In-depth lectures and class discussions on all aspects of presentation skills. Video and anonymous peer review of individual speeches.

PL P 691: Field Plant Pathology
(0-6) Cr. 2. Repeatable. Alt. SS., offered even-numbered years.
Prereq: PL P 408 or PL P 416
Diagnosis of plant diseases, plant disease assessment methods, and the integration of disease management into commercial crop production practices. Objectives are to familiarize students with common diseases of Midwest crops and landscape plants, and to provide experience in disease diagnosis. Field trips include commercial operations, agricultural research facilities, and ornamental plantings.

PL P 692: Molecular Biology of Plant-Pathogen Interactions
(Cross-listed with MICRO). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: PL P 506 or BBMB 405 or GEN 411 or MICRO 402 or strong background in molecular biology
Seminal and current research in molecular and physiological aspects of plant interactions with pathogens, including mechanisms of pathogenesis, host-pathogen recognition and host defense, with an emphasis on critical evaluation of primary literature. Students also complete a research proposal writing and peer review exercise.

PL P 694: Colloquium in Plant Pathology
(2-0) Cr. 2. Repeatable. S.
Prereq: PL P 408 or PL P 416, permission of instructor
Advanced topics in plant pathology, including biological control, cultural control, resistance gene deployment, genetic engineering for disease resistance, chemical control, integrated pest management, emerging diseases, fungal genetics, insect vector biology, professional communications, etc.

PL P 698: Seminar
Cr. 1. Repeatable. F.S.

PL P 699: Thesis and Dissertation Research
Cr. arr. Repeatable.
F.S.SS.

Political Science (POL S)

Courses primarily for undergraduates:

POL S 101: Orientation to Political Science
(2-0) Cr. 1. F.S.
Prereq: Political Science and Open Option majors only or permission of the instructor
Introduction to the discipline and sub-fields of Political Science, including an introduction to analytical thinking, and research skills relevant to political science. Orientation to university, college, and departmental structure, policies, and procedures; student roles and responsibilities; degree planning and career awareness. Offered on a satisfactory-fail basis only.

POL S 215: Introduction to American Government
(3-0) Cr. 3. F.S.SS.
Fundamentals of American democracy; constitutionalism; federalism; rights and duties of citizens; executive, legislative, and judicial branches of government; elections, public opinion, interest groups, and political parties.

POL S 235: Introduction to Ethics and Politics
(3-0) Cr. 3. F.SS.
Introduction to moral controversies surrounding political issues such as violence, deception, corruption, civil disobedience, democracy, justice, equality, and freedom. Students will read classic and contemporary texts and consider political applications.

POL S 241: Introduction to Comparative Government and Politics
(3-0) Cr. 3. F.S.
Basic concepts and major theories; application to selected political systems, including non-western political systems.
Meets International Perspectives Requirement.

POL S 251: Introduction to International Politics
(3-0) Cr. 3. F.S.
Dynamics of interstate relations pertaining to nationalism, the nation state; peace and war; foreign policy making; the national interest; military capability and strategy; case studies of transnational issues, such as population, food, energy, and terrorism.
Meets International Perspectives Requirement.

POL S 298: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of department cooperative education coordinator; sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

POL S 301: Introduction to Empirical Political Science Research
(3-0) Cr. 3. F.S.SS.
Prereq: 3 credits in political science; one statistics course required; sophomore classification
Techniques of quantitative and qualitative political research and analysis. Development and analysis of concepts and theories. Methods of data collection, research design, and critical thinking. Applications of statistics to political research.

POL S 305: Political Behavior
(3-0) Cr. 3. F.
Prereq: Sophomore classification
Empirical theories and descriptions of political behavior, including decision-making, opinion, and attitudes, with an emphasis on groups and political elites.

POL S 306: Public Opinion and Voting Behavior
(3-0) Cr. 3. S.
Prereq: 6 credits in political science or sophomore classification
The formation of political opinions and attitudes, political participation, and voting behavior of the general public, and their influences on American politics; polling as a means of assessing public opinions and behaviors.

POL S 310: State and Local Government
(3-0) Cr. 3. S.
Prereq: 3 credits in political science
Role of state and local governments in the American federal system. Structures of participation: political parties, elections, interest groups. Major governmental institutions: legislative, executive, and judicial. Structure and functions of local governments.

POL S 312: Special Topics in American Government and Politics
(3-0) Cr. 2. F.S.
Half-semester courses on selected topical issues in American government and politics. A topic may not be taken more than once.

POL S 313: Special Topics in Theory and Methods
(1.5-0) Cr. 2. F.S.
Half-semester course on selected topical issues in theory and methods in political science. A topic may not be taken more than once.

POL S 314: Special Topics in Comparative Politics
(1.5-0) Cr. 2. F.S.
Half-semester course on selected topical issues in comparative politics. A topic may not be taken more than once.

POL S 315: Special Topics in International Relations
(1.5-0) Cr. 2. F.S.
Half-semester course on selected topical issues in international relations. A topic may not be taken more than once.
Meets International Perspectives Requirement.

POL S 318: Campaign and Elections
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Methods and techniques of political campaigns in general elections. Supervised participation in candidate and political party campaign activities required.

POL S 319: Law and Politics
(3-0) Cr. 3. F.S.
Prereq: Sophomore standing; POL S 215 recommended
An evaluation of the American judicial system as it relates to controversial topics emphasizing the relationship between law and politics. Primary emphasis on topics such as statutory construction, judicial review, the proper role of the judiciary, vagueness and ambiguity in law, competing constitutional philosophies, executive branch concerns, and relative power of different branches. Credit for both Pol S 319 and 230 may not be applied toward graduation.

POL S 320: American Judicial Process
(Cross-listed with CJ ST). (3-0) Cr. 3. S.
Prereq: POL S 215
An overview of the American judicial process. Emphasis on specific topics such as application of constitutional rights to the states (particularly the Fourth, Fifth, Sixth, and Fourteenth Amendments), mechanics of judicial opinions, constitutional philosophies of Supreme Court Justices, decisions of first impression, and the value and scope of precedent.

POL S 333: Democracy and Diversity in America
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Sophomore classification.
Examination of competing Americans' conceptions of democracy as strategies for responding to the racial, religious, ethnic, gender, and economic diversity of the inhabitants of America. Connections to contemporary debates about topics such immigration, affirmative action, multicultural education, religion, and minority representation.
Meets U.S. Diversity Requirement

POL S 334: Politics and Society
(Cross-listed with SOC). (3-0) Cr. 3. F.
Prereq: A course in political science or sociology
The relationship between politics and society with emphasis on American society. Discussion of theories of inequality, power, social movements, elites, ruling classes, democracy, and capitalism.

POL S 335: Science, Technology, and Public Policy
(3-0) Cr. 3. S.
Examines the history and political dynamics of public science and technology policies. Examines differences in political and technological orientations. Assessment of the roles of politics, media, engineering, science, and private business in the formation public policies that put heavy reliance on or seek to advance science and technology.

POL S 339: Liberty and Law in America
(Cross-listed with CJ ST, PHIL). Cr. 3.
Prereq: Sophomore status
An exploration of competing conceptions of liberty in American political thought and debates about how liberty should be protected by the law. Contemporary debates about topics such as health care, drugs, property, speech, religion, and sex.

POL S 340: Politics of Developing Areas
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Examination of economic and political development as they relate to the political process of developing states. Impact of social and technological change on political systems of developing areas. Some case studies.

POL S 342: Chinese Politics
(3-0) Cr. 3.
Legacies of Imperial China, the origins of the Chinese Civil War, and the causes and consequences of the reform era. Issues of contemporary China, including economic transformation, the structure of the Party/state, the environment, the media and other topics.
Meets International Perspectives Requirement.

POL S 343: Latin American Government and Politics
(Cross-listed with US LS). (3-0) Cr. 3.
Political institutions, processes, and contemporary issues. Selected countries examined intensively to illustrate generalizations. Role of parties, military, church, human rights, women, environmental issues, interest groups, ideology, and globalization.

POL S 344: Public Policy
(3-0) Cr. 3. S.
How agendas come to be set in public policy, theories describing the policy-making process, forces molding policy choices and the impact of such choices.

POL S 345: Immigration Policy
(3-0) Cr. 3.
Prereq: Junior or Senior classification
Political, economic, and social factors that affect immigration policy in the United States and abroad. Systematic analysis and implications of different types of immigration policies in countries sending and receiving immigrants.
Meets International Perspectives Requirement.

POL S 346: European Politics
(3-0) Cr. 3. S.
Comparative study of political institutions of Europe and the European Union; emphasis on parties, elections, and governmental structures. Substance and process of public policies in selected problem areas.

POL S 349: Politics of Russia and the Soviet Successor States
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Nation-states of the former Soviet Union. Analysis of Soviet Communist system 1917-85 and the politics and revolutionary conflict leading to the dissolution of the Soviet Union from 1985 through 1991. Problems of post-Soviet nation-states of Russia and Central Eurasia since 1991.
Meets International Perspectives Requirement.

POL S 350: Politics of the Middle East
(3-0) Cr. 3. S.
Introduction to the Middle East as a region and to issues of political importance to the Middle East and its place in the world. Topics covered include Islam, regional conflicts and alliances, local leaders, economic issues, and gender and social relations.
Meets International Perspectives Requirement.

POL S 354: War and the Politics of Humanitarianism
(Cross-listed with ANTHR). (3-0) Cr. 3. S.
Prereq: Pol S 235, Pol S 251, or Anthr 230
Humanitarianism as a system of thought and a system of intervention in conflict and post-conflict situations: role of humanitarian organizations and actors in addressing human suffering caused by conflict or war military action as a form of humanitarian intervention.
Meets International Perspectives Requirement.

POL S 356: Theories of International Politics
(3-0) Cr. 3.
Introduction to essential theoretical concepts and approaches, both classical and contemporary on world politics including realism, empiricism, liberalism, and postpositivism; for example, war and conflict, peace and cooperation, political economy, crisis decision-making, systemic theory, dependence and interdependence.

POL S 357: International Security Policy
(3-0) Cr. 3. F.
The major theoretical approaches in security policy -- strategy and deterrence, game theory, bargaining theory, compellance, and coercive diplomacy, and crisis diplomacy. Illustration of these various approaches through historical and contemporary cases.

POL S 358: United States Foreign Policy
(3-0) Cr. 3. F.
Prereq: POL S 215 or POL S 251, or HIST 467 or HIST 470 or HIST 471
U.S. foreign policy since World War II with emphasis on changing American values in foreign policy, the role of the President, Congress, and the bureaucracy in policy making, and a survey of current foreign policy issues and problems.

POL S 359: Current Issues in American Foreign Policy
(3-0) Cr. 3. S.
Prereq: POL S 215, POL S 251, or POL S 358
Examination of contemporary U.S. foreign policy issues (e.g., U.S. policy in the Middle East; defense budgeting in the post-Cold War era; conventional and nuclear arms control policy). The course will explore alternate methods to analyze policy, survey the evolution of each issue, and discuss different policy alternatives.

POL S 360: American Institutions: Congress
(3-0) Cr. 3.
Prereq: POL S 215
Theory and practice of representation and deliberation in the legislative branch of the republic; operations of Congress in terms of its committees, leadership, legislative and oversight processes, partisan politics, electoral campaigns, service to local and special electoral campaigns, service to local and special interests, and interactions with the President.

POL S 361: American Institutions: The Presidency
(3-0) Cr. 3. F.
Prereq: POL S 215
Creation and historical development of the office of chief executive; character and behavior of past chief executives; selection and control; powers, roles, functions; executive staff; relations with Congress, press, public opinion.

POL S 362: The Judiciary
Cr. 3.
Exploration of the genesis, purpose, and power of judicial review, federal common law, judicial confirmation, merit of strict construction of the Constitution, and qualifications to serving on Courts; judicial activism and the infusion of politics into courts.

POL S 363: American Institutions: Media
(3-0) Cr. 3.
Prereq: Sophomore standing
Course surveys the influence of mass media organizations, forms, techniques, and technologies on the practices and expectations of American politics. Evaluates the role of media in the political process, exploring the extents to which media promotes or discourages political participation. Topics will examine the influence and political uses of news coverage, political advertising, political debates, talk radio, film, the Internet, and media spectacles.

POL S 364: Political Parties and Interest Groups
(3-0) Cr. 3. F.
Prereq: POL S 215; sophomore classification
Nature of political parties and interest groups, their relation to each other, and their effects on American politics. Topics include party identification, party organization and mobilization, factionalism, lobbying, campaign contributions and financing, and the effects of special interests on public law.

POL S 370: Religion and Politics
(Cross-listed with RELIG). (3-0) Cr. 3.
Prereq: Sophomore classification.
The interaction of religion and politics in the U.S. from both an historical and contemporary perspective, as well as the role of religion in politics internationally.

POL S 371: Public Organizations and Leadership
(3-0) Cr. 3. F.
Prereq: Sophomore classification
A survey of the historic and contemporary administrative realities that contribute to the unique challenges of public governance at the administrative and managerial levels of international, national, state, and local government. This introductory course explores the essential issues and competencies involved in the efficient, effective, and ethical provision of public goods and services. Critical topics addressed in the course include crisis management, intergovernmental relations, social equity, public-private partnerships, and privatization.

POL S 381: International Political Economy
(3-0) Cr. 3. S.
Introduction to the theoretical perspectives on international political economy. Exploration of specific issues such as the changing international trade regime, international finance, and Third World development under conditions of globalization.

POL S 383: Environmental Politics and Policies
(Cross-listed with ENV S). (3-0) Cr. 3. F.
Prereq: sophomore classification
Major ideologies relation to conservation and ecology. Processes, participants, and institutions involved in state, national, and global environmental policymaking. Case studies of environmental controversies and proposals for policy reform.

POL S 385: Women in Politics
(Cross-listed with W S). (3-0) Cr. 3. S.
Examination of the entry and participation of women in politics in the United States and other countries including a focus on contemporary issues and strategies for change through the political process.
Meets U.S. Diversity Requirement

POL S 395: Advanced Writing in Political Science
Cr. R. F.S.SS.
Taken in conjunction with 300- or 400-level Political Science courses. Offered on a satisfactory-fail basis only.

POL S 397: International Study and Travel
Cr. arr. Repeatable. SS.
Prereq: Permission of instructor.
Supervised study in an aspect of discipline while traveling or located in a foreign country.
Meets International Perspectives Requirement.

POL S 398: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing work period.

POL S 402: Legal Analysis
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: Junior classification or permission of instructor.
Introduction to the style of legal analysis traditionally used in American law schools to teach law and prepare for legal practice. Topics include case briefing, legal citation, application of legal doctrines, and adversarial argument.

POL S 413: Intergovernmental Relations
(Dual-listed with POL S 513). (3-0) Cr. 3. S.
Prereq: 6 credits in American government
Theories and practices of the American federal system. Politics and policy making among federal, state, and local governments.

POL S 417: Campaign Rhetoric
(Cross-listed with SP CM). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: SP CM 212
Backgrounds of candidates for state and national elections; selected speeches and issues; persuasive strategies and techniques of individual speakers.

POL S 420: Constitutional Law
(3-0) Cr. 3. F.
Prereq: POL S 215; junior classification
Development of the United States Constitution through judicial action; influence of public law and judicial interpretations upon American government and society.

POL S 421: Constitutional Freedoms
(3-0) Cr. 3. S.
Prereq: POL S 320 or POL S 420
Leading Supreme Court cases interpreting the Bill of Rights and the Fourteenth Amendment. Emphasis on religion, speech, privacy, due process, and equal protection.

POL S 422: International Law
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: POL S 215 or POL S 251; junior classification
Development of the principles of international law of peace and war; analysis of theories concerning its nature and fundamental conceptions; its relation to national law; problems of international legislation and codification.

POL S 430: Foundations of Western Political Thought
(Cross-listed with CL ST). (3-0) Cr. 3.
Prereq: 6 credits in political science, philosophy, or European history
Study of original texts in political thought ranging from the classical period to the renaissance. Topics such as justice, freedom, virtue, the allocation of political power, the meaning of democracy, human nature, and natural law.

POL S 431: Modern Political Thought
(Dual-listed with POL S 531). (3-0) Cr. 3.
Prereq: 6 credits in political science, philosophy, or European history
Study of original texts in political thought ranging from the Reformation to the French Revolution and its aftermath. Topics such as justice, freedom, rights, democracy, toleration, property, power, skepticism, and normative views of international politics.

POL S 442: The Policy and Politics of Coastal Areas
(Dual-listed with POL S 542). (Cross-listed with ENV S). (3-0) Cr. 3. SS.
Exploration of political implications of coastal policy. Issues include: "Carrying capacity," zoning, regulation of human development activities, trade-offs between conservation and jobs, the quality of coastal lifestyle, ways in which citizens participate in policy for coastal areas.

POL S 452: Comparative Foreign Policy
(Dual-listed with POL S 552). (3-0) Cr. 3. S.
Prereq: POL S 251
Various theoretical approaches to explain foreign policy making and behavior through the use of case studies of selected nations.
Meets International Perspectives Requirement.

POL S 453: International Organizations
(3-0) Cr. 3. S.
Prereq: POL S 251
Private and public organizations such as the United Nations, other specialized agencies, and multinational organizations, and their influence on our daily lives.

POL S 470: Political Game Theory
(3-0) Cr. 3.
Prereq: ECON 101
Application of economics to political science in the study of nonmarket decision-making. Behavior of bureaucrats, elected officials, and voters. Market failure, collective action, representative democracies, direct democracies, logrolling, voter paradoxes, and game theory.

POL S 475: Management in the Public Sector
(Dual-listed with POL S 575). (3-0) Cr. 3. F.
Prereq: POL S 371
Literature and research on organizational behavior and management theory with emphasis on applied aspects of managing contemporary public sector organizations. Topics include distinctions between public and private organizations, leadership, productivity, employee motivation, organizational structure, and organizational change.

POL S 477: Government, Business, and Society
(Dual-listed with POL S 577). (3-0) Cr. 3. F.
Prereq: Graduate classification
Diverse perspectives on the changing roles and relationships of business, government, and society so as to open the way for more effective policy decisions on corporate-government affairs. Topics may include the changing economy; transformation of workplace and community conditions; consumerism; social responsibilities of businesses; economic policies and regulations; and politics in the business-government relationship.

POL S 480: Ethics and Public Policy
(Dual-listed with POL S 580). (3-0) Cr. 3.
Prereq: 6 credits in political science
Study of decision making approaches and application to case studies. Topics such as the different roles of public officials, proper scope and use of administrative discretion, and the admissibility of religious, political, and philosophical commitments in governmental decision making.

POL S 485: Comparative Public Administration
(Dual-listed with POL S 585). (3-0) Cr. 3. F.
Comparisons of government bureaucratic structures and processes in major world regions, trends and issues of administrative and management reforms, globalization and other contemporary challenges to state administrative structures and policies, skills needed to evaluate and implement public management reforms.

POL S 487: Electronic Democracy
(Dual-listed with POL S 587). (3-0) Cr. 3.
Prereq: Sophomore standing or instructor approval
The impact of computers, the Internet, and the World Wide Web on politics and policy. The positive and negative effects on information technology (IT) on selected topics such as freedom, power and control, privacy, civic participation, the sense of "community," "virtual cities," interest group behavior, the new media, campaigns, elections, and voting will be examined.

POL S 490: Independent Study
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490A: Independent Study: American Government and Politics
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490B: Independent Study: Theory and Method
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490C: Independent Study: Comparative Politics
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490D: Independent Study: International Relations
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490E: Independent Study: Extended credit
Cr. 1-2. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Extra study for any 300-Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490G: Independent Study: Catt Center Project
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490H: Independent Study: Honors
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 491: Senior Thesis
Cr. 3.
Prereq: 21 credits of POL S and permission of instructor
Written under the supervision of a Political Science faculty advisor.

POL S 496: Teaching Internship in Political Science
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.
Prereq: 12 credits in political science and permission of instructor
Undergraduate teaching experience through assisting an instructor with an introductory course in political science. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. Offered on a satisfactory-fail basis only.

POL S 497: Research Internship in Political Science
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.
Prereq: 12 credits in political science and permission of instructor
Undergraduate research experience through assisting on a scholarly project with an instructor in political science. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. Offered on a satisfactory-fail basis only.

POL S 498: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

POL S 499: Internship in Political Science
Cr. arr. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: 6 credits in political science; junior or senior classification; and permission of internship coordinator
Work experience with a specific nongovernmental or governmental agency at the local, state, national, or international level, combined with academic work under faculty supervision. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

POL S 502: Political Analysis and Research
(3-0) Cr. 3. F.
Prereq: 6 credits in political science
Scope and methods of political science. Introduction to theoretical approaches and analytical reasoning in political science. Relationship of theory and data. Research design.

POL S 504: Proseminar in International Politics
(3-0) Cr. 3. S.
Prereq: 6 credits in political science or graduate standing
An overview of the major theoretical and empirical works in the study of international politics and foreign policy. Among the major theoretical approaches surveyed and applied to international politics are realism, neo-realism, liberalism, functionalism, rational choice theory, game theory, and decision-making theory. Seminal writings by leading scholars will be reviewed.

POL S 505: Proseminar in Comparative Politics
(3-0) Cr. 3. F.
Prereq: 6 credits in political science or graduate standing
Major theoretic approaches to the study of comparative politics -- varying concepts and definitions of society and policy, administrative traditions, institutional arrangements, political behavior, etc. Contrasting research method designs.

POL S 506: Proseminar in American Politics
(3-0) Cr. 3. S.
Prereq: 6 credits in political science or graduate standing
A presentation of the major theories and research on American government and politics. Substantive topics include modern democratic theory, institutional performance, and mass political behavior. A variety of research methodologies are examined, including normative theory, behavioralism, and rational choice analysis.

POL S 507: Proseminar in Public Policy
(3-0) Cr. 3. F.
Prereq: Six credits in political science or graduate standing
An overview of the major theoretical approaches and empirical methods relevant to the study of public policy. Emphasis is placed on agenda setting, policy formation, policy sustainability, and policy analysis. Seminal writings by leading scholars will be reviewed. Leading quantitative and qualitative methodological tools for analyzing policy are presented.

POL S 510: State Government and Politics
(3-0) Cr. 3. Alt. F., offered even-numbered years.Alt. S., offered odd-numbered years.
Prereq: POL S 310
Comparative analysis of state political systems. Role of interest groups, political parties, legislatures, courts, and governors in state politics. Possible determinants of public policy outputs at the state level.

POL S 513: Intergovernmental Relations
(Dual-listed with POL S 413). (3-0) Cr. 3. S.
Prereq: 6 credits of American government
Theories and practices of the American federal system. Politics and policy making among federal, state, and local governments.

POL S 515: Biorenewables Law and Policy
(Cross-listed with BRT). (3-0) Cr. 3. F.
Evaluation of the biorenewables field as it relates to the areas of law and policy. Primary emphasis on the following topics: concerns that motivated the development and expansion of the biorenewables field, a history of the interactions between biorenewable pathways. U.S. law and policy and controversies that have arisen from these interactions and their effects.

POL S 516: International Biorenewables Law & Policy
(Cross-listed with BRT). (3-0) Cr. 3. S.
Evaluation of the international biorenewables field as it relates to the areas of law and policy. Primary emphasis on the following topics: concerns that motivated the development and expansion of the field by adopting countries, a history of the interactions between biorenewable pathways. Law and policy in adopting countries and international controversies that have arisen from these interactions and their effects.

POL S 525: Mass Political Behavior
(3-0) Cr. 3.
Prereq: 6 credits in Political Science or graduate standing
An in-depth survey of the theoretical, empirical, and methodological works concerning mass political behavior in the United States. Substantive topics include political attitudes and ideologies, public opinion and voting behavior, and political psychology. Methods for studying mass behavior include survey research and experimental approaches.

POL S 531: Modern Political Thought
(Dual-listed with POL S 431). (3-0) Cr. 3.
Prereq: 6 credits in political science, philosophy, or European history
Study of original texts in political thought ranging from the Reformation to the French Revolution and its aftermath. Topics such as justice, freedom, rights, democracy, toleration, property, power, skepticism, and normative views of international politics.

POL S 533: E-goverment and Information Policy
(3-0) Cr. 3. S.
Overview of the legal and policy context of E-government development. Topics include the legal and regulatory policies on information management in governments, and public policies that use information technologies to address economic and social concerns and their impacts on citizens and governmental organizations.

POL S 534: Legal and Ethical Issues in Information Assurance
(Cross-listed with CPR E, INFAS). (3-0) Cr. 3. S.
Prereq: Graduate classification; CPR E 531 or INFAS 531
Legal and ethical issues in computer security. State and local codes and regulations. Privacy issues.

POL S 535: Contemporary Political Philosophy
(Cross-listed with PHIL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 6 credits of philosophy or political science
Examination of theories of justice proposed by contemporary political philosophers. Analysis of the philosophical foundations of perspectives such as liberalism, libertarianism, communitarianism, socialism, feminism. Normative assessments of socio-political institutions.

POL S 542: The Policy and Politics of Coastal Areas
(Dual-listed with POL S 442). (Cross-listed with C DEV). (3-0) Cr. 3. SS.
Exploration of political implications of coastal policy. Issues include: "Carrying capacity," zoning, regulation of human development activities, tradeoffs between conservation and jobs, the quality of coastal lifestyle, and ways in which citizens participate in policy for coastal areas.

POL S 544: Comparative Public Policy
(3-0) Cr. 3. Alt. F., offered even-numbered years.Alt. S., offered odd-numbered years.
Prereq: 6 credits in political science
Examines how, why and to what effect governments deal with substantive policy problems differently. Environmental factors, ideologies, cultures, domestic policy making processes, and interest groups.

POL S 552: Comparative Foreign Policy
(Dual-listed with POL S 452). (3-0) Cr. 3. S.
Prereq: POL S 251
Various theoretical approaches to explain foreign policy making and behavior through the use of case studies of selected nations.
Meets International Perspectives Requirement.

POL S 560: American Political Institutions
(3-0) Cr. 3.
Prereq: 6 credits in American government
Examination of policy-making and governance in a separation of powers system. Interaction between the chief executive, the legislature, administrative agencies, and the public. How political and legal forces affect policy makers and are reflected in public policies and programs.

POL S 569: Foundations of Public Administration
(3-0) Cr. 3. F.
Prereq: Graduate classification
An examination of the social, political, intellectual, and environmental factors contributing to the historical development and central issues of American Public Administration. Exploration of classic and contemporary texts of public administration emphasizing constitutional and civic roles of public servants, administrative responsibility in democratic governance and justice, and essential frameworks to identify managerial skills, perspectives, and resources for effective, equitable public service.

POL S 570: Politics and Management of Nonprofit Organizations
(3-0) Cr. 3.
Prereq: Graduate classification
Discussion of contemporary issues and perspectives shaping the policy development and management of national and international nonprofit organizations. Topics include an historic overview of nonprofit and philanthropic perspectives; exploration of nonprofit organization roles in public service provision; review of the legal framework influencing nonprofit governance; and consideration of capacity building issues such as strategic planning, board development, fundraising, human resources, and volunteer management.

POL S 571: Organizational Theory in the Public Sector
(3-0) Cr. 3. F.
Prereq: Graduate classification
Major theories of administrative organization, including motivations of administrators and organizations, comparisons of organizational arrangements, factors affecting organizational arrangements, and formal and informal decision-making structures.

POL S 572: Public Finance and Budgeting
(3-0) Cr. 3. S.
Prereq: Graduate classification
Topics such as the fiscal role of government in a mixed economy; evaluation of sources of public revenue and credit; administrative, political, and institutional aspects of the budget and the budgetary process; alternative budget formats; skills required to analyze public revenue and spending. Spreadsheet use required.

POL S 573: Public Personnel Administration
(3-0) Cr. 3. S.
Prereq: Graduate classification
Course discusses the history and development of high performance personnel administration in the public and nonprofit sectors regarding strategic planning, employee rights and responsibilities, performance assessment, collective bargaining, and civil service systems. Emphasized basic competencies in the essential human resource management tools in the areas of recruitment, retention, employee development, compensation, discipline, and conflict resolution.

POL S 574: Policy and Program Evaluation
(3-0) Cr. 3. F.
Prereq: Graduate classification
Integration, application, and utilization of public administration and public policy concepts in the interpretation of results and effectiveness of public programs and the prediction of consequences for policymakers and administrators.

POL S 575: Management in the Public Sector
(Dual-listed with POL S 475). (3-0) Cr. 3. F.
Prereq: POL S 371
Literature and research on organizational behavior and management theory with emphasis on applied aspects of managing contemporary public sector organizations. Topics include distinctions between public and private organizations, leadership, productivity, employee motivation, organizational structure, and organizational change.

POL S 577: Government, Business, and Society
(Dual-listed with POL S 477). (3-0) Cr. 3. F.
Prereq: Graduate classification
Diverse perspectives on the changing roles and relationships of business, government, and society so as to open the way for more effective policy decisions on corporate-government affairs. Topics may include the changing economy; transformation of workplace and community conditions; consumerism; social responsibilities of businesses; economic policies and regulations; and politics in the business-government relationship.

POL S 580: Ethics and Public Policy
(Dual-listed with POL S 480). (3-0) Cr. 3.
Prereq: 6 credits in political science
Study of decision making approaches and application to case studies. Topics such as the different roles of public officials, proper scope and use of administrative discretion, and the admissibility of religious, political, and philosophical commitments in governmental decision making.

POL S 581: International Political Economy
(3-0) Cr. 3. F.
Prereq: 6 credits in political science
An overview of the international political economy since the end of World War II. Special emphasis on national (primarily U.S.) development assistance and agricultural/food politics and policies, and those of the international food organizations, the World Bank, and the regional development banks.

POL S 585: Comparative Public Administration
(Dual-listed with POL S 485). (3-0) Cr. 3. F.
Comparisons of government bureaucratic structures and processes in major world regions, trends and issues of administrative and management reforms, globalization and other contemporary challenges to state administrative structures and policies, skills needed to evaluate and implement public management reforms.

POL S 587: Electronic Democracy
(Dual-listed with POL S 487). (3-0) Cr. 3.
Prereq: Sophomore standing or instructor approval
The impact of computers, the Internet, and the World Wide Web on politics and policy. The positive and negative effects on information technology (IT) on selected topics such as freedom, power and control, privacy, civic participation, the sense of "community," "virtual cities," interest group behavior, the new media, campaigns, elections, and voting will be examined.

POL S 590: Special Topics
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590A: Special Topics: American Political Institutions
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590B: Special Topics: Public Law
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590C: Special Topics: Political Theory and Methodology
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590D: Special Topics: Comparative Government
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590E: Special Topics: International Relations
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590F: Special Topics: Policy Process
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590G: Special Topics: Public Administration and Public Policy
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590I: Special Topics: Internship
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590T: Special Topics: Teaching Preparation
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 598: Graduate Student Internship
Cr. 3-6. Repeatable, maximum of 6 credits. F.S.
Prereq: 15 credits in political science, permission of the instructor
Supervised internship with administrative agencies, legislative organizations, judicial branch offices, and nonprofit groups.

POL S 599: Creative Component
Cr. arr.

Courses for graduate students:

POL S 610: Graduate Seminars
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610A: Graduate Seminars: American Political Institutions
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610B: Graduate Seminars: Public Law
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610C: Graduate Seminars: Political Theory and Methodology
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610D: Graduate Seminars: Comparative Government
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610E: Graduate Seminars: International Relations
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610F: Graduate Seminars: Policy Process
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610G: Graduate Seminars: Public Administration and Public Policy
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 699: Thesis
Cr. arr. Repeatable.

Psychology (PSYCH)

Courses primarily for undergraduates:

PSYCH 101: Introduction to Psychology
(3-0) Cr. 3. F.S.SS.
Fundamental psychological concepts derived from the application of the scientific method to the study of behavior and mental processes. Applications of psychology.

PSYCH 102: Laboratory in Introductory Psychology
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in PSYCH 101
Laboratory to accompany 101.

PSYCH 111: Orientation to Psychology
Cr. 0.5. F.S.
Program requirements and degree/career options. Required of psychology majors. Offered on a satisfactory-fail basis only.

PSYCH 112: Psychology Learning Community Seminar
(1-0) Cr. 1. Repeatable, maximum of 2 credits. F.S.
Prereq: Participation in Freshman Learning Community
Topics include orientation to academic program requirements, career awareness, strategies for successful transition to college, connections with other disciplines, and applying psychology via service learning opportunities. Offered on a satisfactory-fail basis only.

PSYCH 131: Academic Learning Skills
(0-2) Cr. 1. F.S.
Evidence-based approach to learning and applying academic skills such as time management, note-taking, reading, test preparation, goal setting and motivation, and well-being. Hybrid course structured in a team-based learning format. Offered on a satisfactory-fail basis only.

PSYCH 230: Developmental Psychology
(3-0) Cr. 3. F.S.SS.
Life-span development of physical traits, cognition, intelligence, language, social and emotional behavior, personality, and adjustment.

PSYCH 250: Psychology of the Workplace
(3-0) Cr. 3.
Survey of theories and research methods of psychology applied to the workplace. Consideration of employee selection, training, performance evaluation, leadership, work groups, employee motivation, job attitudes and behaviors, organizational culture, organizational development, human factors, and job design from the scientist-practitioner approach.

PSYCH 280: Social Psychology
(3-0) Cr. 3. F.S.SS.
Individual human behavior in social contexts. Emphasis on social judgments and decisions, attitudes, perceptions of others, social influence, aggression, stereotypes, and helping.

PSYCH 291: Introductory Research Experience
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.
Prereq: PSYCH 101, sophomore classification, and permission of intructor.
Beginning level supervised research experience in a faculty laboratory. Offered on a satisfactory-fail basis only.

PSYCH 301: Research Design and Methodology
(3-0) Cr. 3. F.S.SS.
Prereq: STAT 101; 1 course in psychology
Overview of the principal research techniques used in psychology with an emphasis on the statistical analysis of psychological data.

PSYCH 302: Research Methods in Psychology
(2-2) Cr. 3. F.S.
Prereq: PSYCH 301, ENGL 250
Discussion of and experience in designing research studies, collecting and analyzing data, and preparing research reports in psychology.

PSYCH 310: Brain and Behavior
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101
Survey of basic concepts in the neurosciences with emphasis on brain mechanisms mediating sensory processes, arousal, motivation, learning, and abnormal behavior.

PSYCH 312: Sensation and Perception
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101
Survey of the physiology and psychology of human sensory systems including vision, audition, smell, taste, the skin senses, and the vestibular senses.

PSYCH 313: Learning and Memory
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101
Survey of fundamental concepts and theories related to learning and memory derived from human and animal research.

PSYCH 314: Motivation
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101
Theory and research on motivation at biological, environmental, and psychological levels. Topics include emotion, eating, sex, music, addictions, incentives, goal performance, personality, coping, self-determination and purpose.

PSYCH 315: Drugs and Behavior
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101
Biologically based examination of the effects of drugs on behavior and social interactions, including recreational drugs and drugs used in the treatment of psychiatric and neurological disorders.

PSYCH 316: Cognitive Psychology
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101
Overview of human cognition, including sensation and perception, attention, memory, education, language, and judgment and decision making.

PSYCH 318: Thinking and Decision Making
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101; STAT 101 or MATH 104 or equivalent
Understanding human reasoning and decision making, including evaluating evidence, judging probabilities, emotional influences, and social dilemmas, with emphasis on the mechanisms that underlie decision making.

PSYCH 333: Educational Psychology
(Cross-listed with C I). (3-0) Cr. 3. F.S.
Prereq: PSYCH 230 or HD FS 102, application to the teacher education program or major in psychology
Classroom learning with emphasis on theories of learning and cognition, and instructional techniques. Major emphasis on measurement theory and the classroom assessment of learning outcomes.

PSYCH 335: Abnormal Psychology of Children and Adolescents
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101; PSYCH 230 or HDFS 102
Psychopathology of children and adolescents,including childhood depression and anxiety disorders. Consideration of multiple probable causes and corresponding therapies.

PSYCH 346: Psychology of Women
(Cross-listed with W S). (3-0) Cr. 3. S.
Prereq: 2 courses in psychology including PSYCH 101
Survey of theory and research related to major biological, interpersonal, and cultural issues affecting girls' and women's psychological development and behavior.
Meets U.S. Diversity Requirement

PSYCH 347: U.S. Latino/a Psychology
(Cross-listed with US LS). (3-0) Cr. 3. S.
Prereq: Two courses in Psychology including PSYCH 101
Historical, political, and social contexts of psychological and mental health constructs in terms of their validity and utility for use with Latino/a people in the U.S. Unique aspects of psychological functioning particular to Latino/a people in the U.S.
Meets U.S. Diversity Requirement

PSYCH 348: Psychology of Religion
(Cross-listed with RELIG). (3-0) Cr. 3.
Prereq: Nine credits in psychology
Survey of psychological theory and research investigating religious and spiritual attitudes, beliefs and practices.

PSYCH 350: Human Factors in Technology
(3-0) Cr. 3. F.
Prereq: PSYCH 101; junior classification
Understanding human behavior and cognition in the context of modern technologies. Focus on emergent interactive technologies, human computer interaction, user centered design, usability analysis, and usability testing.

PSYCH 360: Personality Psychology
(3-0) Cr. 3. F.S.SS.
Prereq: PSYCH 101
Historical and contemporary theory and research on development and expression of personality with a focus on normal functioning.

PSYCH 380: Social Cognition
(3-0) Cr. 3.
Prereq: PSYCH 101 or PSYCH 280
How people understand themselves and others, including attribution, social categories and schemas, the self, social inference, stereotypes, and prejudice.

PSYCH 381: Social Psychology of Small Group Behavior
(Cross-listed with SOC). (3-0) Cr. 3. S.
Prereq: SOC 305 or PSYCH 280
A survey of small group theory and research from an interdisciplinary, social psychological perspective.

PSYCH 383: Psychology and Law
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101 or PSYCH 280
Survey of topics in the interface between psychology and the legal system including but not limited to Miranda warning, confessions, police interrogation, lie detection, juries, eyewitness identification, false memories, and the death penalty.

PSYCH 386: Media Psychology
Cr. 3. F.S.SS.
Prereq: PSYCH 101 or PSYCH 230 or PSYCH 280
Theories and research on the psychological mechanisms (e.g., attitudes, perceptions, emotions, arousal) by which media influence children and adults. Topics include media violence, educational media, advertising, music, video games, media literacy, and ratings.

PSYCH 401: History of Psychology
(3-0) Cr. 3. F.S.
Prereq: 4 courses in psychology
Philosophy and science backgrounds of psychology. Development of theories and causes of events in academic and applied psychology.

PSYCH 410: Behavioral Neurology
(Dual-listed with PSYCH 510). (3-0) Cr. 3. F.
Prereq: PSYCH 101; PSYCH 310 or equivalent.
Examination of the neuroanatomical foundation of cognition, affect, and action from a neurological perspective. Focus on basic and applied research with neurological patients.

PSYCH 411: Evolutionary Psychology
(3-0) Cr. 3. S.
Prereq: Junior classification, three courses in psychology; one course in biology
Examination of the application of the principles of evolutionary biology to the understanding of human behavior. Evolutionary perspectives on brain development, cognition, language, mating behavior, sex differences, altruism, artistic behavior, and criminal behavior are explored. Arguments by those critical of the evolutionary approach to psychology are also examined.

PSYCH 413: Psychology of Language
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: PSYCH 101
Introduction to psycholinguistics. Topics may include origin of language, speech perception, language comprehension, reading, bilingualism, brain bases of language, and computational modeling of language processes.

PSYCH 422: Counseling Theories and Techniques
(3-0) Cr. 3. F.
Prereq: 3 courses in psychology
Overview of the major counseling theories and techniques, with emphasis on the key concepts of each theory, the role of the counselor, therapeutic goals, and the main techniques derived from each theory.

PSYCH 422L: Laboratory in Counseling Theory and Techniques
(0-2) Cr. 1. F.
Prereq: Three classes in psychology and credit or enrollment in PSYCH 422.
Learn basic counseling skills such as active listening, reflecting feelings, empathy, confrontation, immediacy and self-disclosure. Supervised practice using basic counseling skills.

PSYCH 440: Psychological Measurement I
(2-2) Cr. 3. F.S.SS.
Prereq: PSYCH 301 and 9 credits in psychology, STAT 101
Principles of psychological measurement, including concepts of reliability and validity; interpretation of scores; factors influencing performance; construction and use of measures of ability, achievement, and personality.

PSYCH 450: Industrial Psychology
(3-0) Cr. 3. F.S.
Prereq: 2 courses in psychology including PSYCH 101, STAT 101
Theory, content and methods of industrial psychology related to the effective operation of organizations. Application of psychology principles to topics including different approaches used to select employees, how to conduct performance appraisals, and how to train and keep employees safe. Work attitudes and behaviors of employees as well as relevant legal issues. Statistics including regression and correlation are used.

PSYCH 460: Abnormal Psychology
(3-0) Cr. 3. F.S.SS.
Prereq: 3 courses in psychology including PSYCH 101
Description of major forms of psychopathology including anxiety, mood disorders, personality disorders, substance abuse, and schizophrenia. Coverage of research examining causes, development, and clinical issues concerning psychopathology.

PSYCH 470: Seminar in Psychology
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 credits in psychology
Current topics in psychological research and practice in the following areas.

PSYCH 470A: Seminar in Psychology: Counseling
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 credits in psychology

PSYCH 470B: Seminar in Psychology: Experimental
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 credits in psychology

PSYCH 470C: Seminar in Psychology: Individual Differences
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 credits in psychology

PSYCH 470D: Seminar in Psychology: Social
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 credits in psychology

PSYCH 484: Psychology of Close Relationships
(3-0) Cr. 3.
Prereq: 9 credits in psychology including PSYCH 280
Theories and research concerning the functions, development, and deterioration of close relationships. Influence of psychological processes on friendship, romantic, marital, and family relationships. Topics include mate selection, interdependence, trust and commitment, power and dominance in relationships, sexuality, divorce, gender roles, and family interaction.

PSYCH 485: Health Psychology
(3-0) Cr. 3. F.
Prereq: Junior classification, 6 credits in psychology
Application of psychological theory and research methods to issues in physical health. Psychological factors in illness prevention, health maintenance, treatment of illness, recovery from injury and illness, and adjustment to chronic illness.

PSYCH 487: Human Aggression
(3-0) Cr. 3. S.
Prereq: PSYCH 230 or PSYCH 280; PSYCH 301; PSYCH 313, PSYCH 316, PSYCH 318, PSYCH 360, or PSYCH 380
Theory and research on development and occurrence of human aggression; implications for prevention and treatment.

PSYCH 488: Cultural Psychology
(3-0) Cr. 3.
Prereq: PSYCH 280 and PSYCH 301; junior classification
Examination of the ways that cultural beliefs, values, and affordances shape cognitive, developmental, social and other psychological phenomena, as well as the forces that shape and change culture. Meets International Perspectives Requirement.

PSYCH 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior classification, 6 credits in psychology, and permission of instructor
Supervised reading in an area of psychology. Writing requirement. No more than 9 credits of Psych 490 may be counted toward a degree in psychology.

PSYCH 491: Research Practicum
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior classification, permission of instructor, and credit or enrollment in PSYCH 301
Supervised research in an area of psychology. Primarily for students intending to pursue graduate education. No more than 9 credits of Psych 491 may be counted toward a degree in psychology.

PSYCH 492: Fieldwork Practicum
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior classification, 12 credits in psychology, and permission of instructor
Supervised fieldwork in one of the following applied psychology settings. Offered on a satisfactory-fail basis only. No more than 9 credits of Psych 492 may be counted toward a degree in psychology.

PSYCH 492A: Fieldwork Practicum: Human Services
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior classification, 12 credits in psychology and permission of instructor
Offered on a satisfactory-fail basis only.

PSYCH 492B: Fieldwork Practicum: I/O Psychology
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior classification, 12 credits in psychology including PSYCH 450 or PSYCH 250 and enrollment in PSYCH 450, and permission of instructor.
Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

PSYCH 501: Foundations of Behavioral Research
(3-0) Cr. 3. F.S.
Prereq: STAT 401 or equivalent
Ethical issues, research design, sampling design, measurement issues, power and precision analysis, interpretation of statistical results in non-experimental, quasi-experimental, and experimental research, use of statistical packages.

PSYCH 508: Research Methods in Applied Psychology
(3-0) Cr. 3.
Prereq: PSYCH 440 and PSYCH 501 or STAT 401
Methods and issues in applied psychological research. Role of theory in research, fidelity of measurement, selection of subjects, sampling, ethical issues, experimenter bias, data collection methods, power analysis, and professional standards for writing research articles. Emphasis on research methodological issues, not statistical issues.

PSYCH 510: Behavioral Neurology
(Dual-listed with PSYCH 410). (3-0) Cr. 3. F.
Prereq: PSYCH 101; PSYCH 310 or equivalent.
Examination of the neuroanatomical foundation of cognition, affect, and action from a neurological perspective. Focus on basic and applied research with neurological patients.

PSYCH 516: Advanced Cognition
(3-0) Cr. 3. F.S.
Prereq: PSYCH 316
Theoretical models and empirical research in human cognition including perception, attention, memory, concepts/categorization, imagery, and judgment and decision making.

PSYCH 517: Psychopharmacology
(3-0) Cr. 3.
Prereq: PSYCH 310, PSYCH 315, or equivalent and permission of instructor
Fundamentals of drug-behavior interactions with emphasis on psychoactive drugs and their use in experimental, therapeutic, and social settings.

PSYCH 519: Cognitive Neuropsychology
(3-0) Cr. 3.
Prereq: PSYCH 310 and PSYCH 316 or PSYCH 313; graduate classification or permission of instructor
Psychological models and related neurological substrates underlying cognition in normal and brain-damaged individuals.

PSYCH 521: Cognitive Psychology of Human Computer Interaction
(Cross-listed with HCI). (3-0) Cr. 3.
Prereq: Graduate classification or instructor approval
Biological, behavioral, perceptual, cognitive and social issues relevant to human computer interactions.

PSYCH 522: Scientific Methods in Human Computer Interaction
(Cross-listed with HCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PSYCH 521 and STAT 101 or equivalent
Basics of hypothesis testing, experimental design, analysis and interpretation of data, and the ethical principles of human research as they apply to research in human computer interaction.

PSYCH 533: Educational Psychology of Learning, Cognition, and Memory
(Cross-listed with C I). (3-0) Cr. 3. F.
Learning, cognition, and memory in educational/training settings.

PSYCH 538: Developmental Disabilities
(Cross-listed with HD FS). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 9 credits in human development and family studies or psychology or permission of instructor
Theories, research, and current issues regarding the intersection of development and disabilities. Investigation of interventions with individuals and families. (on-line course offering via Distance Education).

PSYCH 542: Applied Psychological Measurement
(3-0) Cr. 3. F.
Prereq: PSYCH 440
Principles of psychological measurement, including concepts of reliability and validity; interpretation of scores; factors influencing performance; test construction and use of measures of intelligence, ability, achievement, vocational interest, and personality. Ethical and multicultural issues in measurement.

PSYCH 544: Practicum in Assessment
(2-1) Cr. 2. F.S.
Prereq: PSYCH 542 and admission into the PhD program in counseling psychology
Supervised practice in integration of clinical interviewing, behavioral observation, and administration, scoring, and interpreting individual tests of cognitive function.

PSYCH 560: Advanced Personality Psychology
(3-0) Cr. 3.
Prereq: 4 courses in psychology, including PSYCH 360
Advanced analysis of contemporary theory and research on personality measurement, development, heritability, and social expression.

PSYCH 561: Psychopathology and Behavior Deviations
(3-0) Cr. 3.
Prereq: PSYCH 460
Examination of DSM and research based perspectives pertinent to the major forms of adult psychopathology including: anxiety, mood, psychotic, personality and other disorders. Coverage of research examining causes, development, and clinical issues concerning adult psychopathology.

PSYCH 562: Personality Assessment
(3-0) Cr. 3.
Prereq: PSYCH 360, PSYCH 440, PSYCH 542, and PSYCH 501 or STAT 401 and admission to the PhD program in counseling psychology
Principles, concepts, and methods of personality assessment. Though not a practicum course, exposure is given to a variety of objective, projective, and situational tests.

PSYCH 580: Advanced Social Psychology: Psychological Perspectives
(3-0) Cr. 3.
Prereq: 4 courses in psychology, including PSYCH 280
Current theories, methods, and research in social psychology with an emphasis on cognitive and interpersonal processes such as attribution, social cognition, attitude change, attraction, aggression, and social comparison.

PSYCH 590: Special Topics
Cr. arr. Repeatable.
Prereq: 12 credits in psychology, and permission of instructor
Guided reading on special topics or individual research projects in the following areas.

PSYCH 590A: Special Topics: Counseling
Cr. arr. Repeatable.
Prereq: 12 credits in psychology, and permission of instructor

PSYCH 590Q: Special Topics: Cognitive
Cr. arr. Repeatable.
Prereq: 12 credits in psychology, and permission of instructor

PSYCH 590R: Special Topics: Social
Cr. arr. Repeatable.
Prereq: 12 credits in psychology, and permission of instructor

PSYCH 590Z: Special Topics: General
Cr. arr. Repeatable.
Prereq: 12 credits in psychology, and permission of instructor

PSYCH 592: Seminar in Psychology
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 hours in psychology or graduate classification.
Seminar in the following areas.

PSYCH 592C: Seminar in Psychology: Developmental
(1-0) Cr. 1-3. Repeatable. F.S.
Prereq: 12 hours in psychology or graduate classification.

PSYCH 592P: Seminar in Psychology: Research Methods and Psychometrics
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 hours in psychology or graduate classification.

PSYCH 592Z: Seminar in Psychology: General
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 hours in psychology or graduate classification.

PSYCH 594: Quantitative Behavioral Methods
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent
Specialized quantitative methods for social and behavioral research problems in the following areas.

PSYCH 594A: Quantitative Behavioral Methods: Classical psychometric theory
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594B: Quantitative Behavioral Methods: Modern psychometric methods
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594C: Quantitative Behavioral Methods: Construct validation
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594D: Quantitative Behavioral Methods: Multi-dimensional scaling
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594E: Quantitative Behavioral Methods: Cluster Analysis
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594F: Quantitative Behavioral Methods: Meta-analysis
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594G: Quantitative Behavioral Methods: Longitudinal analysis
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594I: Quantitative Behavioral Methods: Focus Groups
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501or equivalent

PSYCH 594K: Quantitative Behavioral Methods: Mediation and Moderation
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent
Specialized quantitative methods for social and behavioral research problems.

PSYCH 594L: Quantitative Behavioral Methods: Missing Data
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent.
Specialized quantitative methods for social and behavioral research problems.

PSYCH 594M: Quantitative Behavioral Methods: Power Analysis
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent
Specialized quantitative methods for social and behavioral research problems.

PSYCH 595: Seminar in Social Psychology
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology
Seminar in the following areas in social psychology.

PSYCH 595A: Seminar in Social Psychology: Social Cognition
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 595B: Seminar in Social Psychology: Aggression
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 595C: Seminar in Social Psychology: Culture
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 595D: Seminar in Social Psychology: Attitudes and Attitude Change
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 595E: Seminar in Social Psychology: Psychology and Law
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 595G: Seminar in Social Psychology: Close Relationships
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 595I: Seminar in Social Psychology: General
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 596: Seminar in Counseling Psychology
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology
Seminar in the following areas in counseling psychology.

PSYCH 596A: Seminar in Counseling Psychology: Supervision
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 596B: Seminar in Counseling Psychology: Research
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 596C: Seminar in Counseling Psychology: Multicultural
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 596D: Seminar in Counseling Psychology: Professional Issues and Ethics
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 596E: Seminar in Counseling Psychology: General
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 597: Internship in Psychology
Cr. R.
Prereq: M.S. degree candidacy; permission of instructor
Full-time, non-clinical, supervised experience in a setting relevant to psychology. Intended for master's degree level internships.

PSYCH 598: Seminar in Cognitive Psychology
Cr. 0. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401.
Seminar in the following areas in cognitive psychology.

PSYCH 598A: Seminar in Cognitive Psychology: Attention and Perception
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598B: Seminar in Cognitive Psychology: Memory
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598C: Seminar in Cognitive Psychology: Cognitive Neuroscience
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598D: Seminar in Cognitive Psychology: Judgment and Decision Making
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598E: Seminar in Cognitive Psychology: Evolution
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598F: Seminar in Cognitive Psychology: Language
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598G: Seminar in Cognitive Psychology: Applied
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598I: Seminar in Cognitive Psychology: General
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 599: Creative Component
Cr. arr.
Offered on a satisfactory-fail basis only.

Courses for graduate students:

PSYCH 601: History of Philosophy of Psychology
(3-0) Cr. 3.
Prereq: 4 courses in psychology
Origins of psychology in philosophical, medical, and related thought. Development as an independent discipline in the nineteenth and twentieth centuries as a science and as a practice including traditional and contemporary theory and philosophy.

PSYCH 605: Multi-level Modeling
(Cross-listed with HD FS). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HD FS 503 and HD FS 505 or STAT 404 or permission of instructor
Rationale for and interpretation of random coefficient models. Strategies for the analysis of multi-level and panel data including models for random intercepts, random slopes, and growth curves.

PSYCH 621: Psychological Counseling -Theory and Process
(3-0) Cr. 3. F.
Prereq: 3 courses in psychology and permission of instructor
Overview of major counseling theories with emphases upon: key concepts of theories, the role of the counselor, and applications of theory in fostering client change.

PSYCH 621L: Psychological Counseling -Theory and Process: Techniques in Counseling
(0-6) Cr. 3. F.
Prereq: permission of instructor required
Development of basic counseling skills and techniques through observation, role-playing, case studies, and supervised counseling sessions.

PSYCH 623: Vocational Behavior
(3-0) Cr. 3.
Prereq: 3 courses in psychology or graduate classification
Theoretical views, research, and issues in career development through the life span. Methods of career counseling, including appraisal interviewing, assessment, test interpretation, and use of information sources.

PSYCH 626: Group Counseling
(2-2) Cr. 3.
Prereq: Graduate classification
Theory, research, ethical issues, and therapeutic considerations relevant to group counseling. Participation in lab exercises for development of group counseling skills and observation of ongoing groups.

PSYCH 633: Teaching of Psychology
(3-0) Cr. 3.
Prereq: Enrollment in doctoral degree program in psychology, completion of at least 1 year of graduate study, permission of instructor
Orientation to teaching of psychology at college level: academic issues and problems, instructional and evaluative techniques.

PSYCH 691: Practicum in Psychology
Cr. arr. F.S.
Prereq: Prereg: Permission of instructor
Supervised practice and experience in the following fields of specialization in applied psychology.

PSYCH 691A: Practicum in Psychology: Counseling (Beginning)
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: PSYCH 621L

PSYCH 691B: Practicum in Psychology: Counseling (Intermediate)
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Permission of instructor, PSYCH 691A

PSYCH 691C: Practicum in Psychology: Counseling (Advanced)
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Permission of instructor, PSYCH 691A, PSYCH 691B

PSYCH 691D: Practicum in Psychology: Counseling (Advanced External Practicum)
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor, PSYCH 691A, PSYCH 691B

PSYCH 691G: Practicum in Psychology: Group Counseling
Cr. 1-3. F.S.
Prereq: Prereg: Permission of instructor, PSYCH 626, PSYCH 691A

PSYCH 691S: Practicum in Psychology: Supervision
Cr. 1-3. F.S.
Prereq: Permission of instructor, PSYCH 592A, PSYCH 621L

PSYCH 691T: Practicum in Psychology: Teaching
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Permission of instructor,PSYCH 633
Offered on a satisfactory-fail basis only.

PSYCH 691Z: Practicum in Psychology: General
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Permission of instructor

PSYCH 692: Research Seminar
(1-0) Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Research seminar in the following areas.

PSYCH 692A: Research Seminar: Counseling
(1-0) Cr. 1-3. Repeatable.
Prereq: Permission of instructor

PSYCH 692Q: Research Seminar: Cognitive
(1-0) Cr. 1-3. Repeatable.
Prereq: Permission of instructor

PSYCH 692R: Research Seminar: Social
(1-0) Cr. 1-3. Repeatable.
Prereq: Permission of instructor

PSYCH 692Z: Research Seminar: General
(1-0) Cr. 1-3. Repeatable.
Prereq: Permission of instructor

PSYCH 697: Internship in Counseling Psychology
Cr. R.
Prereq: Ph.D. candidacy in the Counseling Psychology program, approved dissertation proposal, and permission of instructor
Full time supervised predoctoral internship experience in a setting relevant to counseling psychology.

PSYCH 699: Research
Cr. arr. Repeatable.
Offered on a satisfactory-fail basis only.

Public Relations (P R)

Courses primarily for undergraduates:

P R 220: Principles of Public Relations
(3-0) Cr. 3.
Introduction to public relations in business, government and non-profit organizations; functions, processes, and management; ethics, public opinion and theory.

P R 301: Research and Strategic Planning for Advertising and Public Relations
(Cross-listed with ADVRT). (3-0) Cr. 3.
Prereq: ADVRT 230 or P R 220
The use of primary and secondary research for situations, organizations and the public. Formation and development of strategic plans for public relations and advertising students.

P R 305: Publicity Methods
(3-0) Cr. 3.
Prereq: ENGL 250, Sophomore classification
Communication and publicity fundamentals and the use of media for publicity purposes. Not available to Greenlee School majors.

P R 321: Public Relations Writing
(2-2) Cr. 3.
Prereq: JL MC 110 and minimum of C+ in JL MC 201; ADVRT/P R 301 credit or concurrent enrollment.
Developing and writing public relations materials with an emphasis on media relations and news. Techniques addressed include media kits, brochures, newsletters, digital media and speeches.

P R 390: Professional Skills Development
(Cross-listed with ADVRT, JL MC). Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Minimum of C+ in JL MC 201; other vary by topic. Instructor permission for non-majors.
Check with Greenlee School for course availability.

P R 420: Crisis Communication
(3-0) Cr. 3.
Prereq: P R 220
Public relations strategies and tactics for crisis situations to protect and recover an organization's reputation: public behavior in crisis, crisis assessment, crisis communication plan, media training for leaders and spokespersons, apology strategy, corporate social responsibility, rumor in social media and reputation management.

P R 424: Public Relations Campaigns
(3-0) Cr. 3.
Prereq: Minimum of C+ in P R 321; ADVRT/P R 301.
Developing public relations and public information campaigns for business and social institutions.

P R 490: Independent Study in Communication

Cr. arr.

Prereq: Junior classification and contract with supervising professor to register.

Independent studies are research-based. Students may study problems associated with a medium, a professional specialization, a philosophical or practical concern, a reportorial method or writing technique, or a special topic in their field. Credit is not given for working on student or professional media without an accompanying research component.

P R 497: Special Topics in Communication

(Cross-listed with ADVRT, JL MC). Cr. 1-3. Repeatable, maximum of 6 credits.

Prereq: Junior classification. See Schedule of Classes for possible pre-requisites.

Seminars or one-time classes on topics of relevance to students in communication.

P R 499: Professional Media Internship

Cr. 1-3. F.S.SS.

Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, junior classification, formal faculty adviser approval.

Required of all Greenlee School majors. A 400-hour (for 3 credits) internship in the student's journalism and mass communication or advertising or public relations specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

P R 499A: Professional Media Internship: Required

Cr. 3. F.S.SS.

Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, junior classification, formal faculty adviser approval.

Initial, required internship. A 400-hour (for 3 credits) internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

P R 499B: Professional Media Internship: Optional

Cr. 1-3. F.S.SS.

Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, junior classification, formal faculty adviser approval.

Optional internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

Religious Studies (RELIG)

Courses primarily for undergraduates:

RELIG 205: Introduction to World Religions

(3-0) Cr. 3. F.S.SS.

An introduction to the academic study of religions, including myths, beliefs, rituals, values, social forms. Examples chosen from oral cultures and major religions of the world.

Meets International Perspectives Requirement.

RELIG 210: Religion in America

(3-0) Cr. 3. F.S.SS.

Introductory study of the major beliefs, practices, and institutions of American Judaism, Catholicism, Protestantism, and Islam with emphasis on the diversity of religion in America, and attention to issues of gender, race, and class.

Meets U.S. Diversity Requirement

RELIG 220: Introduction to the Bible

(3-0) Cr. 3. F.S.

Basic overview of the contents of the Old and New Testament in light of their ancient socio-historical background, and with attention to a variety of interpretations and relevance to modern American society.

RELIG 242: History of Christianity: Beginnings to the Reformation

(3-0) Cr. 3. F.S.SS.

A survey of the major historical developments in Christian thought and practice that shaped Christianity from the time of Jesus through the late medieval period. Attention given to significant persons and major events, including those involving relations with Judaism and Islam.

Meets International Perspectives Requirement.

RELIG 243: History of Christianity: The Reformation to the Present

(3-0) Cr. 3. F.S.SS.

A survey of the major events, issues, and persons that contributed to the Protestant Reformation, the Catholic Counter-Reformation, and the proliferation of Christian denominations. Attention to selected responses of churches to major sixteenth-early twenty-first century developments.

RELIG 280: Introduction to Catholicism

(3-0) Cr. 3. F.

An explanation of the beliefs, spirit, and practices of Roman Catholicism, including its understanding of God, sacramentality, the human person, and community, and its relationship to other forms of Christianity and other world religions.

RELIG 321: Old Testament
(3-0) Cr. 3. F.
An in-depth study of the literature and religion of ancient Israel in light of recent archaeological discoveries, research about the ancient Near East, and a variety of interpretations.

RELIG 322: New Testament
(3-0) Cr. 3. S.
A detailed survey of the sacred scriptures of Christianity in light of recent archaeological discoveries and historical research about their Greco-Roman and Jewish background.

RELIG 324: Christianity and Science
(3-0) Cr. 3. S.
Prereq: BIOL 101, or another science course taught at ISU
Examines major challenges to Christianity's understandings of creation posed by the sciences; attention given to the relations of Christianity and science, and to Christianity's responses to ecological issues.

RELIG 334: African American Religious Experience
(Cross-listed with AF AM). (3-0) Cr. 3. F.
Prereq: Prior course work in Religious Studies or African American Studies recommended
Examination of African-American experience from the perspective of black religion with attention to political, economic, social, theological and artistic expressions, including music, that serve the life of African-American communities.".
Meets U.S. Diversity Requirement

RELIG 336: Women and Religion
(Cross-listed with W S). (3-0) Cr. 3. F.
Prereq: RELIG 205, RELIG 210 or W S 201 recommended
Examines the status of women in various religions, feminist critiques of religious structures and belief systems, and contemporary women's spirituality movements.
Meets U.S. Diversity Requirement

RELIG 340: Magic, Witchcraft, and Religion
(Dual-listed with RELIG 540). (Cross-listed with ANTHR). (3-0) Cr. 3. S.
Prereq: ANTHR 201 or ANTHR 306
Survey of global religious belief and practice from an anthropological perspective. Emphasis on myth and ritual, shamanism, magic, witchcraft, beliefs in spirits, conceptions of the soul, mind and body relationships, and healing and therapeutic practices. Discussion of religious response to dramatic political and social change; effects of globalization on religious practice.
Meets International Perspectives Requirement.

RELIG 342: Religion and U.S. Latino/a Literature
(Cross-listed with US LS). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
A study of the religious behavior and attitudes expressed in the literature of Mexican Americans, Puerto Ricans, Cuban Americans and other groups of people living in the U.S. who trace their ancestry to the Spanish-speaking countries of Latin America.
Meets U.S. Diversity Requirement

RELIG 348: Psychology of Religion
(Cross-listed with PSYCH). (3-0) Cr. 3.
Prereq: Nine credits in psychology
Survey of psychological theory and research investigating religious and spiritual attitudes, beliefs and practices.

RELIG 350: Philosophy of Religion
(Cross-listed with PHIL). (3-0) Cr. 3. F.
Prereq: 6 credits in philosophy
The value and truth of religious life and belief. Mystical experience; religious faith and language; arguments for God's existence; the problem of evil; miracles; and religion and morality. Historical and contemporary readings.

RELIG 352: Religious Traditions of India
(3-0) Cr. 3.
Prereq: Credit in RELIG 205 or equivalent.
Study of texts, practices, beliefs, historical development, and mutual influence of a variety of the religious traditions of India. Emphasis on Vedic religion and the diversity of traditions of Classical Hinduism; survey of Buddhist, Jain, Sikh, and South Asian Islamic traditions. Meets International Perspectives Requirement.
Meets International Perspectives Requirement.

RELIG 358: Introduction to Islam
(3-0) Cr. 3.
An introduction to Islamic religion, culture, and society from 700 to the present.
Meets International Perspectives Requirement.

RELIG 360: Religious Ethics
(3-0) Cr. 3.
Investigates different religious ethical theories and traditions of reasoning about practical moral issues (e.g., abortion, the just distribution of wealth, environmental ethics). Explores in detail the relationship between religious beliefs and moral practice.

RELIG 367: Christianity in the Roman Empire
(Cross-listed with CL ST). (3-0) Cr. 3.
An historical introduction to the rise of Christianity in the Roman empire, with special attention to the impact of Greco-Roman culture on the thought and practice of Christians and the interaction of early Christians with their contemporaries.

RELIG 370: Religion and Politics
(Cross-listed with POL S). (3-0) Cr. 3.
The interaction of religion and politics in the U.S. from both an historical and contemporary perspective, as well as the role of religion in politics internationally.

RELIG 376: Classical Archaeology
(Cross-listed with ANTHR, CL ST). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

RELIG 376A: Classical Archeology: Bronze Age and Early Iron Age Greece
(Cross-listed with ANTHR, CL ST). (3-0) Cr. 3. S.
Bronze Age (Minoan and Mycenaean palatial cultures) and Early Iron Age Greece. (ca 3000-700 BCE). Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

RELIG 376B: Classical Archeology: Archaic through Hellenistic Greece (ca 700-30 BCE)
(Cross-listed with ANTHR, CL ST). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

RELIG 380: Catholic Social Thought
(3-0) Cr. 3. S.
Examines biblical roots of and major developments in Catholic social thought. Contemporary issues such as human rights, economic justice, the environment, and war and peace will be treated using principles of Catholic ethics, social analysis, official church documents, and contributions of notable theologians and activists.
Meets U.S. Diversity Requirement

RELIG 384: Religion and Ecology
(Cross-listed with ENV S). (3-0) Cr. 3.
Introduction to concepts of religion and ecology as they appear in different religious traditions, from both a historical and contemporary perspective. Special attention to religious response to contemporary environmental issues.
Meets International Perspectives Requirement.

RELIG 439: Goddess Religions
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: RELIG 205 recommended
Exploration of the foundational myths of Goddess spirituality, including historical and cross-cultural female images of the divine and their modern usage by American women.

RELIG 453: Buddhism
(3-0) Cr. 3. S.
The various Buddhist paths to realize enlightenment and freedom. Special attention to meditation and yoga and their relationship to altered states of consciousness and to social contexts.
Meets International Perspectives Requirement.

RELIG 475: Seminar: Issues in the Study of Religion
(3-0) Cr. 3. Repeatable, maximum of 6 times.
Prereq: 6 credits in religious studies
Topic changes each time offered. Closed to freshmen. Sophomores must have approval of instructor.

RELIG 485: Theory and Method in Religious Studies
(3-0) Cr. 3.
Prereq: 6 credits in Religious Studies or permission of instructor
Examines the variety of theories and methods employed in the study of religion. Application of these methods to various religions of the world.

RELIG 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in religious studies and permission of instructor, approval of chairman.
Guided reading and research on special topics selected to meet the needs of advanced students. No more than 9 credits of Relig 490 may be counted toward graduation.

RELIG 490H: Independent Study: Honors
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in religious studies and permission of instructor, approval of chairman.
Guided reading and research on special topics selected to meet the needs of advanced students. No more than 9 credits of Relig 490 may be counted toward graduation.

RELIG 491: Senior Thesis
Cr. 3.
Written under the supervision of a Religious Studies faculty advisor.

RELIG 494: Special Studies in Religious Research Languages
Cr. 2-3. Repeatable.
Prereq: 6 credits in Religious Studies and permission of instructor

Courses primarily for graduate students, open to qualified undergraduates:

RELIG 540: Magic, Witchcraft, and Religion
(Dual-listed with RELIG 340). (Cross-listed with ANTHR). (3-0) Cr. 3. S.
Prereq: ANTHR 201 or ANTHR 306
Survey of global religious belief and practice from an anthropological perspective. Emphasis on myth and ritual, shamanism, magic, witchcraft, beliefs in spirits, conceptions of the soul, mind and body relationships, and healing and therapeutic practices. Discussion of religious response to dramatic political and social change; effects of globalization on religious practice.
Meets International Perspectives Requirement.

RELIG 590: Special Topics in Religious Studies
Cr. 1-3. Repeatable.
Prereq: Permission of instructor, 9 credits in religious studies

Research and Evaluation (RESEV)

Courses primarily for graduate students, open to qualified undergraduates:

RESEV 550: Introduction to Educational Research
(3-0) Cr. 3. F.S.SS.
Understanding the nature of quantitative and qualitative research; reviewing the literature; developing research problems and questions; research designs; data collection and analysis issues; evaluating research studies.

RESEV 552: Basic Educational Statistics
(3-0) Cr. 3. F.
Statistical concepts and procedures for analyzing educational data; descriptive statistics, correlation, t tests, and chi square with computer applications.

RESEV 553: Intermediate Educational Statistics
(3-0) Cr. 3.
Prereq: RESEV 552 or STAT 401
A continuation of statistical concepts and procedures for analyzing educational data, using multiple regression and logistic regression.

RESEV 554: Intermediate Research Methods
(3-0) Cr. 3. SS.
Prereq: RESEV 553 or STAT 404
Intermediate quantitative research methodology in preparation for carrying out thesis and dissertation research, with an emphasis on the estimation of causal effects using observational data.

RESEV 570: Surveys in Educational Research
(3-0) Cr. 3. S.
Prereq: RESEV 552 or equivalent
Examination of survey design and administration in educational research. Designing surveys; developing, evaluating, and asking survey questions; survey sampling; measuring survey reliability and validity; administering mail and web surveys; decreasing survey nonresponse; conducting post-collection survey data processing; conducting survey research with integrity.

RESEV 580: Introduction to Qualitative Research Methodology
(3-0) Cr. 3.
Qualitative research in the human sciences, emphasizing education; principles of qualitative inquiry, including theoretical foundations, research design, and fieldwork.

RESEV 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate standing
Guided reading and in research and evaluation study on special topic.

RESEV 591: Supervised Field Experience
Cr. 2-4. Repeatable.
Prereq: RESEV 553 or RESEV 680
Supervised on the job field experience.

RESEV 593: Workshop
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate standing
Intensive, concentrated exposure to a special educational research or evaluation problem.

RESEV 597: Program Assessment and Evaluation
(3-0) Cr. 3. S.
Prereq: RESEV 550
Evaluation models and professional standards. Techniques of evaluating educational programs. Emphasis on both theory and practical applications.

Courses for graduate students:

RESEV 615: Current Topics in Research and Evaluation
Cr. 1-3. Repeatable.

RESEV 620: College Access in Policy, Practice, and Research
(4-0) Cr. 1-3. SS.
Exploration of the plurality of frameworks used to conceptualize college access as a social problem (for research, policy, and practice). Development of application of understandings of college access frameworks to policy, practice, and research.

RESEV 680: Critical Issues in Qualitative Inquiry
(3-0) Cr. 3. S.
Prereq: RESEV 580
An intensive reading and discussion course focusing on contemporary methodological theory for qualitative inquiry; examines epistemological, ontological, axiological and theoretical assumptions and their consequences for qualitative inquiry in the human sciences; interrogates core concepts of qualitative inquiry such as fieldwork, data, validity and representation.

RESEV 681: Analytical Approaches in Qualitative Inquiry
(3-0) Cr. 3. F.
Prereq: RESEV 580 or equivalent
Conceptions of data and analysis in qualitative methodologies; focus on applied topics in qualitative data analysis, such as narrative analysis, ethnographic analysis, life history analysis, postmodern analyses, discourse analysis, arts-based analytical strategies, constructing data; combination format of reading and discussion seminars and classroom workshops focusing on individual research projects (not for thesis or dissertation).

RESEV 690: Advanced Special Topics
Cr. 1-3. Repeatable.
Prereq: Graduate standing
Guided reading and/or study on special topics of an advanced nature.

RESEV 699: Research
Cr. arr. Repeatable. F.S.SS.

Russian (RUS)

Courses primarily for undergraduates:

RUS 101: Elementary Russian I
(4-0) Cr. 4. F.
Introduction to the Russian language, grammar and syntax. Practice in the four basic skills (listening, speaking, reading, and writing) within the context of Russian culture.

RUS 102: Elementary Russian II
(4-0) Cr. 4. S.
Prereq: RUS 101
Introduction to the Russian language, grammar and syntax. Practice in the four basic skills (listening, speaking, reading, and writing) within the context of Russian culture.
Meets International Perspectives Requirement.

RUS 201: Intermediate Russian I
(4-0) Cr. 4. F.
Prereq: RUS 102
Thorough review of grammar and growth of vocabulary. Selected readings. Continued use of the four basic skills.
Meets International Perspectives Requirement.

RUS 202: Intermediate Russian II
(4-0) Cr. 4. S.
Prereq: RUS 201
Thorough review of grammar and growth of vocabulary. Selected readings. Continued use of the four basic skills.
Meets International Perspectives Requirement.

RUS 301: Composition and Conversation
(3-0) Cr. 3. F.
Prereq: RUS 202
Thorough study of the Russian language, with emphasis on strengthening proficiency in writing, speaking, reading, and listening. Increased focus on syntax and word formation.
Meets International Perspectives Requirement.

RUS 304: Russian for Global Professionals
(3-0) Cr. 3. F.
Prereq: RUS 102
Communication in business and professional contexts in Russian-speaking countries. Development of effective communication strategies and project management in the workplace. Cultural contexts of business and professional practice.
Meets International Perspectives Requirement.

RUS 314: Reading Russian Literary and Cultural Texts
(3-0) Cr. 3. Repeatable.
Prereq: RUS 102
Selected readings in Russian literature and culture. Emphasis on techniques of reading and analysis of literary and cultural texts.
Meets International Perspectives Requirement.

RUS 370: Russian Studies in English Translation
(3-0) Cr. 3. Repeatable.
Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English.
Meets International Perspectives Requirement.

RUS 370R: Studies in English Translation: Russian Topics on Women or Feminism
(Cross-listed with W S). (3-0) Cr. 3. Repeatable.
Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English.
Meets International Perspectives Requirement.

RUS 375: Russia Today
(3-0) Cr. 3. Repeatable.
A survey of social, political, economic, and cultural topics relevant to contemporary Russia. Readings, discussions and papers in English.
Meets International Perspectives Requirement.

RUS 378: Russian Film Studies in English
(3-0) Cr. 3.
Analysis and interpretation of cinema in Russia and the Soviet Union. Topics vary according to faculty interest. Film directors, genres, movements, historical survey, aesthetics, and cinematography. Readings, discussions and papers in English.
Meets International Perspectives Requirement.

RUS 395: Study Abroad
Cr. 1-6. Repeatable.
Supervised instruction in language and culture of Russia; formal class instruction at level appropriate to student's training, augmented by practical living experience.
Meets International Perspectives Requirement.

RUS 490: Independent Study
Cr. 1-6. Repeatable.
Prereq: 6 credits in Russian and permission of department chair
Designed to meet the needs of students who seek work in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. No more than 9 credits of Rus 490 may be counted toward graduation.

RUS 499: Internship in Russian
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits of Russian at the 300 level; permission of advisor and WLC Internship Coordinator
Work experience using Russian language skills in the public or private sector combined with academic work under faculty supervision. Available only to minors. No more than 3 credits may be applied to the minor.

Courses primarily for graduate students, open to qualified undergraduates:

RUS 590: Special Topics in Russian
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Russian

RUS 590A: Special Topics in Russian: Literature or Literary Criticism
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Russian

RUS 590B: Special Topics in Russian: Linguistics
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Russian

RUS 590C: Special Topics in Russian: Language Pedagogy
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Russian

RUS 590D: Special Topics in Russian: Civilization
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Russian

Seed Technology and Business (STB)

Courses primarily for graduate students, open to qualified undergraduates:

STB 501: Strategic Management
(Cross-listed with BUSAD). (2-0) Cr. 2.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Critical analysis of current practice and case studies in strategic management with an emphasis on integrative decision making. Strategy formulation and implementation will be investigated in the context of complex business environments.

STB 503: Information Systems
(Cross-listed with BUSAD). (2-0) Cr. 2.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Introduction to a broad variety of information systems (IS) topics, including current and emerging developments in information technology (IT), IT strategy in the context of corporate strategy, and IS planning and development of enterprise architectures. Cases, reading, and discussions highlight the techniques and tactics used by managers to cope with strategic issues within an increasingly technical and data-driven competitive environment.

STB 504: Marketing and Logistics
(Cross-listed with BUSAD). (3-0) Cr. 3.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Integration of the business functions concerned with the marketing and movement of goods along the supply chain with the primary goal of creating value for the ultimate customer. Coordination of marketing, production, and logistics activities within the firm and with outside suppliers and customers in the supply chain.

STB 507: Organizational Behavior
(Cross-listed with BUSAD). (2-0) Cr. 2.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Understanding human behavior in organizations, and the nature of organizations from a managerial perspective. Special emphasis on how individual differences, such as perceptions, personality, and motivation, influence individual and group behavior in organizations and on how behavior can be influenced by job design, leadership, groups, and the structure of organizations.

STB 508: Accounting and Finance
(Cross-listed with BUSAD). (3-0) Cr. 3.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Survey of fundamental topics in accounting and finance. Financial statement reporting and analysis for agriculture firms, corporate governance issues related to financial reporting, (e.g., Sarbanes-Oxley). Basic tools and techniques used in financial management, including stock and bond valuation. How to assess and use capital budgeting methods to evaluate proposed firm investments.

STB 509: Seed Trade, Policy and Regulation
(Cross-listed with BUSAD). (3-0) Cr. 3.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Cultural, financial, economic, political, legal/regulatory environments shaping an organization's international business strategy. Topics include entry (and repatriation) of people, firms, goods, services, and capital. Special attention to the institutions of seed regulation and policy. Ethical issues facing managers operating in an international context.

STB 510: Crop Improvement
(Cross-listed with AGRON). (3-0) Cr. 3.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
A study of the basic principles and methods in the genetic improvement of crop plants. Methods used in manipulating genomes through the use of biotechnology. Methods of cultivar development. Quantitative procedures for describing response to selection. Analysis of the relationship of reproductive characters and growth characteristics to response to selection.

STB 534: Seed and Variety, Testing and Technology
(Cross-listed with AGRON). (2-0) Cr. 2.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
The components of seed quality and how they are assessed in the laboratory, including traits derived from modern biotechnology. The impact of new technologies on seed quality testing. Variety maintenance procedures and breeder seed. Variety identification: phenotype and grow-out trials, isozyme testing, and DNA marker testing. Procedures for evaluating varieties. The variance tests appropriate for fixed effects analysis of variance. Statistical inference and stratification for yield trials. Use of strip plot testing.

STB 535: Introduction to the Seed Industry
(Cross-listed with AGRON). Cr. 1.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
An analysis of the defining characteristics of the seed industry and introduction to the Master in Seed Technology and Business curriculum. The tasks of crop improvement and seed production will be analytically related to basic management functions and classifications of management activities that are used in the study of business administration. Management tasks and roles will be analyzed in related to the public policy issues that shape the seed industry, including ethical and economical approaches to biotechnology, intellectual property, and corporate responsibility.

STB 536: Quantitative Methods for Seed
(Cross-listed with AGRON). (2-0) Cr. 2. F.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
Quantitative Methods for analyzing and interpreting agronomic and business information for the seed industry. Principles of experimental design and hypothesis testing, regression, correlation, analysis of variance, and graphical representation of data. Use of spreadsheets and statistical software for manipulating, analyzing and presenting data.

STB 539: Seed Conditioning and Storage
(Cross-listed with AGRON). (2-0) Cr. 2.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
The technical operations which may be carried out on a seed lot from harvest until it is ready for marketing and use. The opportunities for quality improvement and the risks of deterioration which are present during that time. Analysis of the costs of and benefits of operations. Evaluation of equipment based on benefits to the customer and producer. Interpretation of the role of the conditioning plant and store as a focal points within the overall operations of a seed company.

STB 543: Seed Physiology
(Cross-listed with HORT). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: Admission to the Graduate Seed Technology and Business Program or approval of the instructor
Brief introduction to plant physiology. Physiological aspects of seed development, maturation, longevity, dormancy and germination. Links between physiology and seed quality.

STB 547: Seed Production
(Cross-listed with AGRON). (2-0) Cr. 2.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
Survey of crop production; including management of soil fertility, planting dates, populations, weed control, and insect control. Analysis of the principles of seed multiplication and the key practices which are used to ensure high quality in the products. Field inspection procedures and production aspects that differ from other crop production. Foundation seed production. Analysis of the typical organization of field production tasks. Resources and capabilities required. Survey of differences in seed production strategies between crops and impact of differences on management of seed production.

STB 592: Seed Health Management
(Cross-listed with PL P). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: Admission to the Graduate Program in Seed Technology and Business/Consent of instructor
Munkvold. Occurrence and management of diseases during seed production, harvest, conditioning, storage, and planting. Emphasis on epidemiology, disease management in the field, seed treatment, effects of conditioning on seed health, and seed health testing. Credit may not be obtained for both Pl P/STB 592 and Pl P 594.

STB 595: Seed Quality, Production, and Research Management
(Cross-listed with AGRON). (3-0) Cr. 3.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
Advanced survey of the organization, staff capabilities and management characteristics typical in seed production and crop improvement in seed enterprises. Analysis of the use of quality information in the management of seed operations and sales. Process management applications for seed. Production planning for existing capacity. Analysis of the manager's tasks in the annual cycle and how the tasks of these managers relate to the general categories of business management roles. Difference in management strategies used with different situations and groups of employees.

STB 599: Creative Component
Cr. 2-3.
Prereq: Admission to the Master's in Seed Technology and Business degree program and permission of the instructor
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

Sociology (SOC)

Courses primarily for undergraduates:

SOC 110: Orientation to Public Service and Administration in Agriculture
Cr. R. F.
Survey of public service and administration in agriculture. Exploration of career tracks and career planning. Recommended during first semester of freshman year or as soon as possible after transfer into the department.

SOC 115: Orientation to Sociology
(1-0) Cr. 1. F.S.
Orientation to sociology. A familiarization with University and LAS College requirements and procedures. Occupational tracks and career options open to sociology; introduction to career planning. Recommended during first semester of freshman year, or as soon as possible after transfer into the department. Offered on a satisfactory-fail basis only.

SOC 134: Introduction to Sociology
(3-0) Cr. 3. F.S.SS.
Social interaction and group behavior with emphasis on the scientific study of contemporary U.S. society, including issues relating to socialization, inequality, and changing rural and urban communities. Analysis of relationships among the institutions of family, religion, political participation, work, and leisure.

SOC 134H: Introduction to Sociology: Honors.
(3-0) Cr. 3. F.S.SS.
Social interaction and group behavior with emphasis on the scientific study of contemporary U.S. society, including issues relating to socialization, inequality, and changing rural and urban communities. Analysis of relationships among the institutions of family, religion, political participation, work, and leisure.

SOC 219: Sociology of Intimate Relationships
(3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
Analysis of intimate relationships among couples using a sociological perspective. Attention is given to singlehood; dating and courtship; sexuality; mate selection, cohabitation, and marriage. Relationship quality, communication, conflict and dissolution of these types of relationship will also be explored.

SOC 220: Globalization and Sustainability
(Cross-listed with ANTHR, ENV S, GLOBE, M E, MAT E, T SC). (3-0) Cr. 3. F.S.
An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.
Meets International Perspectives Requirement.

SOC 230: Rural Society in Transition
(3-0) Cr. 3. F.S.
Introduction to the causes and consequences of social and economic change affecting rural people and places. Uses a sociological perspective to examine social structures, social change, and social relationships within rural society. Topics include community, population change, inequality, rural economy, structure of agriculture, social and environmental impacts of resource extraction.

SOC 235: Social Problems and American Values
(3-0) Cr. 3. F.S.
Prereq: SOC 134
Sociological concepts, theories and methods to analyze the causes and consequences of social problems. Social problems discussed may include crime, substance abuse, income inequalities, discrimination, poverty, race relations, health care, family issues, and the environment. How American culture and values shape societal conditions, public discourse and policy.
Meets U.S. Diversity Requirement

SOC 241: Youth and Crime
(Cross-listed with CJ ST). (3-0) Cr. 3. F.
An examination of delinquency that focuses on the relationship between youth as victims and as offenders, social and etiological features of delinquency, the role of the criminal justice system, delinquents' rights, and traditional and alternative ways of dealing with juvenile crime.

SOC 302: Research Methods for the Social Sciences
(3-0) Cr. 3. F.S.
Prereq: SOC 134; STAT 101; or concurrent enrollment in STAT 101
Introduction to the principal research methods used in sociology, including survey research, interviewing, content analysis, experiments, ethnographies, focus groups, historical analysis, and analysis of secondary data. Instruction on sampling and the principles of validity and reliability underlying quantitative and qualitative methods. Training in data analysis using statistical software packages.

SOC 305: Social Psychology: A Sociological Perspective
(3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
Examination of human behavior in a social environment with emphasis on development of the self, interpersonal relations, attitudes, and small groups.

SOC 310: Community
(3-0) Cr. 3. F.S.
Prereq: SOC 134
Analysis of evolving theory and research of community as an ideal type, an ecological system, a political economy, and an interactional field; examination of the impact of economic, cultural, social and political infrastructures on community power structures and change processes in a global era.

SOC 325: Transition in Agriculture
(3-0) Cr. 3. S.
The impacts of agricultural changes on farm families, rural communities, and consumers. Past, present, and future trends in family farms and their social implications.

SOC 327: Sex and Gender in Society
(Cross-listed with W S). (3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
How the biological fact of sex is transformed into a system of gender stratification. The demographics and social positions of women and men in the family, education, media, politics, and the economy. Theories of the social-psychological and sociological bases for behavior and attitudes of women and men. The relationship between gender, class, and race.
Meets U.S. Diversity Requirement

SOC 328: Sociology of Masculinities and Manhood
(Cross-listed with W S). (3-0) Cr. 3. S.
Prereq: SOC 134 or W S 201
Examination of socially constructed and idealized images of manhood, the nature of social hierarchies and relations constructed on the basis of imagery, ideologies, and norms of masculinity. Theories on gender (sociological, psychological, and biological). Particular attention given to theory and research on gender variations among men by race, class, ethnicity, sexual orientation, physical ability and age.
Meets U.S. Diversity Requirement

SOC 330: Ethnic and Race Relations
(Cross-listed with AF AM). (3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
Analysis of ethnic and race relations, particularly in America; emphasis on the sociology and psychology of race and ethnic relations.
Meets U.S. Diversity Requirement

SOC 331: Social Class and Inequality
(3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
Social stratification and processes resulting in social and economic inequalities; implications of status, class, and poverty for people of different races, ethnicities, and gender.
Meets U.S. Diversity Requirement

SOC 332: The Latino/Latina Experience in U.S. Society
(Cross-listed with US LS). (3-0) Cr. 3. F.
Prereq: SOC 134
Examination of the social, historical, economic and political experience of varied Latino ethnic groups in the U.S. - primarily focusing on Mexican, Puerto Ricans, and Cubans.
Meets U.S. Diversity Requirement

SOC 334: Politics and Society
(Cross-listed with POL S). (3-0) Cr. 3. F.
Prereq: A course in political science or sociology
The relationship between politics and society with emphasis on American society. Discussion of theories of inequality, power, social movements, elites, ruling classes, democracy, and capitalism.

SOC 340: Deviant and Criminal Behavior
(Cross-listed with CJ ST). (3-0) Cr. 3. S.SS.
Prereq: SOC 134 or CJ ST 240
Theory and research on the etiology of types of social deviance; issues relating to crime, antisocial behavior and social policies designed to control deviant behavior.

SOC 345: Population and Society
(Cross-listed with ENV S). (3-0) Cr. 3. F.
Prereq: SOC 134
Human population growth and structure; impact on food, environment, and resources; gender issues; trends of births, deaths, and migration; projecting future population; population policies and laws; comparison of the United States with other societies throughout the world.
Meets International Perspectives Requirement.

SOC 348: Global Poverty, Resources and Sustainable Development
Cr. 3.
Prereq: Soc 134
Trends in hunger, poverty, resource use and development. Assessment of theories, policies, and programs to promote sustainable livelihoods, resource management, and development at local and national levels. Examine solutions through institutional efforts and grassroots social movements.
Meets International Perspectives Requirement.

SOC 362: Applied Ethics in Agriculture
(Cross-listed with ECON). (3-0) Cr. 3.
Prereq: ECON 101 or SOC 134, junior or senior status in the College of Agriculture
Identify major ethical issues and dilemmas in the conduct of agricultural and agribusiness management and decision making. Discuss and debate proper ethical behavior in these issues and situations and the relationship between business and personal ethical behavior.

SOC 380: Sociology of Work
(3-0) Cr. 3. F.S.
Prereq: SOC 134
Inequalities (gender, race, class) related to jobs, occupations, firms, and industries. Satisfactions, rewards, alienation, discrimination, and other topics of importance to workers are examined.

SOC 381: Social Psychology of Small Group Behavior
(Cross-listed with PSYCH). (3-0) Cr. 3. S.
Prereq: SOC 305 or PSYCH 280
A survey of small group theory and research from an interdisciplinary, social psychological perspective.

SOC 382: Environmental Sociology
(Cross-listed with ENV S). (3-0) Cr. 3. F.S.
Prereq: Soc 134 or 3 credits of ENV S
Environment-society relations; social construction of nature and the environment; social and environmental impacts of resource extraction, production, and consumption; environmental inequality; environmental mobilization and movements; U.S. and international examples.

SOC 401: Contemporary Sociological Theories
(3-0) Cr. 3. F.S.SS.
Prereq: 9 credits in sociology
Both historical and modern social theories as applied to understanding and researching the social world.

SOC 411: Social Change in Developing Countries
(3-0) Cr. 3. S.
Prereq: SOC 134 plus 3 credits in social sciences
Social change and development in developing countries; international interdependence; causes and consequences of persistent problems in agriculture, city growth, employment, gender equality, basic needs; local and worldwide efforts to foster social change and international development.
Meets International Perspectives Requirement.

SOC 415: Dynamics of Social Change
(3-0) Cr. 3. F.
Prereq: SOC 134 plus 3 credits in social sciences
Examination of public responses to complex and controversial innovations, such as environmentalism, feminism, stem-cell research, same-sex marriage, large-scale hog lots, and others. Strategies for gaining adoption/rejection of controversial innovations. Applications to topics in agriculture, development, business, and marketing. Credit for only Soc 415 or 515 may be applied toward graduation.

SOC 460: Criminal and Juvenile Justice Practicum
Cr. 3-12. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Junior or senior classification; permission of criminal justice studies coordinator; major or minor in criminal justice or sociology
Study of the criminal and juvenile justice systems and social control processes. Supervised placement in a police department, prosecutor's office, court, probation and parole department, penitentiary, juvenile correctional institution, community-based rehabilitation program, or related agency. Assessed service learning component. Offered on a satisfactory-fail basis only. No more than a total of 9 credits of 460 can be counted toward graduation. No credits in Soc 460 may be used to satisfy minimum sociology requirements for sociology majors.

SOC 464: Strategies for Community Engagement
(3-0) Cr. 3. S.SS.
Prereq: 6 credits in sociology
Project-focused engagement in community issues and initiatives. A broad range of strategies will be addressed, including popular education, applied research, network analysis and mapping, policy focused work, action research, curriculum development, community organizing, and organizational development.

SOC 485: Sociology of the Family
(3-0) Cr. 3. S.
Prereq: 6 credits in sociology
The contemporary family in developing, industrial, and post-industrial societies. Effects of modernization, cultural change, and family policies on family dynamics, structures, and functions.

SOC 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in sociology and permission of instructor
Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of Soc 490 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 490 toward graduation.

SOC 490A: Independent Study: General Sociology
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in sociology and permission of instructor
Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of Soc 490 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 490 toward graduation.

SOC 490B: Independent Study: Rural Sociology
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in sociology and permission of instructor
Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of Soc 490 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 490 toward graduation.

SOC 490E: Independent Study: Senior Seminar
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in sociology and permission of instructor
Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of Soc 490 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 490 toward graduation.

SOC 490H: Independent Study: Honors
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in sociology and permission of instructor
Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of Soc 490 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 490 toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

SOC 506: Classical Sociological Theory
(3-0) Cr. 3. S.
Prereq: SOC 401 or SOC 505
The origins of the canonical works of sociology in the mid-Industrial Revolution period including Karl Marx, Max Weber, Emile Durkheim and others.

SOC 509: Agroecosystems Analysis
(Cross-listed with AGRON, SUSAG). (3-4) Cr. 4. F.
Prereq: Senior or above classification
Experiential, interdisciplinary examination of Midwestern agricultural and food systems, emphasizing field visits, with some classroom activities. Focus on understanding multiple elements, perspectives (agronomic, economic, ecological, social, etc), and scales of operation.

SOC 511: Research Methodology for the Social Sciences
(3-0) Cr. 3. S.
Prereq: SOC 302 and STAT 401
Covers the philosophy and the techniques of research methods in sociology and other social sciences, including the ethics and politics of social science, validity issues, conceptualization and operationalization, sampling strategies, appropriate research designs for different questions, survey construction, and various data collection and analysis techniques.

SOC 512: Applied Multivariate Statistics for Social and Behavioral Research
(3-0) Cr. 3. F.
Prereq: STAT 404 or with instructor's permission
Applied techniques of multivariate analysis includng cluster analysis, principal components and factor analysis, multivariate analysis of variance and covariance binomial and multinomial regression, multi-level random coefficient models, and spatial regression. Conceptual and mathematical grounding for nonstatisticians. Instruction in Mplus and SAS.

SOC 513: Qualitative Research Methods
(3-0) Cr. 3. F.
Prereq: SOC 511
Applied qualitative research methods in sociology. Design and implementation of a course-based research project including data collection, analysis, and presentation of results. Qualitative data gathering techniques using observational, historical, in-depth interviewing or content analysis approaches. Laboratory emphasis on completion of data gathering, analysis, and report writing.

SOC 520: Social Psychology: A Sociological Perspective
(3-0) Cr. 3. F.
Prereq: SOC 305 or PSYCH 280
Examination of cognitive, symbolic interaction, exchange, role-reference group, and dramaturgical approaches. Assessment of contemporary issues in social psychology.

SOC 525: Seminar in Social Psychology
(3-0) Cr. 3.
Prereq: SOC 305 or PSYCH 280

SOC 525A: Seminar in Social Psychology: Small Groups
(3-0) Cr. 3.
Prereq: SOC 305 or PSYCH 280

SOC 525B: Seminar in Social Psychology: Attitudes and Attitude Change
(3-0) Cr. 3.
Prereq: SOC 305 or PSYCH 280

SOC 525C: Seminar in Social Psychology: Symbolic interactionism
(3-0) Cr. 3.
Prereq: SOC 305 or PSYCH 280

SOC 525D: Seminar in Social Psychology: Self and Identity
(3-0) Cr. 3.
Prereq: SOC 305 or PSYCH 280

SOC 527: Seminar in Social Inequality
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in sociology
Analysis of racial and ethnic inequality in the United States and the world; focus on the implications of the changing world social and economic order for differences in racial and ethnic groups relative to wealth, status, and power; a critical examination of majority-group domination of minority groups in various societies.

SOC 527A: Seminar in Social Inequality: Sociology of Race and Ethnicity
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in sociology
Analysis of racial and ethnic inequality in the United States and the world; focus on the implications of the changing world social and economic order for differences in racial and ethnic groups relative to wealth, status, and power; a critical examination of majority-group domination of minority groups in various societies.

SOC 527B: Seminar in Social Inequality: Sociology of Gender
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in sociology
Analysis of racial and ethnic inequality in the United States and the world; focus on the implications of the changing world social and economic order for differences in racial and ethnic groups relative to wealth, status, and power; a critical examination of majority-group domination of minority groups in various societies.

SOC 533: Rural Development and Community
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: SOC 511 or equivalent
Linkages between socioeconomic development, space, and community in local and global contexts. Focus on economic, social, cultural, environmental, and spatial dimensions of communities. Presentation of conceptual models. Applications using data and methods.

SOC 534: Race, Class and Gender Inequality
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 6 credits in sociology
Critical examination of the causes and consequences of social stratification and inequality; classical theories, contemporary frameworks, and recent empirical studies; international stratification patterns.

SOC 536: Strategies for Community Engagement in Food and Farming Systems
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in sociology
Project-focused community practice using diverse approaches and perspectives.

SOC 540: Comparative Social Change
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 6 graduate credits in sociology
Contemporary theories of social change, modernization, dependency, and development are critically examined; methodological issues identified; supporting research explored; applicability of theoretical models, concepts, and strategies to current national and international needs are evaluated.

SOC 543: Seminar in Social Change and Development
(Cross-listed with T SC). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology
Seminar in social change and development.

SOC 543A: Seminar in Social Change and Development: Strategies of Community Engagement
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology

SOC 543B: Seminar in Social Change and Development: Sociology of Adoption and Diffusion
(Cross-listed with T SC). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology

SOC 543C: Seminar in Social Change and Development: Technological Innovation, Social Change and Development
(Cross-listed with T SC). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology

SOC 544: Sociology of Food and Agricultural Systems
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 6 credits in sociology
Social organization of food and fiber production, processing, and distribution systems. Sociological comparison of conventional and alternative production systems; gender roles in agriculture and food systems; local, national and global food systems; perspectives on food and agricultural research and policy.

SOC 549: Sociology of the Environment
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology
Social causes and social consequences of environmental problems. Interrelationship between social inequality and environmental inequality. Social construction and social experience of the environment. Contemporary developments in the social theory of the environment. International and domestic implications.

SOC 550: Sociology of Economic Life
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in sociology
Social construction of economic activity in non-industrial and industrial societies with special attention on variations of industrial societies (capitalism and socialism), economic globalization, and economic development. Interaction of economic systems with human values, ideology, organizations, work and individual welfare.

SOC 551: Seminar in Economy, Organization, and Work
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 6 credits in sociology

SOC 551B: Seminar in Economy, Organization, and Work: Complex Organizations
(3-0) Cr. 3. F.
Prereq: 6 credits in sociology

SOC 584: Current Issues in Crime and Justice
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 6 credits in sociology
Discussion of current research and theory in crime and delinquency; topics include the purpose and role of law in social life; emerging theoretical directions in criminology; recent work on specific forms of criminality; controversies in the criminal justice system.

SOC 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: 6 credits in sociology; senior or graduate classification

SOC 590A: Special Topics: General Sociology
Cr. 1-3. Repeatable.
Prereq: 6 credits in sociology; senior or graduate classification

SOC 590B: Special Topics: Rural Sociology
Cr. 1-3. Repeatable.
Prereq: 6 credits in sociology; senior or graduate classification

SOC 591: Orientation to Sociology
(1-0) Cr. 1. F.
Prereq: Formal admission into the sociology graduate program
Introduction to the department, current graduate student policies at department and university levels, departmental administrative procedures. Required of graduate students. Offered on a satisfactory-fail basis only.

SOC 599: Research for Master's Thesis
Cr. 1-6. Repeatable.

SOC 599A: Research for Master's Thesis: General Sociology
Cr. 1-6. Repeatable.

SOC 599B: Research for Master's Thesis: Rural Sociology
Cr. 1-6. Repeatable.

Courses for graduate students:

SOC 607: Contemporary Sociological Theory
(3-0) Cr. 3. S.
Prereq: 6 graduate credits in sociology
Provides a review of modern sociological thought, issues, and controversies as they affect current research and discourse in the discipline.

SOC 610: Foundations of Sustainable Agriculture
(Cross-listed with A B E, AGRON, ANTHR, SUSAG). (3-0) Cr. 3. F.
Prereq: Graduate classification, permission of instructor
Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts.

SOC 613: Structural Equation Models for Social and Behavioral Research
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: SOC 512 and STAT 404, or with instructors permission.
Specification, identification, and interpretation of structural equation models. Techniques include structural or path models, measurement or confirmatory factor models, structural models with latent variables, and multi-level structural models. Conceptual and mathematical grounding for non-statisticians. Instruction in AMOS, MPLUS, and SAS.

SOC 698: Seminars in Sociology
(3-0) Cr. 3.

SOC 698L: Seminars in Sociology: Community Studies and Development
(3-0) Cr. 3.

SOC 698M: Seminars in Sociology: Criminology
(3-0) Cr. 3.

SOC 698N: Seminars in Sociology: The Economy, Organizations, and Work
(3-0) Cr. 3.

SOC 698O: Seminars in Sociology: Food Systems, Agriculture, and the Environment
(3-0) Cr. 3.

SOC 698P: Seminars in Sociology: Methodology
(3-0) Cr. 3.

SOC 698Q: Seminars in Sociology: Social Change and Development
(3-0) Cr. 3.

SOC 698R: Seminars in Sociology: Social Inequality
(3-0) Cr. 3.

SOC 698S: Seminars in Sociology: Social Psychology
(3-0) Cr. 3.

SOC 698T: Seminars in Sociology: Sociology of Families
(3-0) Cr. 3.

SOC 698U: Seminars in Sociology: Theory
(3-0) Cr. 3.

SOC 699: Dissertation Research
Cr. 1-8. Repeatable.

SOC 699A: Dissertation Research: General Sociology
Cr. 1-8. Repeatable.

SOC 699B: Dissertation Research: Rural Sociology
Cr. 1-8. Repeatable.

Software Engineering (S E)

Courses primarily for undergraduates:

S E 101: Software Engineering Orientation
Cr. R.
Introduction to the procedures, policies, and resources of Iowa State University and the department of Computer Science and Electrical and Computer Engineering. Information on engineering and computer-based professions.

S E 166: Careers in Software Engineering
Cr. R.
Overview of the nature and scope of the software engineering profession. Relationship of coursework to careers. Departmental rules, student services operations, degree requirements, program of study planning, career options, and student organizations.

S E 185: Problem Solving in Software Engineering
(2-2) Cr. 3.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Introduction to software engineering and computer programming. Systematic thinking process for problem solving in the context of software engineering. Group problem solving. Solving software engineering problems and presenting solutions through computer programs, written documents and oral presentations. Introduction to principles of programming, software design, and extensive practice in design, writing, running, debugging, and reasoning about programs.

S E 319: Software Construction and User Interfaces
(Cross-listed with COM S). (3-0) Cr. 3. F.
Prereq: COM S 228
Basic theory of grammars, parsing. Language paradigms. State transition and table-based software design. Review of principles of object orientation, object oriented analysis using UML. Frameworks and APIs. User interface architecture, evaluation of user interface. Design of windows, menus, and commands. Introduction to formal specification and model-based software design. Introduction to domain-specific software engineering.

S E 329: Software Project Management
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: COM S 309
Process-based software development. Capability Maturity Model (CMM). Project planning, cost estimation, and scheduling. Project management tools. Factors influencing productivity and success. Productivity metrics. Analysis of options and risks. Version control and configuration management. Inspections and reviews. Managing the testing process. Software quality metrics. Modern software engineering techniques and practices.

S E 339: Software Architecture and Design
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: S E 319
Modeling and design of software at the architectural level. Architectural styles. Basics of model-driven architecture. Object-oriented design and analysis. Iterative development and unified process. Design patterns. Design by contract. Component based design. Product families. Measurement theory and appropriate use of metrics in design. Designing for qualities such as performance, safety, security, reliability, reusability, etc. Analysis and evaluation of software architectures. Introduction to architecture definition languages. Basics of software evolution, reengineering, and reverse engineering. Case studies. Introduction to distributed system software.

S E 342: Principles of Programming Languages
(Cross-listed with COM S). (3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165; COM S 230 or CPR E 310
Study of concepts in programming languages and major programming paradigms, especially functional programming. Special emphasis on design tradeoffs that enable students to make sound choices of programming languages for a given software development task. Programming projects.

S E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

S E 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

S E 409: Software Requirements Engineering
(3-0) Cr. 3. F.
Prereq: COM S 309; for graduate credit: graduate standing or permission of instructor
The requirements engineering process including identification of stakeholders requirements elicitation techniques such as interviews and prototyping, analysis fundamentals, requirements specification, and validation. Use of Models: State-oriented, Function-oriented, and Object-oriented. Documentation for Software Requirements. Informal, semi-formal, and formal representations. Structural, informational, and behavioral requirements. Non-functional requirements. Use of requirements repositories to manage and track requirements through the life cycle. Case studies, software projects, written reports, and oral presentations will be required.

S E 412: Formal Methods in Software Engineering
(Cross-listed with COM S, CPR E). (3-0) Cr. 3. S.
Prereq: COM S 230 or CPR E 310; COM S 311, STAT 330; for graduate credit: graduate standing or permission of instructor
A study of formal techniques for model-based specification and verification of software systems. Topics include logics, formalisms, graph theory, numerical computations, algorithms and tools for automatic analysis of systems. Graduate credit requires in-depth study of concepts.

S E 416: Software Evolution and Maintenance
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: COM S 309
Practical importance of software evolution and maintenance, systematic defect analysis and debugging techniques, tracing and understanding large software, impact analysis, program migration and transformation, refactoring, tools for software evolution and maintenance, experimental studies and quantitative measurements of software evolution. Written reports and oral presentation.

S E 417: Software Testing
(Cross-listed with COM S). (3-0) Cr. 3. S.
Prereq: COM S 309; COM S 230 or CPR E 310; ENGL 250, SP CM 212
Comprehensive study of software testing, principles, methodologies, management strategies and techniques. Test models, test design techniques (black box and white box testing techniques), test adequacy criteria,integration, regression, system testing methods, and software testing tools.

S E 419: Software Tools for Large Scale Data Analysis
(Cross-listed with CPR E). (3-3) Cr. 4.
Prereq: CPR E 308 or COM S 352, COM S 309
Software tools for managing and manipulating large volumes of data, external memory processing, large scale parallelism, and stream processing, data interchange formats. Weekly programming labs that involve the use of a parallel computing cluster.

S E 490: Independent Study
Cr. arr. Repeatable.
Prereq: Senior classification in software engineering
Investigation of an approved topic.

S E 491: Senior Design Project I and Professionalism
(2-3) Cr. 3.
Prereq: S E 329, completion of 29 credits in the S E core professional program, ENGL 314
Preparing for entry to the workplace. Selected professional topics. Use of technical writing skills in developing project plan and design report; project poster. First of two-semester team-oriented, project design and implementation experience.

S E 492: Senior Design Project II
(1-3) Cr. 2.
Prereq: S E 491
Second semester of a team design project experience. Emphasis on the successful implementation and demonstration of the design completed in S E 491 and the evaluation of project results. Technical writing of final project report; oral presentation of project achievements.

S E 494: Software Engineering Portfolio Development
Cr. R. F.S.
Prereq: Credit or enrollment in S E 491
Portfolio assessment for Software Engineers. Guidelines and Advice to improve software engineering portfolios and to better use portfolios as a tool to enhance career opportunities.

Spanish (SPAN)

Courses primarily for undergraduates:

SPAN 097: Accelerated Spanish Review
(3-2) Cr. 0. F.S.
Prereq: Two years but less than three years of high-school Spanish
For students who require additional review at the first year (101-102) level. Course components include a compact review of 101 and the essential elements of 102. Course completed with a passing grade fulfills the LAS foreign language requirement. Not recommended for students who wish to continue language at the second year (201-202) level without completing 102.

SPAN 101: Elementary Spanish I
(4-0) Cr. 4. F.SS.
A communicative approach to grammar and vocabulary within the context of Hispanic culture. For students whose native language is not Spanish.

SPAN 102: Elementary Spanish II
(4-0) Cr. 4. S.SS.
Prereq: SPAN 101, SPAN 97 or placement by departmental exam
Continuation of Spanish 101. A communicative approach to grammar and vocabulary within the context of Hispanic culture. For students whose native language is not Spanish.
Meets International Perspectives Requirement.

SPAN 195: Study Abroad
Cr. 3. SS.
Supervised instruction in Spanish and Hispanic culture; formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Spanish. Consult the department regarding equivalency with SPAN 101 or 102.
Meets International Perspectives Requirement.

SPAN 201: Intermediate Spanish I
(4-0) Cr. 4. F.
Prereq: SPAN 102 or placement by departmental exam
Intensive review of basic grammar and conversation. For students whose native language is not Spanish. Practice in oral and written communication. Development of fluency with idiomatic expressions. Selected readings on culture and literature.
Meets International Perspectives Requirement.

SPAN 202: Intermediate Spanish II
(4-0) Cr. 4. S.
Prereq: SPAN 201 or placement by departmental exam
Continuation of Spanish 201. Intensive review of basic grammar. Practice in oral and written communication. Development of fluency with idiomatic expressions. Selected readings on culture and literature. For students whose native language is not Spanish.
Meets International Perspectives Requirement.

SPAN 295: Study Abroad
Cr. 3. SS.
Prereq: SPAN 102 or equivalent
Supervised instruction in Spanish and Hispanic culture; formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Spanish. Consult the department regarding equivalency with Span 201 or 202.
Meets International Perspectives Requirement.

SPAN 297: Intensive Intermediate Spanish
(4-0) Cr. 4. F.S.
Prereq: 4 years of high school Spanish, two years of Spanish at a community college, Spanish 201, or equivalent by placement
Bridge course between 200- and 300-level Spanish courses that focuses on application of advanced grammatical concepts within the context of Hispanic culture. Accelerated review of SPAN 201 and SPAN 202 designed for students who want to continue at the 300 level. Taught in Spanish for students whose native language is not Spanish.
Meets International Perspectives Requirement.

SPAN 301: Spanish Grammar and Composition
(3-0) Cr. 3. F.S.
Prereq: SPAN 202 or placement by departmental exam
Review and application of grammar concepts in the development of writing skills within the context of Hispanic culture. Taught in Spanish. For students whose native language is not Spanish.
Meets International Perspectives Requirement.

SPAN 303: Spanish Conversation and Composition
(3-0) Cr. 3. F.S.
Prereq: SPAN 202 or placement by departmental exam
Intensive oral practice and improvement of oral proficiency. Application of specific grammatical concepts for development of conversational and writing skills within the context of Hispanic culture. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 303A: Spanish Conversation and Composition: through Culture
(3-0) Cr. 3. F.S.
Prereq: SPAN 202 or placement by departmental exam
Intensive oral practice and improvement of oral proficiency. Application of specific grammatical concepts for development of conversational and writing skills within the context of Hispanic culture. Taught in Spanish. For students whose native language is not Spanish.
Meets International Perspectives Requirement.

SPAN 303B: Spanish Conversation and Composition: for Professionals
(3-0) Cr. 3. F.S.
Prereq: SPAN 202 or placement by departmental exam
Intensive oral practice and improvement of oral proficiency. Application of specific grammatical concepts for development of conversational and writing skills within the context of Hispanic culture. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 304: Spanish for Global Professionals
(3-0) Cr. 3. F.S.
Prereq: SPAN 202 or placement by departmental exam (SPAN 301 recommended)
Introduction to professional communication within a cultural context. Grammar review as needed. Individual projects will focus on special interests. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 314: Textual and Media Analyses
(3-0) Cr. 3. F.S.
Prereq: SPAN 301
Critical reading of Hispanic cultural texts. Presentation of techniques and terminology of textual criticism. Study of basic genres and media-generated artifacts and literary texts. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 321: Spanish Civilization
(3-0) Cr. 3.
Prereq: One course at the 300 level
A survey of the social, political, religious, and cultural history of Spain. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 322: Latin American Civilization
(3-0) Cr. 3.
Prereq: One course at the 300 level
A survey of the social, political, religious, and cultural history of Spanish America. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 323: Spain Today
(3-0) Cr. 3.
Prereq: One course at the 300 level
A survey of social, political, economic, and cultural topics relevant to contemporary Spain. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 324: Latin America Today
(3-0) Cr. 3.
Prereq: One course at the 300 level
A survey of social, political, economic, and cultural topics relevant to contemporary Latin America. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 326: Studies in Hispanic Art or Film
(Dual-listed with SPAN 526). (3-0) Cr. 3.
Prereq: One course at the 300 level
Survey of major currents and figures in Spanish and Latin American art and/or film. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 330: Studies in Spanish Literature
(3-0) Cr. 3.
Prereq: SPAN 314
Introduction to Spanish literature from the earliest times through the present; techniques of literary criticism. Lectures, discussion, and analysis of individual selections in Spanish. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 332: Studies in Latin American Literature
(3-0) Cr. 3.
Prereq: SPAN 314
Introduction to Latin American literature from the earliest times to the present; techniques of literary criticism. Lectures, discussion, and analysis of individual selections in Spanish. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 351: Introduction to Spanish-English Translation
(Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: SPAN 301, SPAN 303 or SPAN 304
Introduction to the theory, methods, techniques, and problems of translation. Consideration of material from business, literature, and the social sciences. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 352: Introduction to Spanish Phonology
(Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: SPAN 301, SPAN 303 or SPAN 304
An introductory study of the articulation, classification, distribution, and regional variations of the sounds of the Spanish language. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 354: Introduction to Spanish-English Interpretation
(Dual-listed with SPAN 554). (Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: SPAN 351
Introduction to the theory, methods, techniques, and problems of consecutive and simultaneous interpretation. Consideration of material from business, agriculture, law, design, medicine, literature, advertisement, and sports. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 370: Hispanic Topics in English Translation
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English. May not be counted as a prerequisite.
Meets International Perspectives Requirement.

SPAN 370A: Hispanic Topics in English Translation: Agriculture
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Topics vary according to faculty interest. Knowledge and understanding of major cultural, ethical, sociopolitical and economic issues directly related to agriculture and agribusiness in Latin America, Spain, and/or Equatorial Guinea. Readings, discussions, and papers in English. May not be counted as a prerequisite.

SPAN 370S: Studies in English Translation: Hispanic Topics on Women or Feminism
(Cross-listed with W S). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English. May not be counted as a prerequisite.
Meets International Perspectives Requirement.

SPAN 395: Study Abroad
Cr. 1-10. Repeatable.
Prereq: 2 years university-level Spanish or equivalent
Supervised instruction in Spanish and Hispanic culture; formal class instruction at level appropriate to students' training, enhanced by practical living experience.
Meets International Perspectives Requirement.

SPAN 401: Advanced Composition and Grammar
(Dual-listed with SPAN 501). (3-0) Cr. 3. F.
Prereq: SPAN 314 and one course at the 320-level or above
Advanced study of Spanish grammar and syntax. Students' writing of compositions incorporates an advanced understanding of grammar, syntax, and principles of organization of thought and ideas. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 440: Seminar on the Literatures and Cultures of Spain
(Dual-listed with SPAN 540). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, or SPAN 333. (Recommended SPAN 330 and SPAN 331)
Discussion and analysis of selected topics in Spanish literature and culture from the Middle Ages to the Present. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 441: Seminar on Cervantes and the Golden Age
(Dual-listed with SPAN 541). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, or SPAN 333. (SPAN 330 recommended)
Discussion and analysis of selected works of Cervantes within the social and cultural context of the Golden Age. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 445: Seminar on the Literatures and Cultures of Latin America
(Dual-listed with SPAN 545). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, SPAN or SPAN 333. (SPAN 332 and SPAN 333 recommended)
Discussion and analysis of selected topics in Latin American literature and culture from Pre-Colonial times to the Present. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 462: Contrastive Analysis of Spanish/ English for Translators
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: SPAN 351
Linguistic study of the major differences between the Spanish and English grammatical systems and their applications in the translation of Spanish to English. Taught in Spanish.

SPAN 463: Hispanic Dialectology
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: SPAN 352
Intensive study of the phonology, morphosyntax and lexicon of the Hispanic dialects of Spain and Latin America in their historical context. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 490: Independent Study
Cr. 1-6. Repeatable, maximum of 6 credits.
Prereq: 6 credits in Spanish and permission of department chair
Designed to meet the needs of students in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. No more than 6 credits in Span 490 may be counted toward graduation.

SPAN 499: Internship in Spanish
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: 9 credits of Spanish at the 300 level; permission of advisor and WLC Internship Coordinator
Work experience using Spanish language skills in the public or private sector, combined with academic work under faculty supervision. Up to 3 credits may apply toward the major. Available only to majors and minors.

Courses primarily for graduate students, open to qualified undergraduates:

SPAN 501: Advanced Composition and Grammar
(Dual-listed with SPAN 401). (3-0) Cr. 3. F.
Prereq: SPAN 314 and one course at the 320-level or above
Advanced study of Spanish grammar and syntax. Students' writing of compositions incorporates an advanced understanding of grammar, syntax, and principles of organization of thought and ideas. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 526: Studies in Hispanic Art or Film
(Dual-listed with SPAN 326). (3-0) Cr. 3.
Prereq: 6 credits in Spanish literature or culture at 400 level
Survey of major currents and figures in Spanish and Latin American art and/or film.

SPAN 540: Seminar on the Literatures and Cultures of Spain
(Dual-listed with SPAN 440). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, or SPAN 333. (Recommended SPAN 330 and SPAN 331)
Discussion and analysis of selected topics in Spanish literature and culture from the Middle Ages to the Present. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 541: Seminar on Cervantes and the Golden Age
(Dual-listed with SPAN 441). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, or SPAN 333. (SPAN 330 recommended)
Discussion and analysis of selected works of Cervantes within the social and cultural context of the Golden Age. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 545: Seminar on the Literatures and Cultures of Latin America
(Dual-listed with SPAN 445). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, SPAN or SPAN 333. (SPAN 332 and SPAN 333 recommended)
Discussion and analysis of selected topics in Latin American literature and culture from Pre-Colonial times to the Present. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 554: Introduction to Spanish-English Interpretation
(Dual-listed with SPAN 354). (Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: SPAN 351
Introduction to the theory, methods, techniques, and problems of consecutive and simultaneous interpretation. Consideration of material from business, agriculture, law, design, medicine, literature, advertisement, and sports. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 590: Special Topics in Spanish
Cr. 1-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Spanish

SPAN 590A: Special Topics in Spanish: Literature or Literary Criticism
Cr. 1-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Spanish

SPAN 590B: Special Topics in Spanish: Linguistics
Cr. 1-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Spanish

SPAN 590C: Special Topics in Spanish: Language Pedagogy
Cr. 1-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Spanish

SPAN 590D: Special Topics in Spanish: Civilization
Cr. 1-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Spanish

Special Education (SP ED)

Courses primarily for undergraduates:

SP ED 250: Education of the Exceptional Learner in a Diverse Society
(3-0) Cr. 3. F.S.
Prereq: C I 204
An overview of students with diverse learning needs, including students with disabilities, English Learners, students who are at risk, and gifted learners. Emphasis is on early identification; educational programming and implications; and legal foundations.
Meets U.S. Diversity Requirement

SP ED 330: Introduction to Instruction for Students with Mild/Moderate Disabilities
(3-0) Cr. 3. F.
Prereq: SP ED 250, concurrent enrollment in C I 280I, C I 377
Educational services and programming for students with mild/moderate disabilities examined from an historical perspective. Current trends, issues, impact of federal and state laws, and identification procedures. Characteristics of students with mild/moderate disabilities.

SP ED 334: Teaching Exceptional Learners in the General Classroom
(3-0) Cr. 3. F.
Prereq: Concurrent enrollment in SP ED 330
Evidence-based teaching strategies and instructional accommodations for inclusive education, including issues related to challenging behavior.

SP ED 355: Classroom Assessment in Inclusive Primary Settings
(2-0) Cr. 2. F.S.
Prereq: Concurrent enrollment in SP ED 455; C I 433, C I 439, C I 468I
Examination and application of strategies for determining special educational needs, planning and evaluating instructional programs, and monitoring student progress.

SP ED 365: Classroom Assessment for Special Education
(3-0) Cr. 3. S.
Prereq: SP ED 330; C I 377
Formal and informal diagnostic instruments. Determination of special education needs. Planning, adaptation, and formative evaluation of instructional programs for students with mild/moderate disabilities.

SP ED 368: Teaching in Inclusive Primary Settings
(1-0) Cr. 1. F.S.
Prereq: Concurrent enrollment in C I 377, C I 438, C I 468F, C I 468G
Emphasis on federal and state law, service delivery models, identification processes, and differentiated instruction.

SP ED 401: Teaching Secondary Students with Exceptionalities in General Education
(3-0) Cr. 3. F.S.
Characteristics and needs of youth with exceptionalities, including appropriate service delivery options. Emphasis on legal foundations, co-teaching models, differentiated instruction, accommodations for instruction and assessment, and collaboration among professionals and parents.

SP ED 416: Supervised Student Teaching
Cr. arr. F.S.
Prereq: Full admission to teacher education, senior classification, elementary education major; SP ED 330, SP ED 334, SP ED 365, SP ED 436, SP ED 439, C I 280I, C I 452
Reservation required.

SP ED 436: Instructional Methods for Students with Mild/Moderate Disabilities
(3-0) Cr. 3. S.
Prereq: C I 245, concurrent enrollment in SP ED 365
Evidence-based instructional strategies in academic areas, as well as class, group, and individual behavior management for elementary students with mild/moderate disabilities.

SP ED 455: Instructional Methods for Inclusive Primary Settings
(2-0) Cr. 2. F.S.
Prereq: Concurrent enrollment in SP ED 355; C I 433, C I 439, C I 468I
Evidence-based instructional strategies and techniques in academic areas that support the learning of students with diverse learning needs. Emphasis on accommodations and alternative teaching strategies to meet individual student needs.

SP ED 459: Pre-Student Teaching Experience III: Mild/Moderate Disabilities
(0-2) Cr. 1. F.
Prereq: SP ED 330, SP ED 339, SP ED 365, SP ED 436; admission to teacher education.
Observation and involvement with students with mild/moderate disabilities in school settings. Concurrent enrollment in Sp Ed 460. 1/2 day of time needed. Clinical Experience Level 3. Offered on a satisfactory-fail basis only.

SP ED 460: Special Education Seminar
(1-0) Cr. 1. F.
Prereq: SP ED 436, concurrent enrollment in SP ED 459
Application of evidence-based instructional strategies/techniques in academic and behavioral areas with students who have mild/moderate disabilities. Discussion of professional practices.

SP ED 464: Collaborative Partnerships in Special Education
(3-0) Cr. 3. F.
Prereq: SP ED 365, SP ED 436
Collaborative skills used in education of students with mild/moderate disabilities. Includes collaboration between general and special education teachers, parents, paraeducators, and other education professionals and agencies.

SP ED 490: Independent Study
Cr. 1-5. Repeatable. F.S.
Prereq: 12 credits in elementary education, permission of department chair

Courses primarily for graduate students, open to qualified undergraduates:

SP ED 501: Teaching Secondary Students with Exceptionalities in General Education
(3-0) Cr. 3. SS.
Prereq: Baccalaureate degree
Characteristics and needs of exceptional children/youth, including appropriate service delivery options. Emphasis on legal foundations, co-teaching models, differentiated instruction, accommodations for instruction and assessment, and collaboration among professionals and parents.

SP ED 510: Foundations in Mild/Moderate Disabilities
(3-0) Cr. 3. S.
Prereq: SP ED 501 or equivalent
Historical and legal foundations for special education. Characteristics, prevalence, and etiology of mild/moderate disabilities. Historical and contemporary models of programming for students with disabilities.

SP ED 511: Foundations of Behavior Disorders and Learning Disabilities
(3-0) Cr. 3. S.
Prereq: Sp Ed 501 or equivalent
Theory, characteristics, and special education service delivery models to students with moderate/severe behavior/learning disabilities in the public schools and residential settings.

SP ED 515: Assessment of Children and Youth with Disabilities
(3-0) Cr. 3. F.
Prereq: SP ED 510 or SP ED 511
Formal and informal methods of assessment for identification/eligibility, IEP development, and progress monitoring. Formative evaluation of academic and behavioral skills, including curriculum-based measurement and functional behavioral assessment.

SP ED 517: Research Review
(2-0) Cr. 2. SS.
Prereq: RESEV 550, SP ED 515
Critical review of recent research in education and related behavioral sciences as applied to education of students with disabilities. Examination of multiple research methodologies.

SP ED 520: Evidence-based Practices for Mild/Moderate Disabilities
(3-0) Cr. 3.
Prereq: SP ED 510, SP ED 515
Evidence-based strategies for meeting the academic and behavioral needs of students with mild/moderate disabilities, including instructional and behavior management strategies.

SP ED 530: Evidence-based Practices in Behavior Disorders
(3-0) Cr. 3. S.
Prereq: SP ED 511, SP ED 515
Current research on evidence-based interventions designed to improve the behavior and social skills of students with moderate/severe behavior disorders. Particular emphasis on positive behavioral supports and behavior change strategies.

SP ED 540: Evidence-based Practices in Learning Disabilities
(3-0) Cr. 3. S.
Prereq: SP ED 511, SP ED 515
Current research on evidence-based interventions designed to improve the academic performance of students with moderate/severe learning disabilities. Particular emphasis on methods for improving reading, written expression, and mathematics, as well as performance in content-area instruction.

SP ED 553: Teaching Adolescent Readers with Reading Difficulties
(Cross-listed with C I). (3-0) Cr. 3. SS.
Prereq: Teaching license
Instructional strategies for enhancing the fluency, vocabulary and comprehension of adolescents with reading difficulties. Attention to content-area reading materials and strategies.

SP ED 555: Career Education and Transition for Youth with Disabilities
(2-0) Cr. 2. SS.
Prereq: SP ED 510 or SP ED 511
Examination of the academic, personal, social, employability, and daily living skills needed for a satisfactory adult life. Exploration of curricula, programs, and services to meet these needs.

SP ED 560: Classroom Management/Behavior Support
(3-0) Cr. 3. F.
Prereq: Teaching license
Emphasis on positive behavioral supports and understanding behavior and its context through a functional behavioral approach. Design and development of carefully planned behavioral intervention programs for groups and individual students in general and special education settings.

SP ED 564: Collaborative Consultation
(3-0) Cr. 3. F.
Prereq: SP ED 515, SP ED 520 or SP ED 530 or SP ED 540
Characteristics and methods to promote effective collaboration with families, paraprofessionals, other school personnel, and representatives of other agencies. Includes specific attention to IEP development as a collaborative process.

SP ED 565: Role of the Consultant
(1-0) Cr. 1.
Prereq: SP ED 564
Explore role of the educational consultant in different settings (state department, area education agency, school district, private). Examine roles in relationship to models (mental health, collaborative, organization).

SP ED 567: Teaching Mathematics to Struggling Secondary Learners
(Cross-listed with C I). (3-0) Cr. 3.
Prereq: Secondary teaching experience
Instructional methods and assessment techniques for secondary students struggling to learn mathematics. Particular emphasis on current research, practices, and trends in mathematics interventions for at-risk students and students with disabilities.

SP ED 570: Systems-level Supports for Youth with Behavior and Learning Disabilities
(3-0) Cr. 3. SS.
Prereq: SP ED 511
Overview of support systems (education, juvenile justice, mental health, communities) that serve students with special education needs. Working with and supporting families.

SP ED 590: Special Topics
Cr. 1-5. F.S.
Prereq: 15 credits in education, permission of department chair

SP ED 591: Supervised Field Experience
(0-2) Cr. 1-6. F.S.
Prereq: 15 graduate credits in special area, admission to the graduate program in special education
Supervised on-the-job field experience in special areas.

SP ED 591G: Supervised Field Experience: Mild/Moderate Disabilities, K-8
(0-2) Cr. 1-6. F.S.
Prereq: 15 graduate credits in special area, admission to the graduate program in special education
Supervised on-the-job field experience in special areas.

SP ED 591H: Supervised Field Experience: Mild/Moderate Disabilities, 5-12
(0-2) Cr. 1-6. F.S.
Prereq: 15 graduate credits in special area, admission to the graduate program in special education
Supervised on-the-job field experience in special areas.

SP ED 591K: Supervised Field Experience: Behavior Disorders/Learning Disabilities, Ages 5-21
(0-2) Cr. 1-6. F.S.
Prereq: 15 graduate credits in special area, admission to the graduate program in special education
Supervised on-the-job field experience in special areas.

SP ED 591L: Supervised Field Experience: Special Education, Non-licensure
Cr. 1-6. F.S.
Prereq: 15 graduate credits in special area, admission to the graduate program in special education
Supervised on-the-job field experience in special areas.

SP ED 599: Creative Component
Cr. 1-5. F.S.SS.
Prereq: 15 credits in education

Courses for graduate students:

SP ED 615: Seminar
(1-0) Cr. 1. Repeatable, maximum of 2 credits.
Selected topics in special education. Analysis of current special education research. Evaluation of impact upon the profession. Implications for additional research.

SP ED 699: Research
Cr. arr.
Prereq: 15 credits in education

Speech Communication (SP CM)

Courses primarily for undergraduates:

SP CM 110: Listening
(3-0) Cr. 3. F.S.
Theory, principles, and competency development in comprehensive, therapeutic, critical, consumer, and appreciative listening. The impact of listening in relationships and partnerships.

SP CM 212: Fundamentals of Public Speaking
(3-0) Cr. 3. F.S.SS.
Theory and practice of basic speech communication principles applied to public speaking. Practice in the preparation and delivery of extemporaneous speeches.

SP CM 216: America Speaks: Great Speakers and Speeches in US History
Cr. 3.
Survey of great speeches examined within their political and cultural contexts. Analysis of the rhetorical strategies of diverse speakers with an emphasis on texts from social movements in the United States.
Meets U.S. Diversity Requirement

SP CM 275: Analysis of Popular Culture Texts
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.
Prereq: Credit in or equivalent of 250
Analysis of how information and entertainment forms persuade and manipulate audiences. Study of several forms that may include newspapers, speeches, television, film, advertising, fiction, and magazines. Special attention to verbal and visual devices.

SP CM 290: Special Projects
Cr. 1-2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: 3 credits in speech communication; permission of program director

SP CM 305: Language, Thought and Action
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: ENGL 250
The study of symbolic processes and how meaning is conveyed in words, sentences, and utterances; discussion of modern theories of meaning; and an exploration of relationships among language, thought and action.

SP CM 312: Business and Professional Speaking
(3-0) Cr. 3. F.S.
Prereq: SP CM 212
Theory, principles, and competency development in the creation of coherent, articulate business and professional oral presentations.

SP CM 313: Communication in Classrooms and Workshops
(3-0) Cr. 3.
Prereq: SP CM 212
Principles of communicating information: training in classroom and workshop-oriented communication activities; use of recording for analysis of presentations.

SP CM 322: Argumentation, Debate, and Critical Thinking
(2-2) Cr. 3.
Prereq: SP CM 212
Practice in preparing and presenting arguments and debates; emphasis on critical thinking and ethical and logical duties of the advocate; analysis, evidence, reasoning, attack, defense, research, case construction, and judging.

SP CM 323: Gender and Communication
(Cross-listed with W S). (3-0) Cr. 3.
Examines how understanding and enactment of gender identity is shaped by communication. Verbal and nonverbal communication across various contexts including personal relationships and the media. Explores discourse of social movements aiming to transform cultural definitions of gender.
Meets U.S. Diversity Requirement

SP CM 324: Legal Communication
(3-0) Cr. 3.
Prereq: SP CM 212
Speech communication in the legal system inside and outside the trial process: interviewing and counseling, negotiating and bargaining, voir dire, opening statements, examination of witnesses, closing arguments, judge's instructions, jury behavior, and appellate advocacy.

SP CM 327: Persuasion and Social Influence
(3-0) Cr. 3. F.S.SS.
Prereq: SP CM 212
Examination of persuasive theories, strategies and research in persuasion. Emphasis on application and analysis; logical, emotional, and ethical proofs.

SP CM 350: Rhetorical Traditions
(Cross-listed with CL ST, ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 250
Ideas about the relationship between rhetoric and society in contemporary and historical contexts. An exploration of classical and contemporary rhetorical theories in relation to selected topics that may include politics, gender, race, ethics, education, science, or technology.

SP CM 404: Seminar
(Dual-listed with SP CM 504). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior or above classification
Seminar on topics central to the field of speech communication.

SP CM 412: Rhetorical Criticism
(3-0) Cr. 3. S.
Prereq: SP CM 212 and 6 credits in speech communication
Development of rhetorical theory and practice from Corax to modern times. Application of principles of criticism to current public speaking practices.

SP CM 416: History of American Public Address
(3-0) Cr. 3. S.
Prereq: SP CM 212
Relationship between public discourse and social change; selected speakers and discourse as linked with political or historical events.

SP CM 417: Campaign Rhetoric
(Cross-listed with POL S). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: SP CM 212
Backgrounds of candidates for state and national elections; selected speeches and issues; persuasive strategies and techniques of individual speakers.

SP CM 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 18 credits in speech communication, junior classification, permission of program director
Only one independent study enrollment is permitted within the department per semester.

SP CM 495A: Independent Study: Directing Speech Activities
(1-0) Cr. 1. S.
Prereq: C I 301; 9 credits in speech communication; minimum GPA of 2.5 in speech communication courses
Problems, methods, and materials related to directing speech activities in secondary schools.

SP CM 495B: Independent Study: Teaching Speech
(Cross-listed with C I). (3-0) Cr. 3. F.
Prereq: C I 301; 9 credits in speech communication; minimum GPA of 2.5 in speech communication courses
Problems, methods, and materials related to teaching speech, theatre, and media in secondary schools.

SP CM 497: Capstone Seminar
(3-0) Cr. 3.
Prereq: 15 credits in speech communication; junior or senior classification
Students synthesize relevant theory and research about contemporary communication practice.

SP CM 499: Communication Internship
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: 18 credits in speech communication courses, other courses deemed appropriate by faculty adviser; 2nd semester junior or senior standing; minimum GPA of 2.5 and minimum GPA of 3.0 in speech communication courses; and permission of the internship committee
Applications should be submitted in the term prior to the term in which the internship is desired. Supervised application of speech communication in professional settings.

Courses primarily for graduate students, open to qualified undergraduates:

SP CM 504: Seminar
(Dual-listed with SP CM 404). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior or above classification
Seminar on topics central to the field of speech communication.

SP CM 513: Proseminar: Teaching Fundamentals of Public Speaking
(1-0) Cr. 1. Repeatable, maximum of 3 credits. F.
Prereq: Permission of instructor
Required of all new SP CM 212 teaching assistants. Introduction to the teaching of public speaking. Support and supervision of teaching assistants of SP CM 212. Discussion of lesson planning, teaching methods, development of speaking assignments, and evaluation of student speaking.

SP CM 547: The History of Rhetorical Theory I: From Plato to Bacon
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: 6 credits in English
Rhetorical theory from the classical period of ancient Greece and Rome through the Middle Ages to the early Renaissance; attention to its relation to the nature of knowledge, communication, practice, and pedagogy.

SP CM 548: The History of Rhetorical Theory II: From Bacon to the Present
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: 6 credits in English
Rhetorical theory from the early modern period (Bacon, Descartes, and Locke) to the present; attention to its relation to the nature of knowledge, communication practice, and pedagogy.

SP CM 590: Special Topics
Cr. 1-4. Repeatable, maximum of 12 credits.
Prereq: Permission of program chair

SP CM 592: Core Studies in Rhetoric, Composition, and Professional Communication
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

SP CM 592A: Core Studies: Rhetoric
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

SP CM 592B: Core Studies: Composition
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

SP CM 592C: Core Studies: Professional Communication
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

Statistics (STAT)

Courses primarily for undergraduates:

STAT 100: Orientation in Statistics
(1-0) Cr. R. F.
Opportunities, challenges, and the scope of the curriculum in statistics. For students planning or considering a career in this area.

STAT 101: Principles of Statistics
(3-2) Cr. 4. F.S.SS.
Prereq: 1 1/2 years of high school algebra
Statistical concepts in modern society; descriptive statistics and graphical displays of data; the normal distribution; data collection (sampling and designing experiments); elementary probability; elements of statistical inference; estimation and hypothesis testing; linear regression and correlation; contingency tables. Credit for only one of the following courses may be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226.

STAT 104: Introduction to Statistics
(2-2) Cr. 3. F.S.SS.
Prereq: 1 1/2 years of high school algebra
Statistical concepts and their use in science; collecting, organizing and drawing conclusions from data; elementary probability; binomial and normal distributions; regression; estimation and hypothesis testing. For students in the agricultural and biological sciences. Credit for only one of the following courses may be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226.

STAT 105: Introduction to Statistics for Engineers
(3-0) Cr. 3. F.S.
Prereq: MATH 165 (or MATH 165H)
Statistical concepts with emphasis on engineering applications. Data collection; descriptive statistics; probability distributions and their properties; elements of statistical inference; regression; statistical quality control charts; use of statistical software; team project involving data collection, description and analysis. Credit for only one of the following courses may be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226. Credit for both STAT 105 and STAT 305 may not be applied for graduation.

STAT 201: Introduction to Statistical Concepts and Methods
(3-2) Cr. 4. S.
Prereq: Credit or enrollment in MATH 165
Statistical thinking and applications of statistical concepts and methods in modern society. Display and summary of categorical and numerical data. Exploring relationships between variables, association, correlation, and regression. Observational studies and experiments. Probability concepts, random variables, discrete and continuous distributions. Elements of statistical inference; estimation and hypothesis testing. Credit for only one of the following courses may be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226.

STAT 226: Introduction to Business Statistics I
(3-0) Cr. 3. F.S.SS.
Prereq: MATH 150 or MATH 165
Obtaining, presenting, and organizing statistical data; measures of location and dispersion; the Normal distribution; sampling and sampling distributions; elements of statistical inference; estimation and confidence intervals; hypothesis testing; inference for simple linear regression analysis; use of computers to visualize and analyze data. Credit for only one of the following courses may be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226.

STAT 231: Probability and Statistical Inference for Engineers
(4-0) Cr. 4. F.S.
Prereq: Credit or enrollment in MATH 265
Emphasis on engineering applications. Basic probability; random variables and probability distributions; joint and sampling distributions. Descriptive statistics; confidence intervals; hypothesis testing; simple linear regression; multiple linear regression; one way analysis of variance; use of statistical software.

STAT 301: Intermediate Statistical Concepts and Methods
(3-2) Cr. 4. F.S.
Prereq: STAT 101 or STAT 104 or STAT 105 or STAT 201
Statistical concepts and methods used in the analysis of data. Statistical models. Analysis of single sample, two sample and paired sample data. Simple and multiple linear regression including polynomial regression. Analysis of residuals. Regression diagnostics. Model building. Regression with indicator variables. Credit for only one of the following courses may be applied toward graduation: STAT 301, STAT 326, or STAT 401

STAT 305: Engineering Statistics
(3-0) Cr. 3. F.S.SS.
Prereq: MATH 165 (or MATH 165H)
Statistics for engineering problem solving. Principles of engineering data collection; descriptive statistics; elementary probability distributions; principles of experimentation; confidence intervals and significance tests; one-, two-, and multi-sample studies; regression analysis; use of statistical software; team project involving engineering experimentation and data analysis. Credit for both Stat 105 and 305 may not be applied for graduation.

STAT 322: Probabilistic Methods for Electrical Engineers
(Cross-listed with E E). (3-0) Cr. 3. F.S.
Prereq: E E 224
Introduction to probability with applications to electrical engineering. Sets and events, probability space, conditional probability, total probability and Bayes' rule. Discrete and continuous random variables, cumulative distribution function, probability mass and density functions, expectation, moments, moment generating functions, multiple random variables, functions of random variables. Elements of statistics, hypothesis testing, confidence intervals, least squares. Introduction to random processes.

STAT 326: Introduction to Business Statistics II
(2-2) Cr. 3. F.S.
Prereq: STAT 226
Multiple regression analysis; regression diagnostics; model building; applications in analysis of variance and time series; random variables; distributions; conditional probability; statistical process control methods; use of computers to visualize and analyze data. Credit for only one of the following courses may be applied toward graduation: STAT 301, STAT 326 or STAT 401.

STAT 330: Probability and Statistics for Computer Science
(3-0) Cr. 3. F.S.
Prereq: MATH 166
Topics from probability and statistics applicable to computer science. Basic probability; Random variables and their distributions; Stochastic processes including Markov chains; Queuing models; Basic statistical inference; Introduction to regression.

STAT 332: Visual Communication of Quantitative Information
(Cross-listed with ENGL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 101, STAT 104, STAT 201 or STAT 226; ENGL 250
Communicating quantitative information using visual displays; visualizing data; interactive and dynamic data displays; evaluating current examples in the media; color, perception, and representation in graphs; interpreting data displays.

STAT 341: Introduction to the Theory of Probability and Statistics I
(Cross-listed with MATH). (3-0) Cr. 3. F.S.
Prereq: MATH 265 (or MATH 265H)
Probability; distribution functions and their properties; classical discrete and continuous distribution functions; multivariate probability distributions and their properties; moment generating functions; simulation of random variables and use of the R statistical package. Credit for both STAT 341 and STAT 447 may not be applied toward graduation.

STAT 342: Introduction to the Theory of Probability and Statistics II
(Cross-listed with MATH). (3-0) Cr. 3. F.S.
Prereq: STAT 341; MATH 207 or MATH 317
Transformations of random variables; sampling distributions; confidence intervals and hypothesis testing; theory of estimation and hypothesis tests; linear model theory; use of the R statistical package for simulation and data analysis.

STAT 361: Statistical Quality Assurance
(Cross-listed with I E). (2-2) Cr. 3. F.S.
Prereq: STAT 231, STAT 301, STAT 326 or STAT 401
Statistical methods for process improvement. Simple quality assurance principles and tools. Measurement system precision and accuracy assessment. Control charts. Process capability assessment. Experimental design and analysis for process improvement. Significant external project in process improvement.

STAT 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department chair
Off-campus work periods for undergraduate students in a field of statistics.

STAT 401: Statistical Methods for Research Workers
(3-2) Cr. 4. F.S.SS.
Prereq: STAT 101 or STAT 104 or STAT 105 or STAT 201 or STAT 226
Graduate students without an equivalent course should contact the department. Methods of analyzing and interpreting experimental and survey data. Statistical concepts and models; estimation; hypothesis tests with continuous and discrete data; simple and multiple linear regression and correlation; introduction to analysis of variance and blocking. Credit for only one of the following courses may be applied toward graduation: STAT 301, STAT 326, or STAT 401.

STAT 402: Statistical Design and the Analysis of Experiments
(3-0) Cr. 3. F.S.
Prereq: STAT 301 or STAT 326 or STAT 401
The role of statistics in research and the principles of experimental design. Experimental units, randomization, replication, blocking, subdividing and repeatedly measuring experimental units; factorial treatment designs and confounding; extensions of the analysis of variance to cover general crossed and nested classifications and models that include both classificatory and continuous factors. Determining sample size.

STAT 404: Regression for Social and Behavioral Research
(2-2) Cr. 3. F.S.
Prereq: STAT 301 or STAT 326 or STAT 401
Applications of generalized linear regression models to social science data. Assumptions of regression; diagnostics and transformations; analysis of variance and covariance; path analysis; logistic, multinomial and Poisson regression.

STAT 406: Statistical Methods for Spatial Data
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Six hours of statistics at the 400-level
The analysis of spatial data; geostatistical methods, mapping and spatial prediction; methods for areal data; models and methods for spatial point processes. Emphasis on application and practical use of spatial statistical analysis. Use of R and R packages for spatial data analysis.

STAT 407: Methods of Multivariate Analysis
(2-2) Cr. 3. F.
Prereq: STAT 301 or STAT 326 or STAT 401, knowledge of matrix algebra
Techniques for displaying and analyzing multivariate data including plotting high-dimensional data using interactive graphics, comparing group mean vectors using Hotelling's T2, multivariate analysis of variance, reducing variable dimension with principal components, grouping/classifying observations with cluster analysis and discriminant analysis. Imputation of missing multivariate observations.

STAT 410: Statistical Methods for Mathematics Teachers
(6-0) Cr. 6. Alt. SS., offered odd-numbered years.
Prereq: STAT 341 or equivalent
Descriptive statistics; data collection through experimentation and sampling; univariate statistical inference; contingency tables; design of experiments and ANOVA; simple linear regression; logistic regression; multiple linear regression; statistics pedagogy.

STAT 415: Advanced Statistical Methods for Research Workers
(1-0) Cr. 1. Repeatable, maximum of 3 credits. S.
Prereq: STAT 301 or STAT 326 or STAT 401
Advanced statistical methods for modeling and analyzing data. Taught as separate 1 cr. sections, each of 5 weeks. Three sections taught in one semester. Areas covered: Logistic and Poisson regression; Structural equation modeling; Smoothing and nonparametric regression; Nonparametric and distribution free methods; Bootstrapping and randomization tests; Visualization of high dimensional data; Analysis of species composition data; Missing data and measurement error.

STAT 416: Statistical Design and Analysis of Gene Expression Experiments
(3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401
Introduction to high-throughput technologies for gene expression studies (especially RNA-sequencing technology): the role of blocking, randomization, and biological and technical replication in the design of gene expression experiments; normalization methods; methods for identifying differentially expressed genes including mixed linear model analysis, generalized linear model analysis, generalized linear mixed model analysis, quasi-likelihood methods, empirical Bayes analysis, and resampling based approaches; procedures for controlling false discovery rate for multiple testing; clustering and classification problems for gene expression data; testing gene categories; emphasis on practical use of methods.

STAT 421: Survey Sampling Techniques
(2-2) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401
Concepts of sample surveys and the survey process; methods of designing sample surveys, including: simple random, stratified, and multistage sampling designs; methods of analyzing sample surveys including ratio, regression, domain estimation and nonresponse.

STAT 430: Empirical Methods for the Computational Sciences
(3-0) Cr. 3. F.
Prereq: STAT 330 or an equivalent course, MATH 166, knowledge of linear algebra.
Statistical methods for research involving computers; exploratory data analysis; selected topics from analysis of designed experiments - analysis of variance, hypothesis testing, interaction among variables; linear regression, logistic regression, Poisson regression; parameter estimation, prediction, confidence regions, dimension reduction techniques, model diagnostics and sensitivity analysis; Markov chains and processes; simulation techniques and bootstrap methods; applications to computer science, bioinformatics, computer engineering - programs, models and systems as objects of empirical study; communicating results of empirical studies. Statistical software: R.

STAT 432: Applied Probability Models
(3-0) Cr. 3. F.
Prereq: STAT 231 or STAT 341 or STAT 447
Probabilistic models in biological, engineering and the physical sciences. Markov chains; Poisson, birth-and-death, renewal, branching and queing processes; applications to bioinformatics and other quantitative problems.

STAT 444: Bayesian Data Analysis
(2-2) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401; STAT 342 or STAT 447.
Probability models and prior distributions; updating priors through the likelihood function. Computational and simulation-based methods for deriving posterior distributions and for estimating parameters. Basic statistical and hierarchical models. Model adequacy and posterior predictive checks. Markov Chain Monte Carlo methods and introduction to WinBUGS or similar software. Emphasis on applications and examples from the social, biological and physical sciences.

STAT 447: Statistical Theory for Research Workers
(4-0) Cr. 4. F.S.SS.
Prereq: MATH 151 and permission of instructor, or MATH 265
Primarily for graduate students not majoring in statistics. Emphasis on aspects of the theory underlying statistical methods. Probability, probability density and mass functions, distribution functions, moment generating functions, sampling distributions, point and interval estimation, maximum likelihood and likelihood ratio tests, linear model theory, conditional expectation and minimum mean square error estimation, introduction to posterior distributions and Bayesian analysis, use of simulation to verify and extend theory. Credit for both STAT 341 and STAT 447 may not be applied toward graduation.

STAT 451: Applied Time Series
(3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401
Meeker. Methods for analyzing data collected over time; review of multiple regression analysis. Elementary forecasting methods: moving averages and exponential smoothing. Autoregressive-moving average (Box-Jenkins) models: identification, estimation, diagnostic checking, and forecasting. Transfer function models and intervention analysis. Introduction to multivariate time series methods.

STAT 457: Applied Categorical Data Analysis
(3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401
Statistical methods for the analysis of categorical data: graphical summaries, estimation and inference for proportions, sample size determination, chi-square tests, measures of relative risk, odds and association, analysis of paired data and measures of agreement, logistic regression models, log-linear models.

STAT 479: Computer Processing of Statistical Data
(3-0) Cr. 3. F.
Prereq: STAT 301 or STAT 326 or STAT 401
Structure, content and programming aspects of the Statistical Analysis System (SAS) software package. Advanced techniques in the use of SAS for data analysis including statistical graphics, regression diagnostics, and complex analysis of variance models. The SAS graphical interfaces Enterprise Guide and Enterprise Miner will be introduced.

STAT 480: Statistical Computing Applications
(3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401
Modern statistical computing. Data management; spread sheets, verifying data accuracy, transferring data between software packages. Data and graphical analysis with statistical software packages. Algorithmic programming concepts and applications. Simulation. Software reliability.

STAT 490: Independent Study
Cr. arr. Repeatable, maximum of 9 credits.
Prereq: 10 credits in statistics
No more than 9 credits in Stat 490 may be counted toward graduation.

STAT 490H: Independent Study: Honors
Cr. arr. Repeatable, maximum of 9 credits.
Prereq: 10 credits in statistics
No more than 9 credits in Stat 490 may be counted toward graduation.

STAT 495: Applied Statistics for Industry I
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 101 or STAT 104 or STAT 105 or STAT 201 or STAT 226; MATH 166 (or MATH 166H)
Graduate students without an equivalent course should consult the department. Statistical thinking applied to industrial processes. Assessing, monitoring and improving processes using statistical methods. Analytic/enumerative studies; graphical displays of data; fundamentals of six sigma; process monitoring; control charts; capability analysis.

STAT 496: Applied Statistics for Industry II
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 495
Statistical design and analysis of industrial experiments. Concepts of control, randomization and replication. Simple and multiple regression; factorial and fractional factorial experiments; application of ideas of six sigma; reliability; analysis of lifetime data.

Courses primarily for graduate students, open to qualified undergraduates:

STAT 500: Statistical Methods I

(3-2) Cr. 4. F.

Prereq: STAT 447 or current enrollment in STAT 542; knowledge of matrix algebra.

Analysis of data from designed experiments and observational studies. Randomization-based inference; inference on group means; nonparametric bootstrap; pairing/blocking and other uses of restricted randomization. Use of linear models to analyze data; least squares estimation; estimability; sampling distributions of estimators; general linear tests; inference for parameters and contrasts. Model assessment and diagnostics; remedial measures; alternative approaches based on ranks.

STAT 501: Multivariate Statistical Methods

(3-0) Cr. 3. S.

Prereq: STAT 500 or STAT 402; STAT 447 or STAT 542; STAT 579 or equivalent; knowledge of matrix algebra.

Statistical methods for analyzing and displaying multivariate data; the multivariate normal distribution; inference in multivariate populations, simultaneous analysis of multiple responses, multivariate analysis of variance; summarizing high dimensional data with principal components, factor analysis, canonical correlations, classification methods, clustering, multidimensional scaling; introduction to basic nonparametric multivariate methods. Statistical software: SAS or R.

STAT 502: Applied Modern Multivariate Statistical Learning

(3-0) Cr. 3. Alt. S., offered even-numbered years.

Prereq: STAT 500, STAT 542, STAT 579.

A Statistics-MS-level introduction to Modern Multivariate Statistical Learning. Theory-based methods for modern data mining and machine learning, inference and prediction. Variance-bias trade-offs and choice of predictors; linear methods of prediction; basis expansions; smoothing, regularization, kernel smoothing methods; neural networks and radial basis function networks; bootstrapping, model averaging, and stacking; linear and quadratic methods of classification; support vector machines; trees and random forests; boosting; prototype methods; unsupervised learning including clustering, principal components, and multi-dimensional scaling; kernel mechanics. Substantial use of R packages implementing these methods.

STAT 503: Exploratory Methods and Data Mining

(2-2) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: STAT 301 or STAT 326 or STAT 401; STAT 341 or STAT 447 or STAT 542; STAT 480 or STAT 579

Approaches to finding the unexpected in data; exploratory data analysis; pattern recognition; dimension reduction; supervised and unsupervised classification; interactive and dynamic graphical methods; computer-intensive statistical techniques for large or high dimensional data and visual inference. Emphasis is on problem solving, topical problems, and learning how so-called black-box methods actually work.

STAT 505: Environmental Statistics

(3-0) Cr. 3. Alt. S., offered even-numbered years.

Prereq: STAT 341 or STAT 447; STAT 401

Statistical methods and models for environmental applications. Emphasis on environmental toxicology. Analysis of data with below detection-limit values. Dose-response curve modeling, including overdispersion and estimation of safe doses. Trend analysis; analysis of autocorrelated data. Equivalence testing.

STAT 506: Statistical Methods for Spatial Data

(3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: STAT 447 or STAT 542

The analysis of spatial data; geostatistical methods and spatial prediction; discrete index random fields and Markkov random field models; models for spatial point processes.

STAT 510: Statistical Methods II

(3-0) Cr. 3. S.

Prereq: STAT 500, STAT 447 or credit/enrollment in STAT 543

Model selection and collinearity in linear regression. Likelihood analysis for general models and models with non-normal random components; linear model results in the context of likelihood; linear mixed models and their application; estimation, inference, and prediction. Computational issues in iterative algorithms; expectation- maximization algorithm and its use in mixed models. Case studies of applications including problem formulation, exploratory analysis, model development, estimation and inference, and model assessment.

STAT 512: Design of Experiments

(3-0) Cr. 3. F.

Prereq: STAT 511

Basic techniques of experimental design developed in the context of the general linear model; completely randomized, randomized complete block, and Latin Square designs; factorial experiments, confounding, fractional replication; split-plot and incomplete block designs.

STAT 513: Response Surface Methodology
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 402 or STAT 512, knowledge of elementary matrix theory and matrix formulation of regression
Analysis techniques for locating optimum and near-optimum operating conditions: standard experimental designs for first- and second-order response surface models; design performance criteria; use of data transformations; mixture experiments; optimization for multiple-response problems. Requires use of statistical software with matrix functions.

STAT 515: Theory and Applications of Nonlinear Models
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 447 or STAT 543; STAT 510
Construction of nonlinear statistical models; random and systematic model components, additive error nonlinear regression with constant and non-constant error variances, generalized linear models, transform both sides models. Iterative algorithms for estimation and asymptotic inference. Basic random parameter models, beta-binomial and gamma-Poisson mixtures. Requires use of instructor-supplied and student-written R functions.

STAT 516: Statistical Design and Analysis of Gene Expression Experiments
(3-0) Cr. 3. S.
Prereq: STAT 500; STAT 447 or STAT 542
Introduction to high-throughput technologies for gene expression studies (especially RNA-sequencing technology): the role of blocking, randomization, and biological and technical replication in the design of gene expression experiments; normalization methods; methods for identifying differentially expressed genes including mixed linear model analysis, generalized linear model analysis, generalized linear mixed model analysis, quasi-likelihood methods, empirical Bayes analysis, and resampling based approaches; procedures for controlling false discovery rate for multiple testing; clustering and classification problems for gene expression data; testing gene categories; emphasis on current research topics for statistical analysis of high dimensional gene expression data.

STAT 520: Statistical Methods III
(3-0) Cr. 3. F.
Prereq: STAT 510, STAT 447 or STAT 543
Nonlinear regression; generalized least squares; asymptotic inference. Generalized linear models; exponential dispersion families; maximum likelihood and inference. Designing Monte Carlo studies; bootstrap; cross-validation. Fundamentals of Bayesian analysis; data models, priors and posteriors; posterior prediction; credible intervals; Bayes Factors; types of priors; simulation of posteriors; introduction to hierarchical models and Markov Chain Monte Carlo methods.

STAT 521: Theory and Applications of Sample Surveys
(3-0) Cr. 3. S.
Prereq: STAT 401; STAT 447 or STAT 542
Practical aspects and basic theory of design and estimation in sample surveys for finite populations. Simple random, systematic, stratified, cluster multistage and unequal-probability sampling. Horvitz-Thompson estimation of totals and functions of totals: means, proportions, regression coefficients. Linearization technique for variance estimation. Model-assisted ratio and regression estimation. Two-phase sampling and sampling on two occasions. Non-response effects. Imputation.

STAT 522: Advanced Applied Survey Sampling
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 521 or both STAT 421 and STAT 447
Advanced topics in survey sampling and methodology: clustering and stratification in practice, adjustments and imputation for missing data, variance estimation in complex surveys, methods of panel and/or longitudinal surveys, procedures to increase response rates, and computing. Examples are taken from large, well-known surveys in various subject areas. Prior exposure to mathematical statistics, probability, and at least one course in survey sampling theory is assumed.

STAT 531: Quality Control and Engineering Statistics
(Cross-listed with I E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 401; STAT 342 or STAT 447
Statistical methods and theory applicable to problems of industrial process monitoring and improvement. Statistical issues in industrial measurement; Shewhart, CUSUM, and other control charts; feedback control; process characterization studies; estimation of product and process characteristics; acceptance sampling, continuous sampling and sequential sampling; economic and decision theoretic arguments in industrial statistics.

STAT 533: Reliability
(Cross-listed with I E). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 342 or STAT 432 or STAT 447
Probabilistic modeling and inference in engineering reliability; lifetime models, product limit estimator, probability plotting, maximum likelihood estimation for censored data, Bayesian methods in reliability, system reliability models, competing risk analysis, acceleration models and analysis of accelerated test data; analysis of recurrence data; planning studies to obtain reliability data.

STAT 534: Ecological Statistics

(3-0) Cr. 3. Alt. F., offered odd-numbered years.

Prereq: STAT 447 or STAT 542

Statistical methods for non-standard problems, illustrated using questions and data from ecological field studies. Estimation of abundance and survival from mark-recapture studies, deterministic and stochastic matrix models of population trends, integral projection models, and hierarchical modeling, especially of population dynamics. Additional topics vary based on student interest.

STAT 536: Statistical Genetics

(Cross-listed with GDCB). (3-0) Cr. 3. Alt. F., offered even-numbered years.

Prereq: STAT 401, STAT 447; GEN 320 or BIOL 313

Statistical models and methods for genetics covering models of population processes: selection, mutation, migration, population structure, and linkage disequilibrium, and inference techniques: genetic mapping, linkage analysis, and quantitative trait analysis. Applications include genetic map construction, gene mapping, genome-wide association studies (GWAS), inference about population structure, phylogenetic tree construction, and forensic and paternity identification.

STAT 542: Theory of Probability and Statistics I

(4-0) Cr. 4. F.

Prereq: MATH 414.

Sample spaces, basic probability results, conditional probability. Random variables, univariate distributions, moment generating functions. Joint distributions, conditional distributions and independence, correlation and covariance. Probability laws and transformations. Introduction to the multivariate normal distribution. Sampling distributions, normal theory, sums and order statistics. Convergence concepts, the law of large numbers, the central limit theorem and delta method. Basics of stochastic simulation.

STAT 543: Theory of Probability and Statistics II

(3-0) Cr. 3. S.

Prereq: STAT 542.

Point estimation including method of moments, maximum likelihood and Bayes. Properties of point estimators, mean squared error, unbiasedness, consistency, loss functions. Large sample properties of maximum likelihood estimators. Exponential families, sufficiency, completeness, ancilarity, Basu's theorem. Hypothesis tests, Neyman-Pearson lemma, uniformly most powerful tests, likelihood ratio tests, Bayes tests. Interval estimation, inverting tests, pivotal quantities. Nonparametric theory, bootstrap.

STAT 544: Bayesian Statistics

(3-0) Cr. 3. S.

Prereq: STAT 543

Specification of probability models; subjective, conjugate, and noninformative prior distributions; hierarchical models; analytical and computational techniques for obtaining posterior distributions; model checking, model selection, diagnostics; comparison of Bayesian and traditional methods.

STAT 546: Nonparametric Methods in Statistics

(3-0) Cr. 3. Alt. F., offered even-numbered years.

Prereq: STAT 510, STAT 542

Overview of parametric versus nonparametric methods of inference; introduction to rank-based tests and/or nonparametric smoothing methods for estimating density and regression functions; smoothing parameter selection; applications to semiparametric models and goodness-of-fit tests of a parametric model.

STAT 547: Functional Data Analysis

(3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: STAT 543, STAT 511

Theory and methods for analyzing functional data, which are high dimensional data resulted from discrete, error-contaminated measurements on smooth curves and images. The topics include kernel and spline smoothing, basis expansion, semiparametric regression, functional analysis of variance, covariance modeling and estimation, functional principal component analysis, functional generalization linear models, joint modeling, dimension reduction, classification and clustering functional data.

STAT 551: Time Series Analysis

(3-0) Cr. 3. F.

Prereq: STAT 447 or STAT 542

Concepts of trend and dependence in time series data; stationarity and basic model structures for dealing with temporal dependence; moving average and autoregressive error structures; analysis in the time domain and the frequency domain; parameter estimation, prediction and forecasting; identification of appropriate model structure for actual data and model assessment techniques. Possible extended topics include dynamic models and linear filters.

STAT 554: Introduction to Stochastic Processes

(Cross-listed with MATH). (3-0) Cr. 3. F.

Prereq: STAT 542

Markov chains on discrete spaces in discrete and continuous time (random walks, Poisson processes, birth and death processes) and their long-term behavior. Optional topics may include branching processes, renewal theory, introduction to Brownian motion.

STAT 557: Statistical Methods for Counts and Proportions
(3-0) Cr. 3. F.
Prereq: STAT 500 or STAT 401; STAT 543 or STAT 447
Statistical methods for analyzing simple random samples when outcomes are counts or proportions; measures of association and relative risk, chi-squared tests, loglinear models, logistic regression and other generalized linear models, tree-based methods. Extensions to longitudinal studies and complex designs, models with fixed and random effects. Use of statistical software: SAS, S-Plus or R.

STAT 565: Methods in Biostatistics and Epidemiology
(Cross-listed with TOX). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 500 or STAT 401; STAT 543 or STAT 447
Statistical methods commonly used in epidemiology and human and animal health studies. Overview of cohort studies, case-control studies and randomized clinical trials. topics include inference procedures for disease risk factors, analysis of time-to-event and survival data, analysis of longitudinal studies of disease progression and health status, approaches to handling missing data, and meta-analysis. Examples will come from recent studies of physical and mental health, nutrition and disease progression in human and animal populations. Use of statistical software: SAS or R.

STAT 568: Bioinformatics II (Statistical Bioinformatics)
(Cross-listed with BCB, COM S, GDCB). (3-0) Cr. 3. S.
Prereq: BCB 567 or (BIOL 315 and STAT 430), credit or enrollment in GEN 409
Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models.

STAT 570: Bioinformatics IV (Systems Biology)
(Cross-listed with BCB, COM S, CPR E, GDCB). (3-0) Cr. 3. S.
Prereq: BCB 567 or COM S 311, COM S 228, GEN 409, STAT 430
Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration.

STAT 579: An Introduction to R
(0-2) Cr. 1. F.
Prereq: Enrollment in STAT 500
An introduction to the logic of programming, numerical algorithms, and graphics. The R statistical programming environment will be used to demonstrate how data can be stored, manipulated, plotted, and analyzed using both built-in functions and user extensions. Concepts of modularization, looping, vectorization, conditional execution, and function construction will be emphasized.

STAT 580: Statistical Computing
(3-0) Cr. 3. S.
Prereq: STAT 579; STAT 447 or STAT 542
Introduction to scientific computing for statistics using tools and concepts in R: programming tools, modern programming methodologies, modularization, design of statistical algorithms. Introduction to C programming for efficiency; interfacing R with C. Building statistical libraries. Use of algorithms in modern subroutine packages, optimization and integration. Implementation of simulation methods; inversion of probability integral transform, rejection sampling, importance sampling. Monte Carlo integration.

STAT 590: Special Topics
Cr. arr. Repeatable.

STAT 590A: Special Topics: Theory
Cr. arr. Repeatable.

STAT 590B: Special Topics: Methods
Cr. arr. Repeatable.

STAT 590C: Special Topics: Design of Experiments
Cr. arr. Repeatable.

STAT 590D: Special Topics: Sample Surveys
Cr. arr. Repeatable.

STAT 590E: Special Topics: Statistics Education
Cr. arr. Repeatable.

STAT 590F: Special Topics: Statistical Computing and Graphics
Cr. arr. Repeatable. F.

STAT 598: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the department chair
Off-campus work periods for graduate students in a field of statistics.

STAT 599: Creative Component
Cr. arr.

Courses for graduate students:

STAT 601: Advanced Statistical Methods
(3-0) Cr. 3. S.
Prereq: STAT 520, STAT 543 and MATH 414 or enrollment in STAT 641
Methods of constructing complex models including adding parameters to existing structures, incorporating stochastic processes and latent variables. Use of modified likelihood functions; quasi-likelihoods; profiles; composite likelihoods. Asymptotic normality as a basis of inference; Godambe information. Sample reuse; block bootstrap; resampling with dependence. Simulation for model assessment. Issues in Bayesian analysis.

STAT 602: Modern Multivariate Statistical Learning
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 520, STAT 543, STAT 579
Statistical theory and methods for modern data mining and machine learning, inference, and prediction. Variance-bias trade-offs and choice of predictors; linear methods of prediction; basis expansions; smoothing, regularization, and reproducing kernel Hilbert spaces; kernel smoothing methods; neural networks and radial basis function networks; bootstrapping, model averaging, and stacking; linear and quadratic methods of classification; support vector machines; trees and random forests; boosting; prototype methods; unsupervised learning including clustering, principal components, and multi-dimensional scaling; kernel mechanics.

STAT 606: Advanced Spatial Statistics
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 506, STAT 642
Consideration of advanced topics in spatial statistics, including areas of current research. Topics may include construction of nonstationary covariance structures including intrinsic random functions, examination of edge effects, general formulation of Markov random field models, spatial subsampling, use of pseudo-likelihood and empirical likelihood concepts in spatial analysis, the applicability of asymptotic frameworks for inference, and a discussion of appropriate measures for point processes.

STAT 611: Theory and Applications of Linear Models
(3-0) Cr. 3. F.
Prereq: STAT 510; STAT 542 or STAT 447; a course in matrix algebra
Matrix preliminaries, estimability, theory of least squares and of best linear unbiased estimation, analysis of variance and covariance, distribution of quadratic forms, extension of theory to mixed and random models, inference for variance components.

STAT 612: Advanced Design of Experiments
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 512
General theory of factorial experiments. Design optimality criteria, approximate design and general equivalence theory, computational approaches to constructing optimal designs for linear models, and extensions to nonlinear models. Advanced topics of current interest in the design of experiments, including one or more of: distance based design criteria and construction of spatial process models, screening design strategies for high-dimensional problems, and design problems associated with computational experiments.

STAT 615: Advanced Bayesian Methods
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 544 and STAT 601
Complex hierarchical and multilevel models, dynamic linear and generalized linear models, spatial models. Bayesian nonparametric methods. Specialized Markov chain Monte Carlo algorithms and practical approaches to increasing mixing and speed convergence. Summarizing posterior distributions, and issues in inference. Model assessment, model selection, and model averaging.

STAT 621: Advanced Theory of Survey Statistics
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 521
Advanced topics of current interest in the design of surveys and analysis of survey data, including: asymptotic theory for design and model-based estimators, use of auxiliary information in estimation, variance estimation techniques, small area estimation, non-response modeling and imputation.

STAT 641: Foundations of Probability Theory
(Cross-listed with MATH). (3-0) Cr. 3. F.
Prereq: MATH 414 or MATH 501 or equivalent course.
Sequences and set theory; Lebesgue measure, measurable functions. Absolute continuity of functions, integrability and the fundamental theorem of Lebesgue integration. General measure spaces, probability measure, extension theorem and construction of Lebesgue-Stieljes measures on Euclidean spaces. Measurable transformations and random variables, induced measures and probability distributions. General integration and expectation, Lp-spaces and integral inequalities. Uniform integrability and absolute continuity of measures. Probability densities and the Radon-Nikodym theorem. Product spaces and Fubini-Tonelli theorems.

STAT 642: Advanced Probability Theory
(Cross-listed with MATH). (3-0) Cr. 3. S.
Prereq: STAT 641, or STAT 543 and MATH 515.
Probability spaces and random variables. Kolmogorov's consistency theorem. Independence, Borel-Cantelli lemmas and Kolmogorov's 0 - 1 Law. Comparing types of convergence for random variables. Sums of independent random variables, empirical distributions, weak and strong laws of large numbers. Convergence in distribution and its characterizations, tightness, characteristic functions, central limit theorems and Lindeberg-Feller conditions. Conditional probability and expectation. Discrete parameter martingales and their properties and applications.

STAT 643: Advanced Theory of Statistical Inference
(3-0) Cr. 3. F.
Prereq: STAT 543, STAT 642
Sufficiency and related concepts, completeness, exponential families and statistical information. Elements of decision theory, decision rules, invariance and Bayes rule. Maximum likelihood and asymptotic inference. Generalized estimating equations and estimating functions, M-estimation, U-statistics. Likelihood ratio tests, simple and composite hypotheses, multiple testing. Bayesian inference. Nonparametric inference, bootstrap, empirical likelihood, and tests for nonparametric models.

STAT 644: Advanced Bayesian Theory
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 544 and STAT 642
Exchangeability, parametric models, consistency and asymptotic normality of posterior distributions, posterior robustness, selection of priors using formal rules, improper priors and posterior propriety, Bayes factors, model selection, MCMC theory, irreducibility, Harris recurrence, regeneration, minorization, drift, ergodicity, limit theorems, techniques for speeding up convergence of certain MCMC algorithms.

STAT 645: Advanced Stochastic Processes
(Cross-listed with MATH). (3-0) Cr. 3. S.
Weak convergence. Random walks and Brownian motion. Martingales. Stochastic integration and Ito's Formula. Stochastic differential equations and applications.

STAT 647: Advanced Multivariate Analysis
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 543, knowledge of matrix algebra
Multivariate normal distribution, estimation of the mean vector and the covariance matrix, multiple and partial correlation, Hotelling's T2 statistic, Wishart distribution, multivariate regression, principle components, discriminant analysis, high dimensional data analysis, latent variables.

STAT 648: Seminar on Theory of Statistics and Probability
Cr. arr. F.
Prereq: STAT 543.
Seminar topics change with each offering.

STAT 651: Advanced Time Series
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 551, STAT 642
Stationary and nonstationary time series models, including ARMA, ARCH, and GARCH. Covariance and spectral representation of time series. Fourier and periodogram analyses. Predictions. CLT for mixing processes. Estimation and distribution theory. Long range dependence.

STAT 680: Advanced Statistical Computing
(3-0) Cr. 3. F.
Prereq: STAT 543 and STAT 580
Normal approximations to likelihoods. The delta-method and propagation of errors. Topics in the use of the E-M algorithm including; its use in the exponential family, computation of standard errors, acceleration. Resampling methods: brief theory and application of the jackknife and the bootstrap. Randomization tests. Stochastic simulation: Markov Chain, Monte Carlo, Gibbs' sampling, Hastings-Metropolis algorithms, critical slowing-down and remedies, auxiliary variables, simulated tempering, reversible-jump MCMC and multi-grid methods.

STAT 690: Advanced Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690A: Advanced Special Topics: Theory
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690B: Advanced Special Topics: Methods
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690C: Advanced Special Topics: Design of Experiments
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690D: Advanced Special Topics: Sample Surveys
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690E: Advanced Special Topics: Statistical Computing
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690F: Advanced Special Topics: Graphics
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 699: Research
Cr. arr. Repeatable.

Supply Chain Management (SCM)

Courses primarily for undergraduates:

SCM 301: Supply Chain Management
(3-0) Cr. 3.
Prereq: ECON 101 and STAT 226
Various supply chain activities and integration of supply chain management with supply and demand, both within and between firms. Exposure to a wide range of supply chain management terminology, analytical tools, and theories related to four key elements of supply chain management: purchasing, operations, distribution, and integration. Specific topics include strategic sourcing, supply management, demand forecasting, resource planning, inventory management, process management, logistics, location analysis, process integration, and performance measurement.

SCM 340: Project Management
(Cross-listed with MIS). (3-0) Cr. 3.
Prereq: credit or enrollment in MIS 301
Equips students to support team activities in the general project management environment and better manage their careers. Practical experience using project management techniques and tools. Course topics include project initiation and execution, risk assessment, estimating and contracts, planning, human factors, and standard methods.

SCM 424: Process Management, Analysis, and Improvement
(3-0) Cr. 3.
Prereq: SCM 301
The design, analysis, and management of production processes to improve performance. Performance measures and their relationships; process design and evaluation; and managerial levers for improving and controlling process performance.

SCM 428: Special Topics in Operations Management
(3-0) Cr. 3.
Prereq: SCM 301
In-depth analysis of current issues, problems, and systems in operations management with emphasis on new theoretical and methodological developments. Topics may include in different semesters, supply chain management, productivity and quality improvement, management of technology and innovation, information technology in operations management, quick response manufacturing, and service operations management.

SCM 440: Supply Chain Information Systems
(Cross-listed with MIS). (3-0) Cr. 3.
Prereq: MIS 301, SCM 301
Internal and inter-organizational information systems necessary for a supply chain to achieve competitive advantage. Topics include: design, development, implementation, and maintenance of supply chain information systems; enterprise resource planning; advanced planning and scheduling, manufacturing execution systems; and the interface between manufacturing planning and control processes, logistics processes, and the information system.

SCM 450: Enterprise Resource Planning Systems in Supply Chain
(Cross-listed with MIS). (3-0) Cr. 3.
Prereq: SCM 301, MIS 301 or I E 148, I E 341
Examination of the role of enterprise resource planning systems (ERP) in the supply chain. Hands-on experience with a major software application in use by many corporations to manage and improve the efficiency of their supply chains and operations. Students will develop a more process-centric perspective about how a supply chain operates and how ERP enables and supports such operations.

SCM 453: Supply Chain Planning and Control
(3-0) Cr. 3. F.
Prereq: SCM 301
Supply chain planning and control is the process which synchronizes demand with manufacturing and distribution. This course will cover sales and operations planning with emphasis on forecasting, master scheduling, materials requirements planning, inventory management and demand planning. Linking business plans and information systems for integration and distribution channels are also covered.

SCM 460: Decision Tools for Logistics and Operations Management
(3-0) Cr. 3.
Prereq: SCM 301
Technical tools and skills required for problem solving and decision making in logistics and operations management. Transportation and network planning, inventory decision making, facility location planning, vehicle routing, scheduling, and production planning. Quantitative tools include linear and integer programming, non-linear programming, and simulation. Emphasis on the use of PC-based spreadsheet programs.

SCM 461: Principles of Transportation
(3-0) Cr. 3.
Prereq: SCM 301
Economic, operating, and service characteristics of the various modes of transportation, with a special emphasis on freight transportation. Factors that influence transport demand, costs, market structures, carrier pricing, and carrier operating and service characteristics and their influence on other supply chain costs and supply chain performance.

SCM 462: Transportation Carrier Management
(3-0) Cr. 3.
Prereq: Credit or enrollment in SCM 461
Analysis of transport users' requirements. Carrier management problems involving ownership and mergers, routes, competition, labor, and other decision areas.

SCM 466: Global Trade Management
(3-0) Cr. 3. F.S.
Prereq: SCM 301
Logistics systems and legal framework for the international movement of goods. Operational characteristics of providers of exporting and importing services. The effects of government trade policies on global logistics.

SCM 486: Principles of Purchasing and Supply Management
(3-0) Cr. 3.
Prereq: SCM 301
Sourcing strategies, concepts, tools and dynamics in the context of the integrated supply chain. Make or buy decision, supplier evaluation and selection, global sourcing, the total cost of ownership, contracts and legal terms, negotiation, purchasing ethics, and information systems requirements.

SCM 487: Strategic Supply Chain Management
(3-0) Cr. 3.
Prereq: SCM 460 or SCM 422 or SCM 424; SCM 485 or SCM 486
Capstone course in supply chain management. Integrating and applying the theories, concepts, and methods covered in the prerequisite courses through the use of readings, case studies, projects, and industry speakers.

SCM 490: Independent Study
Cr. 1-3. Repeatable.
Prereq: SCM 301, senior classification, permission of instructor

SCM 491: International Live Case and Study Tour
Cr. 3. S.
Prereq: SCM 301
Students follow supply chain of major firm from overseas manufacturer to domestic point-of-sale. Students are expected to complete projects and present findings to senior leadership.

SCM 495: Case Practicum
(3-0) Cr. 3. Repeatable, maximum of 2 times. F.S.
Prereq: SCM 301
Students explore different practical scenarios related supply chain projects and cases. Students acquire necessary skills and knowledge to solve practical issues associated with presented cases and problems. Students compete at different venues around the country.

Courses primarily for graduate students, open to qualified undergraduates:

SCM 501: Supply Chain Management
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission
Introduction to supply chain management including aspects of operations, logistics and global supply chain strategy development. Topic areas include lean manufacturing and value stream mapping; supplier development and measurement; sustainable supply chain operations; process measurement, management and improvement; supply chain risk and uncertainty; visibility and integration in the supply chain; and inventory control.

SCM 520: Decision Models for Supply Chain Management
(3-0) Cr. 3.
Prereq: SCM 501 or permission of instructor
The application of decision models for supply chain management. Topics include business applications of decision theory, inventory theory, business forecasting, optimization models, transportation and network models, routing problems, and project management.

SCM 524: Strategic Process Analysis and Improvement
(3-0) Cr. 3.
Prereq: SCM 501 or permission of instructor
Analysis, management, and improvement of the business processes used to produce and deliver products and services that satisfy customer needs. Process attributes that managers can control to influence the key operational performance measures of throughput time, inventory, cost, quality, and flexibility are discussed. Topics such as theory of constraints, lean production, and six sigma are included.

SCM 560: Strategic Logistics Management
(3-0) Cr. 3.
Prereq: SCM 501 or permission of instructor
Positions logistics vis-a-vis supply chain management (SCM). Presents different perspectives on SCM vs. logistics. Describes primary logistics functions: transportation, warehousing, facility location, customer service, order processing, inventory management and packaging. Benefits of and obstacles to the integration of these functions.

SCM 561: Transportation Management and Policy
(3-0) Cr. 3.
Prereq: SCM 501 or permission of instructor
Analysis of contemporary issues and strategies in transportation management and policy. Emphasis on evaluation of the impacts of transportation policies, new technologies, and strategic carrier and shipper management practices on the freight transportation industry and logistics systems.

SCM 563: Purchasing and Supply Management
(3-0) Cr. 3.
Prereq: SCM 501 or permission of instructor
Mechanics, procedures and tools used in purchasing. Recruiting, selecting, developing and managing supply chain partners in order to achieve competitive advantage via superior supply chain management. Factors and information needs for making supply management decisions.

SCM 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
For students who wish to do individual research in a particular area of supply chain management.

Courses for graduate students:

SCM 601: Theoretical Foundations of Supply Chain Management
(3-0) Cr. 3.
Prereq: MGMT 601 or permission of instructor
An overview of the development of supply chain management (SCM) theory, including review of seminal articles in logistics, operations, and purchasing management and theories from allied disciplines (e.g., economics, marketing, sociology, strategic management). Analysis of trends in SCM research topics and methodologies. Identification of emerging and future areas for research and theory development.

SCM 602: Seminar in Supply Chain Strategy
(3-0) Cr. 3.
Prereq: SCM 601 or concurrent enrollment
Review of research literature on supply chain strategy, including the impact of technology, global economic and social factors, and intra- and inter-organizational integration on supply chain strategy formation. The role of SCM in overall corporate strategy and the impact of SCM on firm performance will also be addressed.

SCM 603: Seminar in Purchasing
(3-0) Cr. 3.
Prereq: SCM 601 or concurrent enrollment
Review of classic purchasing theories. Discussion of contemporary supply management strategy; the role of supply management and its relationship with other functional areas; its impact on logistics and transportation issues; management of supply uncertainties.

SCM 604: Seminar in Logistics Management
(3-0) Cr. 3.
Prereq: SCM 601 or concurrent enrollment
Integration of network, economic, and systems theory in the design, management, and control of logistics systems in the context of integrated supply chain management. Functional areas addressed include transportation, inventory order fulfillment, distribution, and warehousing. Facility location analysis will also be covered.

SCM 605: Seminar in Operations Management
(3-0) Cr. 3.
Prereq: SCM 601 or concurrent enrollment
Review of the research literature on methods of organizing, planning, controlling, and improving manufacturing systems to achieve the desired performance objectives related to cost, quality, speed, and flexibility. The relationship between the performance of the manufacturing system and the performance of the supply chain system will also be discussed.

SCM 650: Research Practicum I
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a research manuscript to be submitted to a peer-reviewed academic journal. Students will work with a faculty mentor on a research project.

SCM 651: Research Practicum II
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a second research manuscript to be submitted to a peer-reviewed academic journal. Although students work under the supervision of a faculty mentor, the students will take independent responsibility for the research project.

SCM 699: Dissertation
Cr. 12.
Prereq: Graduate classification, permission of dissertation supervisor
Research.

Sustainable Agriculture (SUSAG)

Courses primarily for graduate students, open to qualified undergraduates:

SUSAG 509: Agroecosystems Analysis
(Cross-listed with AGRON, SOC). (3-4) Cr. 4. F.
Prereq: Senior or above classification
Experiential, interdisciplinary examination of Midwestern agricultural and food systems, emphasizing field visits, with some classroom activities. Focus on understanding multiple elements, perspectives (agronomic, economic, ecological, social, etc), and scales of operation.

SUSAG 515: Integrated Crop and Livestock Production Systems
(Cross-listed with A B E, AGRON, AN S). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: SUSAG 509
Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms.

SUSAG 530: Ecologically Based Pest Management Strategies
(Cross-listed with AGRON, ENT, PL P). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes.

SUSAG 546: Strategies for Diversified Food and Farming Systems
(Cross-listed with AGRON, HORT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: SUSAG 509
Project-focused engagement in food and farming systems using tools and perspectives drawn from multiple disciplines. Includes a field component.

SUSAG 571: Agroforestry Systems
(Cross-listed with NREM). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 6 credits in biological science at 300-level or above
Concepts of sustainable land use, agroecological dynamics, and component interactions of agroforestry systems. Agroforestry systems in temperate and tropical regions. Design and evaluation techniques for agroforestry systems. Ecological, socioeconomic and political aspects of agroforestry.
Meets International Perspectives Requirement.

SUSAG 584: Organic Agricultural Theory and Practice
(Cross-listed with AGRON, HORT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 9 cr. in biological or physical sciences
Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives.

SUSAG 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification, permission of instructor
For students wishing to conduct in-depth study of a particular topic in sustainable agriculture.

SUSAG 599: Creative Component
Cr. arr. F.S.SS.
Pre-enrollment contract required. For MS students pursuing the non-thesis degree option. Final product is a creative component.

Courses for graduate students:

SUSAG 600: Sustainable Agriculture Colloquium
(1-0) Cr. 1. Repeatable. F.S.
Weekly seminar for graduate students in the Sustainable Agriculture program.

SUSAG 610: Foundations of Sustainable Agriculture
(Cross-listed with A B E, AGRON, ANTHR, SOC). (3-0) Cr. 3. F.
Prereq: Graduate classification, permission of instructor
Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts.

SUSAG 699: Research
Cr. arr. Repeatable. F.S.SS.
MS and PhD thesis and dissertation research.

Sustainable Environments (SUS E)

Courses primarily for graduate students, open to qualified undergraduates:

SUS E 501: Sustainable Design Studio I
(0-10) Cr. 5.
Prereq: SUS E 521
Addressing sustainable design at multiple scales of constructed and natural systems and artifacts, this studio engages multidisciplinary graduate students in a team-oriented, project-based learning environment. Faculty-directed projects will include theoretical investigations and applications of an interdisciplinary design process through brief readings and discussions.

SUS E 502: Sustainable Design Studio II
(0-10) Cr. 5.
Prereq: SUS E 501, SUS E 512, SUS E 531
This advanced studio provides a community-based context for an interdisciplinary design team to work on a variety of faculty-directed projects including funded, basic, and applied research. Coursework addresses sustainable design at multiple scales, engaging both systems and artifacts. Field trips.

SUS E 511: Sustainable Design Colloquium I

(3-0) Cr. 3.

Prereq: Admission to MDSE program

Study and discuss practices of sustainable design and design research. Investigate responsibilities, roles, technologies and methods for studying and advancing the art and science of designing sustainable environments.

SUS E 512: Sustainable Design Colloquium II

(1-0) Cr. 1.

Prereq: SUS E 511

A graduate student-led seminar designed to foster the knowledge and skills to support innovation, entrepreneurship, and leadership in the field of sustainable design. Invitation of outside speakers.

SUS E 521: Foundation of Sustainable Design

(3-0) Cr. 3.

Prereq: Graduate standing or senior classification with instructor permission.

Introduction to the broad frameworks and tools for implementing sustainability among a variety of environments, industries, and enterprises. Investigates the role and opportunity for sustainable design strategies.

SUS E 531: Human Dimensions of Sustainability

(3-0) Cr. 3.

Prereq: Graduate standing or senior classification with instructor permission.

This seminar provides students from multiple disciplines with a grounding in designers' interactions with clients, consumers, communities, cultures, and biospheres. Through a review of literature and the production of new case studies in sustainable design, students discover and represent conditions in which products of design operate across scales, markets, social conditions, geographic domains, academic disciplines, and zones of professional responsibility.

SUS E 540: Methods for Sustainable Design

(3-0) Cr. 3. S.

Prereq: senior or graduate standing.

Overview of qualitative, quantitative and design research methods. In-depth application of methods relevant to capstone project proposal development (SUS E 502). Proposal must address research questions, articulation of research methods and preliminary findings grounded within contemporary theoretical discourse on Sustainable Environments.

SUS E 550: Making Resilient Environments

(3-0) Cr. 3. S.

Prereq: senior or graduate standing.

Major theories and ideas revolving around the concept of resilience. Assessing the social and political processes associated with policy making for resilience. Application of the concept of resilience in order to understand and evaluate environments. Evaluate the different approaches toward resilience and develop an understanding of the relationship between sustainability and resilience. Case studies of communities that proactively prepare for, absorb, recorver from, and adapt to actual or potential future adverse events.

Technology Systems Management (TSM)

Courses primarily for undergraduates:

TSM 110: Introduction to Technology

(1-0) Cr. 1. F.

Prereq: AST or I Tec majors only or permission of instructor

Team-oriented introduction to agricultural systems technology and industrial technology. Internships, careers, competencies, academic success strategies, transition to academic life.

TSM 111: Experiencing Technology

(0-2) Cr. 1. S.

Prereq: AST or I Tec majors only or permission of instructor

Laboratory-based, team-oriented experiences in a spectrum of topics common to the practice of technology. Internships, competencies, industry visits.

TSM 115: Solving Technology Problems

(2-2) Cr. 3. F.S.

Prereq: Credit or enrollment for credit in MATH 140 or higher

Solving technology problems and presenting solutions through data analysis and technical report writing. Problem solving cycle, unit conversion, unit factor method, SI units, significant digits, graphing, curve fitting and computer programming. Use of modern hardware and software tools for applied data-driven problem solving.

TSM 116: Introduction to Design in Technology

(2-2) Cr. 3. F.S.

Use of parametric solid modeling software to create three dimensional solid models and document parts and assemblies. Includes national and international standards for documentation, design projects, and teamwork. Rapid prototyping design creation, 3D printing, assemblies, rendering, and detailing technical drawings.

TSM 201: Preparing for Workplace Seminar
(Cross-listed with A B E). (1-0) Cr. 1. F.S.
Prereq: Prereq: Sophomore classification in AE, AST, BSE, or I TEC
8 week course. Professionalism in the context of the engineering/technical workplace. Development and demonstration of key workplace competencies: teamwork, initiative, communication, and engineering/technical knowledge. Resumes; Cover Letters; Behavioral Based Interviewing; Industry Speakers; Preparation for internships experiences.

TSM 210: Fundamentals of Technology
(3-0) Cr. 3. F.S.
Prereq: TSM 115 or equivalent; and MATH 140 or higher
Introduction to problem solving related to fundamental agricultural and/or industrial technology systems and mathematical tools needed for data analysis. Basic laws of energy, force, and mass applied to technology systems such as: mechanical power transmission; heating, ventilation and air conditioning; electrical circuits. Introduction to engineering economics: using the time value of money to make economic decisions.

TSM 214: Managing Technology Projects
(2-0) Cr. 1. F.S.
Prereq: TSM 201 or A B E 201; and sophomore classification in A E, AST, BSE, or ITEC.
8 week course. Introduction to project management principles. Use of project management in technology-based projects for academic, industry, and personal use.

TSM 216: Advanced Technical Graphics, Interpretation, and CAD
(1-2) Cr. 2. F.S.
Prereq: TSM 116
Advanced computer-aided-design topics incorporating 3D design and documentation used in manufacturing settings. Topics include: geometric dimensioning and tolerancing, weldments, sheet metal parts, advanced visualization, feature based design of parts and assemblies.

TSM 240: Introduction to Manufacturing Processes
(1-4) Cr. 3. F.S.
A study of selected materials and related processes used in manufacturing. Lecture and laboratory activities focus on materials, properties, and processes. This includes plastics and metals.

TSM 270: Principles of Injury Prevention
(3-0) Cr. 3. F.
Basic foundations of injury causation and prevention in home, motor vehicle, public, and work environments. Offered online only.

TSM 310: Total Quality Improvement
(3-0) Cr. 3. S.
Prereq: STAT 101 or STAT 104, junior classification
Introduction to the fundamental concepts of TQM - Deming style of management, statistical studies to understand the behavior of products, processes, or services, and how to define and document processes and customer focus. Introduction to continuous improvement tools and methods - emphasis on team work and problem solving skills.

TSM 322: Preservation of Grain Quality
(2-0) Cr. 2. S.
Prereq: MATH 140 or higher
Principles and management for grain quality preservation. Quality measurement. Drying and storage. Fans and airflow through grain. Handling methods.

TSM 322L: Preservation of Grain Quality Laboratory
(0-3) Cr. 1. S.
Prereq: Credit or enrollment for credit in TSM 322
Hands-on experiences in the principles and management for grain quality preservation. Quality measurement. Drying and storage. Fans and airflow through grain. Handling methods. System planning. Industry tour.

TSM 324: Soil and Water Conservation Management
(2-2) Cr. 3. S.
Prereq: MATH 140 or MATH 151
Introduction to engineering and conservation principles applied to the planning of erosion control systems, water control structures, water quality management, and drainage and irrigation systems.

TSM 325: Biorenewable Systems
(Cross-listed with A B E). (3-0) Cr. 3. F.
Prereq: ECON 101; CHEM 163 or higher; and MATH 140 or higher
Converting biorenewable resources into bioenergy and biobased products. Biorenewable concepts as they relate to drivers of change, feedstock production, processes, products, co-products, economics, and transportation/logistics.

TSM 327: Animal Production Systems
(3-0) Cr. 3. F.
Prereq: TSM 210
Confined animal feeding operations. Environmental controls for animal production. Response of animals to the environment. Heat and moisture balance in animal housing. Ventilation, water, feed handling, air pollution, odor and waste management systems.

TSM 330: Agricultural Machinery and Power Management
(2-3) Cr. 3. S.
Prereq: MATH 145 or MATH 151; and TSM 210
Selection, sizing, and operational principles of tractors and machinery systems. Cost analysis and computer techniques applied to planning and management of agricultural machine systems. Principles, operation, and application of agricultural machinery.

TSM 335: Tractor Power
(3-3) Cr. 4. F.
Prereq: TSM 210, MATH 145
Theory and construction of tractor engines, mechanical power trains and hydraulic systems. Introduction to traction, chassis mechanics, and hydraulic power.

TSM 337: Fluid Power Systems Technology
(2-2) Cr. 3. S.
Prereq: TSM 210
Fundamental fluid power principles. Fluid properties. Function and performance of components such as pumps, valves, actuators, hydrostatic transmission. Analysis of fluid power circuits and systems. Introduction to electrohydraulics. Course includes lab using fluid power trainers.

TSM 340: Advanced Automated Manufacturing Processes
(2-2) Cr. 3. F.
Prereq: TSM 216, TSM 240, MATH 151
NC programming operations for CNC mills and lathes. Transfer of parts descriptions into detailed process plans, tool selection, and NC codes. Computer assisted CAD/CAM NC programming for 2D/3D machining and machining of student programmed NC code in lab.

TSM 363: Electric Power and Electronics for Agriculture and Industry
(3-3) Cr. 4. F.
Prereq: TSM 210
Basic electricity. Electrical safety, wiring, 3-phase service, controls, and motors for agricultural and industrial applications. Planning building lighting and electrical systems. Electronics to sense, monitor, and control mechanical processes.

TSM 370: Occupational Safety
(3-0) Cr. 3. S.
Prereq: TSM 270, junior standing
Identifies safety and health risks in industrial work environments. Focus on how managers and supervisors meet their responsibilities for providing a safe workplace for their employees. Includes the identification and remediation of workplace hazards.

TSM 371: Occupational Safety Management
(2-0) Cr. 2. S.
Introduction to occupational safety and health administration and management. Focus on development and management of safety programs and obtaining employee involvement in occupational safety programs.

TSM 372: Legal Aspects of Occupational Safety and Health
(2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: TSM 371
A review of the common legal issues facing safety practitioners in the workplace. Includes OSHA, EPA and DOT regulations; workers' compensation, as well as common liability issues.

TSM 376: Fire Protection and Prevention
(3-0) Cr. 3. Alt. F., offered even-numbered years.
An overview of the current problems and technology in the fields of fire protection and fire prevention, with emphasis on industrial needs, focusing on the individual with industrial safety responsibilities.

TSM 393: Topics in Technology
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393A: Topics in Technology: Agriculture and Biosystems Management
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393B: Topics in Technology: Machine Systems
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393C: Topics in Technology: Manufacturing
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393D: Topics in Technology: Occupational Safety
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393E: Topics in Technology: Chemical Application Systems
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393F: Topics in Technology: Agricultural Safety and Health
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393G: Topics in Technology: Electronic Integration for Agriculture and Production Systems
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393I: Topics in Technology: Irrigation Systems Management
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393J: Topics in Technology: Machinery Management Using Precision Agriculture Technology
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 397: Internship in Technology
Cr. R. Repeatable. F.S.SS.
Prereq: At least 45 credits of coursework, AST or I Tec major, and approval of internship coordinator
A supervised work experience in an approved learning setting with application to technology practices and principles. Reporting during work experience and self and employer evaluation required. Minimum GPA requirement.

TSM 399: Work Experience in Technology
Cr. 2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: TSM 397 in the preceding semester and approval of internship coordinator
Written reports and reflection on work experience. A maximum of 4 credits of TSM 399 maybe be used toward the total credits required for graduation.

TSM 408: Interdisciplinary Problem Solving
(3-0) Cr. 3.
Prereq: Junior or senior classification
Use of the Theory of Constraints as a way of approaching problem solving, win-win negotiation, project planning and effective delegation in the context of engineering/business systems. Team projects aimed at improving design outcomes.

TSM 409: Interdisciplinary Systems Effectiveness
(3-0) Cr. 3.
Prereq: Junior or senior classification
Focus on functions that determine the effectiveness of an entire organization. Generic Theory of Constraints solutions to production, distribution, and project management are compared to traditional solutions. Strategy for improvements discovered using simulations.

TSM 415: Applied Project Management in Technology
(2-0) Cr. 2. F.S.
Prereq: Senior classification with less than 32 credits remaining; TSM 214; and credit or enrollment for credit in TSM 310.
Implementation of project management principles using case studies and teamwork; problem definition in a technology context; development of charter for technology capstone project.

TSM 416: Technology Capstone
(1-4) Cr. 3. F.S.
Prereq: TSM 415 in previous semester
Application of project management tools to a technology capstone project; development and evaluation of potential project solutions using tools from the technology curriculum; problem resolution emphasizing communication, critical analysis, and planning techniques; presentation of project through oral presentation and written reports with input from client, faculty, and other stakeholders.

TSM 433: Precision Agriculture
(Dual-listed with TSM 533). (2-2) Cr. 3. F.
Prereq: MATH 140 or higher
Geographic information systems (GIS) and global positioning systems (GPS). Hardware systems for precision farming emphasized. Autosteering and automatic implement control systems. Collection and management of yield data. Sampling strategies for precision farming. Introduction to building fertilizer prescriptions and recommendations. Economic benefits of precision farming systems.

TSM 440: Cellular Lean Manufacturing Systems
(2-2) Cr. 3. F.
Prereq: TSM 310
Introduction to lean tools and techniques that reduce costs and improve business performance: JIT, VSM, SMED, Kaizen, Standard Work, Cycle Time Reduction, Takt Time, A3, etc. Emphasis on lean thinking and competency development through application: simulations, case studies, industry guests and mentors, teamwork and industry-related lean projects.

TSM 443: Statics and Strength of Materials for Technology
(2-2) Cr. 3. S.
Prereq: PHYS 111; and MATH 145 or MATH 151
Application of standard analytic and computer based techniques of solving problems related to force and moments. The properties of materials and how to select appropriate materials for a particular design is reviewed.

TSM 444: Facility Planning
(3-0) Cr. 3. F.
Prereq: TSM 216; TSM 240; and STAT 101 or STAT 104
Fundamental principles and practices in designing, evaluating, and organizing new or existing facilities. Emphasis on CAD-based facility design, production flow analysis, activity relationship analysis, materials handling, office layout, supporting services design, and facility cost analysis.

TSM 465: Automation Systems
(2-2) Cr. 3. S.
Prereq: TSM 363
Theory and applications of automation systems. Emphasizes features, capabilities, design and programming skills of Programmable Logic Controller (PLC) based industrial control systems. Introduction to industrial robots and sensors.

TSM 470: Industrial Hygiene: Physical, Chemical, and Biological Hazards
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 151 or higher
A qualitative and quantitative introduction to health effects of chemical, biological, and physical hazards in a workplace.

TSM 471: Safety Laboratory
(0-2) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: Credit or enrollment for credit in TSM 470
Introduction to equipment, methods, and strategies to measure, evaluate, control, and research hazards and risk in the workplaces.

TSM 477: Risk Analysis and Management
(Dual-listed with TSM 577). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 151; and STAT 101 or STAT 104
Risk analysis and management focuses on developing a risk oriented pattern of thinking that is appropriate for today's complex world. The tools that will be gained in this course will be helpful in recognizing, understanding, and analyzing hazards and risks in modern complex systems.

TSM 490: Independent Study
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490H: Independent Study: Honors
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490I: Independent Study: Manufacturing
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490J: Independent Study: Agriculture and Biosystems Management
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490M: Independent Study: Machine Systems
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490O: Independent Study: Occupational Safety
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 493: Workshop in Technology
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 493A: Workshop in Technology: Agriculture and Biosystems Management
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 493B: Workshop in Technology: Machine Systems
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 493C: Workshop in Technology: Manufacturing
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 493D: Workshop in Technology: Occupational Safety
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 495: Agricultural and Biosystems Engineering Department Study Abroad Preparation or Follow-up
(Cross-listed with A B E). Cr. 1-2. Repeatable. F.S.SS.
Prereq: Permission of instructor
Preparation for, or follow-up of, study abroad experience (496). For preparation, course focuses on understanding the tour destination through readings, discussions, and research on topics such as the regional industries, climate, crops, culture, economics, food, geography, government, history, natural resources, and public policies. For follow-up, course focuses on presentations by students, report writing, and reflection. Students enrolled in this course intend to register for 496 the following term or have had taken 496 the previous term.
Meets International Perspectives Requirement.

TSM 496: Agricultural and Biosystems Engineering Department Study Abroad
(Cross-listed with A B E). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
Tour and study at international sites relevant to disciplines of industrial technology, biological systems engineering, agricultural systems technology, and agricultural engineering. Location and duration of tours will vary. Trip expenses paid by students. Pre-trip preparation and/or post-trip reflection and reports arranged through 495.
Meets International Perspectives Requirement.

Courses primarily for graduate students, open to qualified undergraduates:

TSM 533: Precision Agriculture
(Dual-listed with TSM 433). (2-2) Cr. 3. F.
Prereq: MATH 140 or higher
Geographic information systems (GIS) and global positioning systems (GPS). Hardware systems for precision farming emphasized. Autosteering and automatic implement control systems. Collection and management of yield data. Sampling strategies for precision farming. Introduction to building fertilizer prescriptions and recommendations. Economic benefits of precision farming systems.

TSM 540: Advanced Design and Manufacturing
(3-0) Cr. 3. S.
Prereq: Permission of instructor
Application of six sigma philosophy to advance product design and process control. Application of value steam mapping to the existing manufacturing system to develop future continuous improvement plans. Application of Taguchi Parameter design methodologies for optimizing the performance of manufacturing processes. Application of Taguchi Tolerance Design methodologies for product design.

TSM 575: Safety and Public Health Issues in Modern Society
(2-0) Cr. 2. Repeatable, maximum of 2 times.
Exploration and analysis of current safety and public health issues impacting society. The focus will be on topics that impact individuals in work, public, and home environments.

TSM 577: Risk Analysis and Management
(Dual-listed with TSM 477). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 151; and STAT 101 or STAT 104
Risk analysis and management focuses on developing a risk oriented pattern of thinking that is appropriate for today's complex world. The tools that will be gained in this course will be helpful in recognizing, understanding, and analyzing hazards and risks in modern complex systems.

TSM 590: Special Topics in Technology
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 590A: Special Topics in Technology: Agriculture and Biosystems Management
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 590B: Special Topics in Technology: Machine Systems
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 590C: Special Topics in Technology: Manufacturing
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 590D: Special Topics in Technology: Occupational Safety
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 593: Workshop in Technology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

TSM 598: Technical Communications for a Master's Degree
(Cross-listed with A B E). Cr. 1. F.S.SS.
A technical paper draft based on the M.S. thesis or creative component is required of all master's students. This paper must be in a form that satisfies the requirements of some specific journal and be ready for submission. A technical presentation based on M.S. thesis or creative component is required of all master's students. This presentation must be in a form that satisfies the normal presentation requirements of a professional society. The presentation itself (oral or poster) may be made at a professional society meeting or at any international, regional, state, or university conference/event as long as the presentation content and form conforms to normal expectations. Offered on a satisfactory-fail basis only.

TSM 599: Creative Component
Cr. 1-3. Repeatable, maximum of 6 credits.
A discipline-related problem to be identified and completed under the direction of the program adviser. Three credits required for all nonthesis master's degree students.

Courses for graduate students:

TSM 601: Graduate Seminar
(Cross-listed with A B E). (1-0) Cr. 1. F.
Keys to starting a good MS thesis or PhD dissertation project. Learning how to begin formulating research questions. Review of literature, research hypotheses, objectives, methods, making figures and tables, and discussing results. Discussion of appropriate outlets including peer-reviewed journals, patents and intellectual property rights, responsible conduct, plagiarism, authorship, and reproducible research. Using peer review, conducting a peer review, and responding to feedback. Other topics may include on-campus library resources, data management, and time management.

TSM 652: Program and Learner Evaluation
(3-0) Cr. 3.
Prereq: STAT 401 or equivalent
Techniques for evaluating learners, facilities, programs, and staff utilizing theories for developing measurement instruments. Outcomes assessment is emphasized.

TSM 655: Academic Leadership in Technology and Engineering
(3-0) Cr. 3.
Prereq: Permission of instructor
A definition of the faculty role in technology and engineering disciplines, including strategies for dealing with programs, personnel, and constituencies are presented. Leadership skills involving team formation, team operation, and conflict resolution are addressed.

TSM 657: Curriculum Development in Technology and Engineering
(3-0) Cr. 3.
Prereq: Permission of instructor
Basic concepts, trends, practices, and factors influencing curriculum development, techniques, organization and procedures. Emphasis will be given to course development using the backward design process.

TSM 694: Teaching Practicum
(Cross-listed with A B E). Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and permission of instructor
Graduate student experience in the agricultural and biosystems engineering departmental teaching program.

TSM 697: Internship in Technology
Cr. R.
Prereq: permission of major professor and approval by department chair, graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

TSM 698: Technical Communications for a Doctoral Degree
(Cross-listed with A B E). Cr. 1. F.S.SS.
A technical paper draft based on the dissertation is required of all Ph.D. students. This paper must be in a form that satisfies the requirements of some specific journal and be ready for submission. A technical presentation based on the dissertation is required of all Ph.D. students. This presentation must be in a form that satisfies the normal presentation requirements of a professional society. The presentation itself (oral or poster) may be made at a professional society meeting or at any international, regional, state, or university conference/event as long as the presentation content and form conforms to normal expectations. Offered on a satisfactory-fail basis only.

TSM 699: Research
Cr. arr.

Technology and Social Change (T SC)

Courses primarily for undergraduates:

T SC 220: Globalization and Sustainability
(Cross-listed with ANTHR, ENV S, GLOBE, M E, MAT E, SOC). (3-0) Cr. 3. F.S.
An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.
Meets International Perspectives Requirement.

T SC 342: World Food Issues: Past and Present
(Cross-listed with AGRON, ENV S, FS HN). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

T SC 342H: World Food Issues: Past and Present, Honors
(Cross-listed with AGRON, ENV S). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

T SC 343: Philosophy of Technology
(Cross-listed with PHIL). (3-0) Cr. 3. F.S.
Prereq: 6 credits of social science or T SC 341 and 3 credits of social science
Moral and other philosophical problems related to developments in technology. Topics may include conditions under which technological innovations contribute to human emancipation, relationship of technology and democracy, utility and limits of technical rationality, and problems of ensuring that benefits of technological advance are communally shared. Topics discussed with reference to such issues as contemporary developments in microelectronics, technology transfer to the Third World, etc.

Courses primarily for graduate students, open to qualified undergraduates:

T SC 543: Seminar in Social Change and Development
(Cross-listed with SOC). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology
Seminar in social change and development.

T SC 543B: Seminar in Social Change and Development: Sociology of Adoption and Diffusion
(Cross-listed with SOC). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology

T SC 543C: Seminar in Social Change and Development: Technological Innovation, Social Change and Development
(Cross-listed with SOC). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology

Theatre (THTRE)

Courses primarily for undergraduates:

THTRE 106: Introduction to the Performing Arts
(3-0) Cr. 3. F.S.SS.
An audience oriented, broad-based, team-taught survey of the performing arts which emphasizes theatre and includes segments on television, radio, film, dance, and music.

THTRE 110: Theatre and Society
(3-0) Cr. 3. F.S.
An introduction to Theatre focusing on its relationship with society throughout history.

THTRE 151: The Actor's Voice
(3-0) Cr. 3. F.
Study and practice of fundamentals of vocal production: breathing, quality, articulation, projection, and expressiveness for the performing artist.

THTRE 224: Concert and Theatre Dance
(Cross-listed with DANCE). (0-3) Cr. 0.5-2. Repeatable, maximum of 6 credits. F.S.
Prereq: By audition only
Choreography, rehearsal, and performance in campus dance concerts and/or musical theatre productions. Offered on a satisfactory-fail basis only.

THTRE 250: Theatre Practicum
Cr. 1-2. Repeatable, maximum of 6 credits. F.S.
Prereq: Permission of instructor
Practice in various aspects of technical theatre production. Offered on a satisfactory-fail basis only.

THTRE 251: Acting I
(3-0) Cr. 3. F.S.
Theory and practice in fundamentals of acting.

THTRE 255: Introduction to Theatrical Production
(3-3) Cr. 4. F.S.
Standard structure and procedures, historical overview of performing arts production including the design and creation of scenery, costumes and lighting.

THTRE 263: Script Analysis
(3-0) Cr. 3. F.S.
Theory, analysis, and interpretation of play scripts for production.

THTRE 290: Special Projects
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: 3 credits in theatre; permission of instructor; approval of written proposal

THTRE 316: Creative Writing: Playwriting
(Cross-listed with ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 250, not open to freshmen
Progresses from production of scenes to fully developed one-act plays. Emphasis on action, staging, writing, analytical reading, workshop criticism, and individual conferences.

THTRE 351: Acting II
(3-0) Cr. 3. S.
Prereq: THTRE 251, DANCE 120 recommended
Theory and practice of techniques of acting with emphasis on character and scene analysis.

THTRE 354: Musical Theatre I
(2-2) Cr. 3.
Prereq: THTRE 251 or MUSIC 232 or 3 credits in Dance
Theory, history and practice of musical theatre techniques. Designed to develop the musical theatre performance skills of singers, dancers, and actors.

THTRE 355: Musical Theatre II
(2-2) Cr. 3.
Prereq: THTRE 354
Theory, history and practice of musical theatre techniques. Designed to develop the musical theatre performance skills of singers, dancers, and actors.

THTRE 357: Stage Make-up
(1-2) Cr. 2. F.
Theory and practice of make-up and hair-styling techniques for the performing arts: Theatre, Opera, Dance, Television and Film. Lab required.

THTRE 358: Oral Interpretation
(3-0) Cr. 3. F.
Principles of oral interpretation: practice in analysis, in reading aloud of literary selections, and in reader's theatre.

THTRE 360: Stagecraft
(3-2) Cr. 4. S.
Prereq: THTRE 255
Tools, materials, and techniques of planning, constructing and painting of performing arts scenography. Basic principles of lighting technology. Technical drawing for performing arts production.

THTRE 365: Theatrical Design I
(2-2) Cr. 3. F.
Prereq: THTRE 255
An exploration of the elements, principles and art of theatrical design.

THTRE 366: Theatrical Design II
(2-2) Cr. 3. S.
Prereq: THTRE 365
Intensive application of the principles introduced in 365. In-depth study and practice of the graphic skills of rendering and drafting.

THTRE 393: Studies in Theatre Design and Production Workshop
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Studies in Theatre Design and Production.

THTRE 393A: Studies in Theatre Design and Production Workshop: Costume Design
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics related to costume design.

THTRE 393B: Studies in Theatre Design and Production Workshop: Scenic Design
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics related to scenic design.

THTRE 393C: Studies in Theatre Design and Production Workshop: Lighting Design
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics in lighting design.

THTRE 393D: Studies in Theatre Design and Production Workshop: Sound Design
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics in sound design.

THTRE 393E: Studies in Theatre Design and Production Workshop: Stagecraft
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics in stagecraft.

THTRE 393F: Studies in Theatre Design and Production Workshop: Costume Draping and Patterning
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics in costume draping and patterning.

THTRE 393G: Studies in Theatre Design and Production Workshop: Advanced Makeup
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics related to advanced makeup.

THTRE 393I: Studies in Theatre Design and Production Workshop: Stage Management
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics related to stage management.

THTRE 393J: Studies in Theatre Design and Production Workshop: Technical Direction
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics related to technical direction.

THTRE 393K: Studies in Theatre Design and Production Workshop: Arts Management
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics related to Arts Management.

THTRE 451: Acting III
(3-0) Cr. 3. F.
Prereq: THTRE 351 and permission of instructor
Analysis and practice of period scenes.

THTRE 455: Directing I
(3-0) Cr. 3. F.
Prereq: THTRE 255; THTRE 263; THTRE 251 recommended
Theory, techniques, and practice of directing.

THTRE 456: Directing II
(2-2) Cr. 3. S.
Prereq: THTRE 455
Practical and theoretical experience in directing the stage play.

THTRE 461: Theatrical Design Studio
(3-2) Cr. 4. Repeatable, maximum of 12 credits. F.S.
Prereq: Permission of instructor
Focuses on the art and craft of specific areas of theatrical design. Each semester the student will focus on one or two of the following: scenic, costume, or lighting design.

THTRE 465: History of Theatre I
(3-0) Cr. 3. F.
Prereq: HIST 201 or equivalent
Theatre history from ancient times to 1800.

THTRE 466: History of Theatre II
(3-0) Cr. 3. S.
Prereq: THTRE 465
Theatre history from 1800 to present.

THTRE 469: Advanced Theatre Practicum
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: 9 credits in theatre courses; junior classification
Practicum in production with ISU Theatre, with opportunities for specialization within various areas. Required: Approval of written proposal.

THTRE 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in theatre, approved written proposal, junior classification
Only one independent study enrollment within the department is permitted per semester. No more than 9 credits in Thtre 490 may be counted toward graduation.

THTRE 499: Theatre Internship
Cr. 1-8. Repeatable, maximum of 8 credits. F.S.SS.
Prereq: 18 credits in THTRE, other courses deemed appropriate by faculty adviser; 2nd semester junior or senior standing; minimum GPA of 2.5 and minimum GPA of 3.0 in THTRE courses
Supervised application of theatre in professional settings.

Courses primarily for graduate students, open to qualified undergraduates:

THTRE 504: Seminar
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in theatre
Topics may include the following:.

THTRE 504A: Seminar: Musical Theatre
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in theatre
Topics may include the following:.

THTRE 504B: Seminar: Acting Techniques
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in theatre
Topics may include the following:.

THTRE 504C: Seminar: Acting Styles
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in theatre
Topics may include the following:.

THTRE 504D: Seminar: Design and Technical Theatre
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in theatre
Topics may include the following:.

THTRE 504E: Seminar: Arts Management
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in theatre
Topics may include the following:.

THTRE 590: Special Topics
Cr. 1-4. Repeatable, maximum of 12 credits.
Prereq: Approved written proposal

Toxicology (TOX)

Courses primarily for undergraduates:

TOX 354: General Pharmacology
(Dual-listed with TOX 554). (Cross-listed with B M S). (3-0) Cr. 3. S.
Prereq: B M S 549 and B M S 552; BBMB 404, BBMB 405
General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems.

TOX 401: Principles of Toxicology
(Dual-listed with TOX 501). (3-0) Cr. 3. F.
Prereq: BBMB 404 or equivalent
Principles of toxicology governing entry, fate, and effects of toxicants on living systems. Includes toxicokinetics and foreign compound metabolism relative to toxification or detoxification. Fundamentals of foreign compound effects on metabolism, physiology, and morphology of different cell types, tissues, and organ systems.

TOX 419: Foodborne Hazards
(Cross-listed with FS HN, MICRO). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MICRO 201 or MICRO 302, a course in biochemistry
Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

TOX 420: Food Microbiology
(Cross-listed with FS HN, MICRO). (3-0) Cr. 3.
Prereq: MICRO 201 or MICRO 302
Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications.

TOX 426: Veterinary Toxicology
(Dual-listed with TOX 526). (Cross-listed with VDPAM). (3-0) Cr. 3. S.
Prereq: Third year classification in veterinary medicine
Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials.

TOX 429: Foodborne Toxicants
(Dual-listed with TOX 529). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: A course in biochemistry
Mechanisms of action, metabolism, sources, remediation or detoxification, risk assessment of major foodborne toxicants of current interest, design of HACCP plans for use in food industries targeting foodborne toxicants. Taught online only.

TOX 490: Independent Study
Cr. 1-2. Repeatable. F.S.SS.
Prereq: Permission of instructor is required prior to registration.
Independent study with a faculty mentor. Intended for students enrolled in the Pharmacology and Toxicology minor. Students in the Pharmacology and Toxicology minor may use no more than 9 credits of university-wide 490 credits towards the total of 120 credits required for graduation.

TOX 499: Undergraduate Research
Cr. 1-3. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: Permission of instructor is required prior to registration.
Independent research under faculty guidance. Intended for students enrolled in the Pharmacology and Toxicology minor. Offered on a satisfactory-fail basis only. Students may use no more than 9 credits of university-wide 499 credits towards the total of 120 credits required for graduation.

Courses primarily for graduate students, open to qualified undergraduates:

TOX 501: Principles of Toxicology
(Dual-listed with TOX 401). (3-0) Cr. 3. F.
Prereq: BBMB 404 or equivalent
Principles of toxicology governing entry, fate, and effects of toxicants on living systems. Includes toxicokinetics and foreign compound metabolism relative to toxification or detoxification. Fundamentals of foreign compound effects on metabolism, physiology, and morphology of different cell types, tissues, and organ systems.

TOX 502: Toxicology Methods
(0-6) Cr. 3. Alt. S., offered even-numbered years.
Prereq: TOX 501
Provides demonstrations or laboratory experience in the application of methods used in toxicology, including safety procedures, calculation and data analysis, teratologic and morphologic evaluation, cellular/molecular toxicological techniques, electrophysiologic measures, in vitro enzyme induction/biotransformation, neural and behavioral toxicology testing.

TOX 504: Toxicology Seminar
(1-0) Cr. 1. Repeatable, maximum of 2 credits. F.S.SS.
Prereq: Permission of instructor required
Presentation of a seminar about a current topic in toxicology as part of a weekly series of seminars by graduate students, faculty, and guest lecturers from off campus. Graduate student speakers will meet with the instructor at least one week prior to their formal presentation.

TOX 506: Diet and Cancer Prevention
(Cross-listed with NUTRS). (1-0) Cr. 1. Alt. F., offered even-numbered years.
Prereq: BBMB 404 and BBMB 405 or BBMB 420
Principles of cancer biology and cancer etiology will be integrated with the impacts of diet on cancer development and prevention. Contributions of research with humans, animals, cultured cells and cell free systems will be included. The importance of dietary contaminants, macronutrients and micronutrients will be examined with an emphasis on the strength of the evidence and mechanisms of action.

TOX 515: Regulatory Toxicology
(1-0) Cr. 1. Alt. F., offered even-numbered years.
Prereq: BBMB 404 or FSHN 403
Survey of approaches used by toxicologists in government and industry for generating, enforcing and complying with laws and regulations. Regulatory policies and decision making. Toxicological risk assessment and risk analysis. Taught online only.

TOX 519: Food Toxicology
(Cross-listed with FS HN, NUTRS). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A course in biochemistry
Basic principles of toxicology. Toxicants in the food supply: modes of action, toxicant defense systems, toxicant and nutrient interactions, risk assessment. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

TOX 526: Veterinary Toxicology
(Dual-listed with TOX 426). (Cross-listed with VDPAM). (3-0) Cr. 3. S.
Prereq: Third year classification in veterinary medicine
Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials.

TOX 529: Foodborne Toxicants
(Cross-listed with FS HN). (2-0) Cr. 2. F.
Prereq: A course in biochemistry; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Mechanisms of action, metabolism, sources, remediation/detoxification, risk assessment of major foodborne toxicants of current interest, design of HAACP plans for use in food industries targeting foodborne toxicants, discussion of toxicants from a food defense perspective. Offered online only.

TOX 546: Clinical and Diagnostic Toxicology
(Cross-listed with VDPAM). (0-3) Cr. 1-3. Repeatable. F.S.SS.
Prereq: D.V.M. degree or VDPAM 526
Advanced study of current problems and issues in toxicology. Emphasis on problem solving utilizing clinical, epidemiological, and laboratory resources.

TOX 550: Pesticides in the Environment
(Cross-listed with ENT). (2-0) Cr. 2. S.
Prereq: 9 credits of biological sciences
Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere.

TOX 554: General Pharmacology
(Dual-listed with TOX 354). (Cross-listed with B M S). (3-0) Cr. 3. S.
Prereq: B M S 549 and B M S 552; BBMB 404, BBMB 405
General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems.

TOX 565: Methods in Biostatistics and Epidemiology
(Cross-listed with STAT). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 500 or STAT 401; STAT 543 or STAT 447
Statistical methods commonly used in epidemiology and human and animal health studies. Overview of cohort studies, case-control studies and randomized clinical trials. topics include inference procedures for disease risk factors, analysis of time-to-event and survival data, analysis of longitudinal studies of disease progression and health status, approaches to handling missing data, and meta-analysis. Examples will come from recent studies of physical and mental health, nutrition and disease progression in human and animal populations. Use of statistical software: SAS or R.

TOX 570: Risk Assessment for Food, Agriculture and Veterinary Medicine
(Cross-listed with AGRON, VDPAM). (3-0) Cr. 3. F.
Prereq: Statistics 300-level or higher.
Risk assessment principles as applied to biological systems. Exposure and effects characterization in human and animal health and ecological risk assessment. Risk analysis frameworks and regulatory decision-making. Introduction to quantitative methods for risk assessment using epidemiological and distributional analysis. Uncertainty analysis. This course is available only by distance.

TOX 575: Cell Biology
(Cross-listed with B M S). (3-0) Cr. 3. F.
Prereq: 10 credits in biological science and permission of instructor
A multi-instructor course covering major topics in cell structure and function, including: universal features of prokaryotic and eukaryotic cells, types of utilization and conversion of energy, genetic control of cell shape and functionality, internal organization of cells, communication between cells and their environment, development of multicellular systems. Students have to write a term paper.

TOX 590: Special Topics
Cr. arr. Repeatable.
Contact individual faculty for special projects or topics. Graded.

Courses for graduate students:

TOX 626: Advanced Food Microbiology
(Cross-listed with FS HN, MICRO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials.

TOX 627: Rapid Methods in Food Microbiology
(Cross-listed with FS HN, MICRO). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Provides an overview of rapid microbial detection methods for use in foods. Topics include historical aspects of rapid microbial detection, basic categories of rapid tests (phenotypic, genotypic, whole cell, etc.), existing commercial test formats and kits, automation in testing, sample preparation and "next generation" testing formats now in development.

TOX 656: Cellular and Molecular Pathology II
(Cross-listed with V PTH). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Graduate course in biochemistry, genetics, or cell biology
Cellular and molecular mechanisms of carcinogenesis.

TOX 675: Insecticide Toxicology
(Cross-listed with ENT). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENT 555 or TOX 501
Principles of insecticide toxicology; classification, mode of action, metabolism, and environmental effects of insecticides.

TOX 689: Current Topics in Toxicology
Cr. R. Repeatable. F.S.
Lecture and discussion participation on current topics in toxicology. An 80% attendance is expected to satisfactorily complete the course. Offered on a satisfactory-fail basis only.

TOX 697: Graduate Research Rotation
(0-12) Cr. 1-12. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Admission to Toxicology graduate program
Graduate research projects performed under the supervision of selected faculty members in the graduate Toxicology major.

TOX 699: Research
Cr. arr. Repeatable. F.S.SS.
Research.

Transportation (TRANS)

Courses primarily for graduate students, open to qualified undergraduates:

TRANS 555: Economic Analysis of Transportation Investments
(3-0) Cr. 3.
Prereq: C E 350 or C E 355
Application of economic analysis methodologies to evaluate transportation projects. Multi-modal approaches to evaluate impacts of transportation investments and maximize economic efficiency while considering equity and other social issues related to investment options.

TRANS 599: Creative Component
Cr. 1-3.
Prereq: Pre-enrollment contract required
Advanced topic for creative component report in lieu of thesis.

Courses for graduate students:

TRANS 691: Seminar in Transportation Planning
Cr. 1. Repeatable. S.
Provides an overview of current transportation issues; speakers provide seminars on a variety of timely transportation topics.

TRANS 699: Research
Cr. arr. Repeatable.

U.S. Latino/a Studies Program (US LS)

Courses primarily for undergraduates:

US LS 211: Introduction to U.S. Latino/a Studies
(3-0) Cr. 3. F.S.
History and current lives of the Latino/a peoples in the United States, including Mexican, Cuban, Puerto Rican, Dominican, and South and Central Americans, as well as information specific to Iowa Latino/as, will be covered. Through readings, class discussions, writing assignments, and guest speakers, students will acquire accurate information and a solid understanding of the US Latino/a population and cultural perspectives. Elements of Latino/a culture to be covered include historical, sociological, educational, psychological, economic, and political facets.
Meets U.S. Diversity Requirement

US LS 240: Latina/o History
(Cross-listed with HIST). (3-0) Cr. 3.
Historical and cultural heritage of Latinas/os in the United States. The histories of Mexican, Puerto Rican, Cuban, and other Latin American peoples in the U.S. emphasizing political and cultural convergence and congruencies.
Meets U.S. Diversity Requirement

US LS 332: The Latino/Latina Experience in U.S. Society
(Cross-listed with SOC). (3-0) Cr. 3. F.
Prereq: SOC 134
Examination of the social, historical, economic and political experience of varied Latino ethnic groups in the U.S. - primarily focusing on Mexican, Puerto Ricans, and Cubans.
Meets U.S. Diversity Requirement

US LS 342: Religion and U.S. Latino/a Literature
(Cross-listed with RELIG). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
A study of the religious behavior and attitudes expressed in the literature of Mexican Americans, Puerto Ricans, Cuban Americans and other groups of people living in the U.S. who trace their ancestry to the Spanish-speaking countries of Latin America.
Meets U.S. Diversity Requirement

US LS 343: Latin American Government and Politics
(Cross-listed with POL S). (3-0) Cr. 3.
Political institutions, processes, and contemporary issues. Selected countries examined intensively to illustrate generalizations. Role of parties, military, church, human rights, women, environmental issues, interest groups, ideology, and globalization.

US LS 344: U.S. Latino/a Literature
(Cross-listed with ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 250
An introduction to the literature of Mexican Americans, Puerto Ricans, Cuban Americans and other Latino/a sub-groups. Special emphasis on themes such as ethnic relations and comparisons with EuroAmerican literary traditions.
Meets U.S. Diversity Requirement

US LS 347: U.S. Latino/a Psychology
(Cross-listed with PSYCH). (3-0) Cr. 3. S.
Prereq: Two courses in Psychology including PSYCH 101
Historical, political, and social contexts of psychological and mental health constructs in terms of their validity and utility for use with Latino/a people in the U.S. Unique aspects of psychological functioning particular to Latino/a people in the U.S.
Meets U.S. Diversity Requirement

US LS 371: Mexican American History
(Cross-listed with HIST). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 3 credits of 200-level HIST at Iowa State and sophomore classification.
History of the Mexican American community in the U.S. from the 1820s to the present. Topics include community development, employment, social marginalization, racism/discrimination, depression and world wars, civil rights, ethnic power and politics.
Meets U.S. Diversity Requirement

US LS 473: Civil Rights and Ethnic Power
(Cross-listed with AF AM, HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
Comparative history of the civil rights and ethnic power movements (African American, Chicano, American Indian, Puerto Rican, among others) in the U.S. from World War II to the present. Topics include institutional foundations, leadership, gender and racial dynamics, and the convergences and divergences of these differing ethnic struggles for rights.
Meets U.S. Diversity Requirement

US LS 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: permission of instructor
Independent study under supervision of instructor. No more than 3 credits may count towards the U.S. Latino/a Studies certificate.

University Studies (U ST)

Courses primarily for undergraduates:

U ST 101: First Year Seminar I
(1-0) Cr. 1. F.S.
Prereq: Acceptance/participation in appropriate learning community or special program.
Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only.

U ST 101A: First Year Seminar I: Hixson Scholars
(1-0) Cr. 1. F.S.
Prereq: Acceptance/participation in appropriate learning community or special program.
Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only.

U ST 101B: First Year Seminar I: MVP Award
(1-0) Cr. 1. F.S.
Prereq: Acceptance/participation in appropriate learning community or special program.
Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only.

U ST 101C: First Year Seminar I: Science Bound
(1-0) Cr. 1. F.S.
Prereq: Acceptance/participation in appropriate learning community or special program.
Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only.

U ST 101D: First Year Seminar I: Student Athlete Experience
(1-0) Cr. 1. F.S.
Prereq: Acceptance/participation in appropriate learning community or special program.
Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only.

U ST 101E: First Year Seminar I: Student Support Services Program
(1-0) Cr. 1. F.S.
Prereq: Acceptance/participation in appropriate learning community or special program.
Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only.

U ST 102: First Year Seminar II
(1-0) Cr. 1. S.
Prereq: U St 101 or instructor permission.
Acceptance/participation in appropriate learning community. Continued exploration of university services, strategies for student success, leadership, and acclimation to university. Exploration of issues associated with learning community focus. Offered on a satisfactory-fail basis only.

U ST 102A: First Year Seminar II: MVP Award
(1-0) Cr. 1. S.
Prereq: U St 101 or instructor permission.
Acceptance/participation in appropriate learning community. Continued exploration of university services, strategies for student success, leadership, and acclimation to university. Exploration of issues associated with learning community focus. Offered on a satisfactory-fail basis only.

U ST 102B: First Year Seminar II: Science Bound
(1-0) Cr. 1. S.
Prereq: U St 101 or instructor permission.
Acceptance/participation in appropriate learning community. Continued exploration of university services, strategies for student success, leadership, and acclimation to university. Exploration of issues associated with learning community focus. Offered on a satisfactory-fail basis only.

U ST 104: Personal Career Development
(2-0) Cr. 2. F.S.
Comprehensive approach to personal career development providing students with the skills and structure to make informed choices about their major and career path. Self-exploration of interests, skills, values, and personality as related to the world of work using a variety of techniques; exploration of majors and occupations; model for major and career decision-making and career goal implementation; exposure to effective job search and interviewing skills and resources.

U ST 105: Carver Academy Seminar: Freshmen
(1-0) Cr. 1. F.
Prereq: Acceptance in Carver Academy Program, George Washington Carver scholarship recipient
Orientation to the university for Carver Academy students focusing primarily on transition and acclimation to the university environment. Individual and group identity development. Life and legacy of George Washington Carver. Offered on a satisfactory-fail basis only.
Meets U.S. Diversity Requirement

U ST 106: Carver Academy Seminar: Freshmen
(1-0) Cr. 1. S.
Prereq: Acceptance in Carver Academy Program, George Washington Carver scholarship recipient
Introduction for Carver Academy students to resources at ISU to supplement classroom learning. Exploration of multicultural communities and leadership opportunities at ISU. Offered on a satisfactory-fail basis only.
Meets U.S. Diversity Requirement

U ST 110: International First-Year Experience Seminar
(1-1) Cr. 1. F.S.
Topics to help international students transition to the United States and academic culture, such as culture shock, classroom culture, campus and community resources, learning styles, study skills, basic immigration status and employment benefits, student health and wellness, and research and presentation skills. Offered on a satisfactory-fail basis only.

U ST 201: WiSE Success Seminar
(1-0) Cr. 1. F.S.
Prereq: Participation in Women in Science and Engineering Sophomore or Transfer Learning Community.
Exploration of individual leadership styles, career opportunities, personal values as they relate to career possibilities, and issues facing women in the workplace. Offered on a satisfactory-fail basis only.

U ST 205: Carver Academy Seminar: Peer Mentors
(1-0) Cr. 1. F.
Prereq: U ST 106, intended primarily for sophomores
Leadership and peer mentor training for Carver Academy students who will be serving as peer mentors in Carver Academy. Definitions and analysis of diversity in academia. Academic portfolio preparation and career exploration. Offered on a satisfactory-fail basis only.
Meets U.S. Diversity Requirement

U ST 207: Science Bound Pre-Professional Seminar
(1-0) Cr. 0.5. Repeatable, maximum of 4 times. F.S.
Prereq: 102B or instructor permission
Seminar topics prepare sophomore and upper-class students to pursue research and internship experiences in science, technology, engineering and math fields. Offered on a satisfactory-fail basis only.

U ST 290: Independent Study
Cr. arr.
Prereq: Permission of the associate provost for academic programs
Independent study on topics of an interdisciplinary nature. Intended primarily for freshmen and sophomores.

U ST 301: McNair Program: Introduction to Research I
(2-0) Cr. 2. F.
Prereq: Acceptance to the Iowa State University McNair Program
Introduction to academic research focusing on the initial stages of research with lessons on how to define a research idea, formulate a research question or hypothesis, gather, critique, analyze and synthetize the literature on the subject of inquiry, and understand and be able to apply a number of methodologies to gather data.

U ST 302: McNair Program: Introduction to Research II
(2-0) Cr. 2. S.
Prereq: U ST 301
Continuation of research preparation focusing on methodologies and the relevance to specific research questions, data collection and analysis processes, and scientific research writing and presentation. Lessons on how to determine appropriate methodology and design a scientific protocol, gather and analyze data, and understand findings so as to effectively report and present findings and conclusions.

U ST 311: Leaders Seminar I
(1-0) Cr. 1. Repeatable.
For students serving as peer mentor first-year seminar leaders under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

U ST 311A: Leaders Seminar I: Leaders in Hixson Seminar
(1-0) Cr. 1. Repeatable.
For students serving as peer mentor first-year seminar leaders under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

U ST 311B: Leaders Seminar I: Leaders in MVP Seminar
(1-0) Cr. 1. Repeatable.
For students serving as peer mentor first-year seminar leaders under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

U ST 311C: Leaders Seminar I: Leaders in Strengths Seminar
(1-0) Cr. 1. Repeatable. F.
For students serving as peer mentor learning community leaders under faculty supervision. Development of peer mentor abilities through an understanding of personal strengths and how strengths interact with leadership style. Exploration of connections between strengths and mentor role will be coupled with learning community peer mentor training to interweave identified strengths with those of the students they serve. Offered on a satisfactory-fail basis only.

U ST 312: Leaders Seminar II
(1-0) Cr. 1. Repeatable.
Prereq: U ST 311
For students serving as leaders in Hixson Seminar or MVP Seminar under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

U ST 312A: Leaders Seminar II: Leaders in Hixson Seminar
(1-0) Cr. 1. Repeatable.
Prereq: U ST 311
For students serving as leaders in Hixson Seminar or MVP Seminar under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

U ST 312B: Leaders Seminar II: Leaders in MVP Seminar
(1-0) Cr. 1. Repeatable.
Prereq: U ST 311
For students serving as leaders in Hixson Seminar or MVP Seminar under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

U ST 315: Cyclone Aide Leaders Seminar
(3-0) Cr. 2. Repeatable, maximum of 4 credits. S.
Prereq: Selection as Cyclone Aide or Cyclone Aide Adviser
Development of public speaking, group facilitation, and peer leadership skills. Exploration of issues associated with student transition to college, university organizational structures, and processes associated with student matriculation. Offered on a satisfactory-fail basis only.

U ST 321: NCORE Scholars: Race and Ethnicity in the U.S
(2-2) Cr. 3. F.
Prereq: Selection as an NCORE Student Scholar and attendance at NCORE.
Exploration of issues of race and ethnicity in the United States.
Meets U.S. Diversity Requirement

U ST 401: McNair Senior Seminar I
(1-0) Cr. 1. F.
Prereq: Intended for second year McNair participants
Comprehensive approach to choosing and applying to graduate school including drafting and finalizing the personal and research essay, understanding graduate funding, preparing for the grad interview, standardized exam preparation, and conversations with faculty and graduate students. Offered on a satisfactory-fail basis only.

U ST 402: McNair Senior Seminar II
(1-0) Cr. 1. S.
Prereq: U ST 401
Continuation of graduate school preparation focusing on transitioning, navigating the critical first year, succeeding in graduate school through to the completion of the PhD, and conversations with faculty and graduate students. Offered on a satisfactory-fail basis only.

U ST 490: Independent Study
Cr. arr. Repeatable.
Prereq: Permission of the associate provost for academic programs
Independent study on topics of an interdisciplinary nature. Intended primarily for juniors and seniors.

Urban Design (URB D)

Courses primarily for graduate students, open to qualified undergraduates:

URB D 501: Urban Design Local Studio
(3-6) Cr. 6.
Prereq: Graduate standing or senior classification with instructor permission
Analysis and observation of urban morphology and culture with urban design projects set in local cities of the United States. Students with learn skills to observe and interpret urbanism as they develop processes for designing cities concerned for both physical form, ecological principles and human activity.

URB D 502: Urban Design Global Studio
(1-10) Cr. 6.
Prereq: Graduate standing or senior classification with instructor permission.
Students develop proposals for urban design interventions in an international context at multiple scales using investigation, analysis, observation, and interaction. Field trips.

URB D 511: North American Urbanization
(3-0) Cr. 3.
Prereq: Graduate standing or senior classification with instructor permission
Focus on the historical role of planning and urban design in the shaping of North American cities and regions, from the colonial period to the late twentieth century. Examine the legacy of planning and design by exploring the intersection of geographic space, politics, and policy. Investigate the factors and the processes that produce the built environment.

URB D 521: Foundations of Urban Design
(3-0) Cr. 3.
Prereq: Graduate standing, senior classification with instructor permission.
Introduction to the ways that urban designers think about the city with a focus on how history, theory, and a wide range of contextual factors inform urban design practice. Field trip.

URB D 522: Contemporary Urban Design Practices
(3-0) Cr. 3.
Prereq: Graduate standing or senior classification with instructor permission.
Study of emerging trends and practices in urban design using a range of current media communication platforms. Course will be conducted in a combination of lecture, seminar formats. Graduate level readings, discussions, research, and development of projective scenarios.

URB D 531: Methods of Urban Design Workshop
(3-0) Cr. 3.
Prereq: Graduate standing or senior classification with instructor permission.
An exploration of contemporary urban design methods derived from significant urban projects and (re)development initiatives. Selected case studies to articulate and evaluate methods for implementing urban design goals and objectives in a variety of urbanized contexts. Case studies will build on a combination of analytical research, lectures, student presentations, and field trips.

URB D 532: Urban Design Media Workshop
(3-0) Cr. 3.
Prereq: Graduate standing or senior classification with instructor permission.
An introduction to visual representation tools and techniques for generating and communicating urban design concepts and analytical research. Projects and exercises will utilize traditional and contemporary approaches to drawing, modeling, and mapping, as well as desktop publishing tools for print, web, and presentation graphics. Field trip.

URB D 533: Urbanism Theory and Methods
(3-0) Cr. 3.
Prereq: Graduate standing or senior classification with instructor permission.
This course examines how political-economic forces shape the contemporary built and social environments and the way urban designers respond to these forces. The course highlights various methods urban designers use to create change and, in turn, how these affect stakeholders and communities. Students develop critical awareness of existing social, political and economic systems; understand the impact of the decision they make, and the methods they use, on the city and these systems.

Veterinary Clinical Sciences (V C S)

Courses primarily for professional curriculum students:

V C S 305: Shelter Medicine
Cr. 1. S.
Prereq: First year classification in Veterinary Medicine or with permission of instructor
An elective course designed to educate the veterinary student about issues of relevance to companion animal population and shelter medicine and welfare.

V C S 311: Veterinarian in Society I
Cr. R. F.
Prereq: First-year classification in veterinary medicine
Introduction to the veterinary profession and the various career opportunities available.

V C S 313: Veterinarian in Society III
(1-1) Cr. 1. F.
Prereq: Second-year classification in veterinary medicine
A continuation of the Veterinarian in Society series. The course covers selected topics on moral and ethical issues affecting the practice of veterinary medicine.

V C S 314: Veterinarian in Society IV
(1-0) Cr. 1. F.
Prereq: Third-year classification in veterinary medicine
A continuation of the Veterinarian in Society series. This course will focus on helping students develop their communication, leadership, team building and conflict resolution skills.

V C S 315: Veterinarian in Society V
(1-0) Cr. 1. S.
Prereq: Third-year classification in veterinary medicine
A continuation of the Veterinarian in Society series. This course will emphasize veterinary law.

V C S 339: Clinical Foundations I
(Cross-listed with B M S). (0-2) Cr. 1. F.
Prereq: First-year classification in veterinary medicine
Canine physical examination; basic behavior, animal handling and restraint; medical record keeping.

V C S 385: Grand Rounds
Cr. R. Repeatable. F.S.
Prereq: Classification in veterinary medicine
Seminars and case presentations on selected clinical subjects by fourth-year students of the College of Veterinary Medicine. Attendance is required for a passing grade. Offered on a satisfactory-fail basis only.

V C S 391: Clinical Imaging
(1-0) Cr. 1. F.
Prereq: First-year classification in veterinary medicine
Evaluation of morphologic anatomy of the dog and cat utilizing clinical imaging methods - radiography, ultrasonography, computed tomography, magnetic resonance imaging and nuclear imaging. Emphasis will be placed on normal radiographic anatomy.

V C S 393: Principles of Surgery
(2-2) Cr. 3. F.
Prereq: Second year classification in veterinary medicine
General principles of surgery of companion animals.

V C S 394: Principles of Surgery Laboratory
(0-3) Cr. 1. S.
Prereq: Second year classification in veterinary medicine
General principles of surgery of companion animals.

V C S 395: Small Animal Surgery
(2-0) Cr. 2. S.
Prereq: V C S 394
Small animal surgery.

V C S 396: Equine Surgery
(2-0) Cr. 2. S.
Prereq: V C S 394
Elective course in equine surgery.

V C S 398: Anesthesiology
(2-0) Cr. 2. S.
Prereq: Second-year classification in veterinary medicine
Anesthetic equipment, agents and procedures, including pain management for core species.

V C S 399: Ophthalmology
(1-0) Cr. 1. S.
Prereq: Third year classification in veterinary medicine
Principles and techniques of medical and surgical ophthalmology.

V C S 402: Clinical Cardiology I
(1-0) Cr. 1. F.
Prereq: Third or fourth-year classification in veterinary medicine; V CS 444 or concurrent enrollment in V C S 444
Elective course in diagnosis and management of cardiac diseases. Emphasis on interpretation of electrocardiography.

V C S 405: Pet Bird and Exotic Species Medicine
(1-3) Cr. 2. S.
Prereq: third classification in veterinary medicine
Elective course in management and diseases of pet birds and exotic species.

V C S 407: Feline Internal Medicine
(1-0) Cr. 1. F.
Prereq: Third-year classification in veterinary medicine
Elective course in feline internal medicine.

V C S 409: Oncology
Cr. 2-4. Repeatable, maximum of 4 credits.
Prereq: Fourth-year classification in veterinary medicine
Elective clinical assignment in oncology.

V C S 414: Companion Animal Nutrition
(1-0) Cr. 1. S.
Prereq: Third or fourth -year classification in veterinary medicine
Elective course in small animal and equine nutrition.

V C S 415: Advanced Small Animal Dermatology
(1-2) Cr. 2. F.
Prereq: Third or Fourth-year classification in veterinary medicine
Elective course in dermatology.

V C S 419: Preceptorship in Companion Animal/Equine Veterinary Medical Practice
Cr. 2-6. Repeatable, maximum of 6 credits.
Prereq: Fourth-year classification in veterinary medicine, permission of department curriculum committee
Elective course in veterinary practice under the guidance of veterinarians in approved practice settings. Maximum of 6 credits in 2 credit increments.

V C S 420: Practicum
Cr. R. Repeatable.
Prereq: VM4 classification, permission of instructor
External practical experiences in the fourth year curriculum for additional professional development of the veterinary student. Offered on a satisfactory-fail basis only.

V C S 422: Rotation at Blank Park Zoo
Cr. 4. F.S.SS.
Prereq: Fourth-year classification in veterinary medicine and completion of V C S 405. Enrollment by permission of instructor.
Clinical experience in husbandry, nutrition and training of exotic animals in a zoo environment. Students will get instruction and learn the application of the clinical skills required when dealing with exotic animals, including the hands-off visual examination obtaining historical and clinical information from zookeepers, and the use of immobilization drugs for patient exams. Students will learn the common medical disorders of exotic species and treatment techniques.

V C S 436: Small Animal Internal Medicine
(3-0) Cr. 3. F.
Prereq: Third year classification in veterinary medicine
Clinical diagnosis and treatment of diseases of small animals.

V C S 437: Small Animal Shelter Medicine
(2-0) Cr. 2. Repeatable.
Prereq: Fourth year classification in Veterinary Medicine
A 2-week elective rotation at an animal shelter/humane society that works with the public to place pets in homes. This rotation will encompass population medicine (medicine, surgery, intake, adoption, behavior and temperament, neglect and cruelty) that animal shelters deal with on a daily basis. The selected animal shelter/humane society must have a veterinarian(s) on staff and be approved by the course coordinator. More than one VCS 437 may be taken upon approval of the course coordinator.

V C S 440: Introduction to Clinics
Cr. R. S.
Prereq: Third-year classification in veterinary medicine
Rotating assignments through multiple sections within the Veterinary Medical Center.

V C S 441: Canine Rehabilitation
Cr. 2.
Prereq: Fourth-year classification in veterinary medicine.
Elective clinical assignment in rehabilitation.

V C S 443: Equine Lameness
(1-2) Cr. 2. S.
Prereq: Second or third-year classification in veterinary medicine
Orthopedic diseases of the equine.

V C S 444: Small Animal Medicine
(4-0) Cr. 4. F.S.
Prereq: Third-year classification in veterinary medicine
Clinical diagnosis and treatment of diseases of small animals.

V C S 445: Equine Medicine
(2-0) Cr. 2. F.
Prereq: Third-year classification in veterinary medicine
Clinical diagnosis and treatment of diseases of equine.

V C S 446: Clinical Neurology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical rotation in neurology with an emphasis on neurolocalization, disease processes, use of diagnostics in medical and surgical neurology and treatment options. Exposure to neurosurgical techniques.

V C S 447: Equine Veterinary Diagnostic Skills
(3-0) Cr. 2. S.
Prereq: Fourth-year classification in veterinary medicine - preference to equine track student. Limited to 16 students.
Hands on experience with equine veterinary diagnostic skills related to theriogenology, medicine, surgery, radiology, and ophthalmology.

V C S 448: Diagnostic Imaging and Radiobiology
(2-2) Cr. 3. F.S.
Prereq: Third-year classification in veterinary medicine
Essentials of diagnostic image interpretation. Essentials of radiobiology, radiation therapy and protection from radiation.

V C S 449: Junior Surgery Laboratory
(1-6) Cr. 3. F.
Prereq: Third-year classification in veterinary medicine
Pre-laboratory presentations and laboratories introduce the student to anesthetic and surgical principles and techniques that can be applied to all animal species.

V C S 449A: Junior Surgery Laboratory: Alternative Curriculum
(1-6) Cr. 3. F.
Prereq: Third-year classification in veterinary medicine
This laboratory introduces the student to anesthetic and surgical principles - and techniques that can be applied to all animal species. Consists of only neutering humane society animals throughout the laboratory.

V C S 449B: Junior Surgery Laboratory: Traditional Curriculum
(1-6) Cr. 3. F.
Prereq: Third-year classification in veterinary medicine
This laboratory introduces the student to anesthetic and surgical principles and techniques that can be applied to all animal species. Provides a broader range of surgical experiences throughout the laboratory.

V C S 451: Advanced Junior Surgery Laboratory
(1-6) Cr. 2. S.
Prereq: V C S 449
8 weeks. Continuation of surgical laboratory experience. Techniques and advanced principles learned are applicable to all animal species.

V C S 451A: Advanced Junior Surgery Laboratory: Alternative Curriculum
(1-6) Cr. 2. S.
Prereq: V C S 449
8 weeks. Continuation of surgical laboratory experience. Techniques and advanced principles learned are applicable to all animal species. Consists of only neutering humane society animals throughout the laboratory.

V C S 451B: Advanced Junior Surgery Laboratory: Traditional Curriculum
(1-6) Cr. 2. S.
Prereq: V C S 449
8 weeks. Continuation of surgical laboratory experience. Techniques and advanced principles learned are applicable to all animal species. Exposure to more advanced surgical techniques with most surgical principles.

V C S 451C: Advanced Junior Surgery Laboratory: Traditional Curriculum
(1-6) Cr. 2. S.
Prereq: V C S 449
8 weeks. Continuation of surgical laboratory experience. Techniques and advanced principles learned are applicable to all animal species. A second repeat for students with a special interest in small animal surgery.

V C S 452: Clinical Dermatology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine. Must have instructor permission to repeat this course.
Study of clinical dermatological problems via computer-aided instruction, case simulations, and/or lectures. Clinical management of cases presented to Veterinary Medical Center.

V C S 453: Small Animal Medicine I
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in small animal medicine.

V C S 455: Small Animal Soft Tissue Surgery
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in soft tissue surgery.

V C S 456: Small Animal Orthopedic Surgery
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in orthopedic surgery.

V C S 457: Equine Medicine
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in equine medicine.

V C S 458: Equine Surgery
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in equine surgery.

V C S 459: Small Animal Overpopulation Medicine and Surgery
Cr. 2.
Prereq: Fourth year classification in Veterinary Medicine
A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues. Each section can be taken for credit once.

V C S 459A: Small Animal Overpopulation Medicine and Surgery :Nebraska Humane Society, Omaha NE
Cr. 2.
Prereq: Fourth year classification in Veterinary Medicine
A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues. Each section can be taken for credit once.

V C S 459B: Small Animal Overpopulation Medicine and Surgery: Animal Rescue League of Iowa, Des Moines IA
Cr. 2.
Prereq: Fourth year classification in Veterinary Medicine
A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues. Each section can be taken for credit once.

V C S 459C: Small Animal Overpopulation Medicine and Surgery: WaySide Waifs, Kansas City MO
Cr. 2.
Prereq: Fourth year classification in Veterinary Medicine
A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues. Each section can be taken for credit once.

V C S 460: Radiology
Cr. 2.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in veterinary radiology.

V C S 461: Advanced Small Animal Internal Medicine
Cr. 1. S.
Prereq: V C S 444 and V C S 436
A discussion of advanced topics in small animal internal medicine.

V C S 463: Primary Care
Cr. 2. Repeatable, maximum of 4 credits.
Prereq: Fourth-year classification in veterinary medicine
Clinical experience in hospital based general practice.

V C S 464: Equine Field Services
Cr. 2.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in equine ambulatory practice.

V C S 465: Farrier
Cr. 2.
Prereq: Fourth-year classification in veterinary medicine.
Elective clinical assignment on the principles and practices of normal and therapeutic horseshoeing and equine foot care.

V C S 466: Anesthesiology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in small animal and large animal anesthesiology.

V C S 467: Pain Management
Cr. 1-2. Repeatable, maximum of 2 credits.
Prereq: Fourth year classification in veterinary medicine
Elective clinical assignment with emphasis on pain management.

V C S 468: Intensive Care
Cr. 4. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment to provide supervision of hospital cases requiring intensive care and including emergency cases.

V C S 469: Ophthalmology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in ophthalmology.

V C S 470: Radiology
Cr. 2. Repeatable, maximum of 4 credits.
Prereq: Fourth-year classification in veterinary medicine. Completion of V C S 460 Radiology is required. Enrollment by permission of instructor.
Elective clinical assignment in veterinary radiology.

V C S 471: Animal Reproduction
Cr. 2.
Prereq: Fourth-year classification in veterinary medicine
Elective clinical assignment in animal reproduction. Equine, Small Animal, Comparative, and Food Animal reproduction only.

V C S 471A: Animal Reproduction: Equine and Small Animal Reproduction
Cr. 2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Fourth-year classification in veterinary medicine
Elective clinical assignment in equine and small animal Theriogenology involving breeding management, cool-shipped semen preparation and semen cryopreservation, embryo transfer.

V C S 471C: Animal Reproduction: Comparative
Cr. 2. Repeatable, maximum of 4 credits. SS.
Prereq: Fourth-year classification in veterinary medicine.
Elective comparative clinical assignment in Theriogenology with caseload management in Food Animal, Equine, Small Animal and Small Ruminants sections. Rotation through these different sections will depend on the caseload (by species)and include routine breeding management, semen collection and cryopreservation in different species, advanced laparoscopic and non-surgical procedures for insemination and embryo flushing/transfer, pregnancy diagnosis as well as management of reproductive emergencies.

V C S 471E: Animal Reproduction: Equine Reproduction
Cr. 2.
Prereq: Fourth-year classification in veterinary medicine
Elective clinical assignment in Equine Theriogenology involving both mare and stallion breeding management, cool-shipped semen preparation and semen cryopreservation, embryo transfer, foaling of high-risk pregnant mares as well as normal mares, breeding soundness exams of the mare and stallion, treatment of retained fetal membranes and neonatal care.

V C S 473: Small Animal Surgery
Cr. 1.
Prereq: fourth-year classification in veterinary medicine
Clinical assignment in small animal surgery split between soft tissue surgery (one week) and orthopedic surgery (one week).

V C S 473O: Small Animal Surgery: Orthopedic
Cr. 1.
Prereq: fourth-year classification in veterinary medicine
Clinical assignment in small animal surgery split between soft tissue surgery (one week) and orthopedic surgery (one week).

V C S 473S: Small Animal Surgery: Soft Tissue
Cr. 1.
Prereq: fourth-year classification in veterinary medicine
Clinical assignment in small animal surgery split between soft tissue surgery (one week) and orthopedic surgery (one week).

V C S 475: Cardiology Rotation
Cr. 2. Repeatable.
Prereq: Fourth year classification in veterinary medicine
Elective clinical assignment in cardiology.

V C S 476: Veterinary Anesthesiology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Assignments in equine, small animal, and large animal anesthesiology. Experience includes case work-up, management and recovery. Understanding of the unique physiology and potential complications of anesthetized patients. Pharmacology of commonly used drugs. Specific protocols and management for both field and general anesthesia.

V C S 476E: Equine Anesthesiology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Assignments in equine, small animal, and large animal anesthesiology. Experience includes case work-up, management and recovery. Understanding of the unique physiology and potential complications of anesthetized patients. Pharmacology of commonly used drugs. Specific protocols and management for both field and general anesthesia.

V C S 476S: Small Animal Anesthesiology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Assignments in equine, small animal, and large animal anesthesiology. Experience includes case work-up, management and recovery. Understanding of the unique physiology and potential complications of anesthetized patients. Pharmacology of commonly used drugs. Specific protocols and management for both field and general anesthesia.

V C S 478: Intensive and Critical Care
(2-0) Cr. 2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Fourth-year classification in veterinary medicine
Elective clinical assignment in intensive care.

V C S 480: Veterinary Dentistry
Cr. 1. F.
Prereq: Third or Fourth-year classification in veterinary medicine
All aspects of veterinary dentistry, prophylaxis, endodontics, and orthodontics. This course is an on-line course.

V C S 481: Advanced Equine Dentistry
Cr. 2. S.
Prereq: Fourth year classification in veterinary medicine
Clinical rotation in equine dentistry with an emphasis on routine equine dental examinations, specialized equipment, and corrective procedures. Offered only offered for one 2-week rotation. Enrollment is limited.

V C S 490: Independent Study
Cr. arr. Repeatable.
Prereq: Permission of instructor and the VCS Associate Chair for Academic Affairs.
Independent Study in veterinary medicine focusing on basic / translational research or learning issues. Enrollment in this course is not appropriate for clinical experiences in the Veterinary Medical Center or extramural experiences in clinical veterinary practice (i.e., preceptorships).

V C S 492: Orientation for International Experience
(2-0) Cr. 1. Repeatable. S.
Prereq: Classification in veterinary medicine
8 weeks. Predeparture orientation for group study abroad. Cultural considerations for the study abroad experience and a conversational language introduction. Out of class work may be assigned.

V C S 495: Grand Rounds Presentations
Cr. R. S.
Prereq: Fourth-year classification in veterinary medicine
Seminars and case presentations on selected subjects by fourth year students of the College of Veterinary Medicine. Completion of a seminar presentation is required for graduation. Offered on a satisfactory-fail basis only.

V C S 496: International Preceptorship
Cr. 1-12. Repeatable.
Prereq: Second-year classification in veterinary medicine.
International Preceptorships and Study Abroad Group programs. Provides opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

V C S 590: Special Topics
Cr. 1-3. Repeatable.

V C S 590A: Special Topics: Medicine
Cr. 1-3. Repeatable.

V C S 590B: Special Topics: Surgery
Cr. 1-3. Repeatable.

V C S 590C: Special Topics: Theriogenology
Cr. 1-3. Repeatable.

V C S 590D: Special Topics: Radiology
Cr. 1-3. Repeatable.

V C S 590E: Special Topics: Anesthesiology
Cr. 1-3. Repeatable.

V C S 590F: Special Topics - Ophthalmology
Cr. 1-3. Repeatable, maximum of 3 credits. F.S.
Special topics in Ophthalmology.

V C S 596: International Preceptorship
(0-40) Cr. 1-12. Repeatable. F.S.SS.
Prereq: Admission to graduate college
International Preceptorships and Study Abroad Group programs. Provides opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities.

V C S 599: Creative Component
Cr. arr.
Prereq: Enrollment in nonthesis master's degree program

Courses for graduate students:

V C S 604: Seminar
Cr. 1. Repeatable. F.S.

V C S 640: Advanced Radiology
(2-0) Cr. 2.
Prereq: V C S 448
Detailed principles of clinical radiology with particular reference to radiographic interpretation.

V C S 671: Advanced General Surgery
(1-3) Cr. 2.
Prereq: Permission of instructor
Course designed to discuss and perform advanced surgical procedures in soft tissue, orthopedic and neurological surgery. Minimally invasive surgical procedures and organ transplantation will be included.

V C S 672: Advanced Special Surgery
(1-3) Cr. 2.
Prereq: Permission of instructor
Innovative techniques in microvascular, thoracic, gastrointestinal, neurological and reconstructive surgery will be investigated.

V C S 676: Advanced Medicine
(2-0) Cr. 2.
Prereq: V C S 445
Principles of general medicine. A study in depth of factors that contribute to the development of clinical signs as related to the pathogenesis of disease.

V C S 677: Advanced Medicine
(2-0) Cr. 2.
Prereq: V C S 445
An advanced study of metabolic diseases.

V C S 699: Research
Cr. arr. Repeatable.

V C S 699A: Research: Medicine
Cr. arr. Repeatable.

V C S 699B: Research: Surgery
Cr. arr. Repeatable.

V C S 699C: Research: Theriogenology
Cr. arr. Repeatable.

V C S 699E: Research: Anesthesiology
Cr. arr. Repeatable.

V C S 699F: Research: Ophthalmology
Cr. arr. Repeatable.
Graduate Level Research.

V C S 699G: Research: Cardiology
Cr. arr. Repeatable.
Graduate Level Research.

Veterinary Diagnostic and Production Animal Medicine (VDPAM)

Courses primarily for professional curriculum students:

VDPAM 308: Spanish for Veterinarians
(2-0) Cr. 2. S.
Prereq: Classification in veterinary medicine and basic knowledge of Spanish
This course is designed to meet the needs of veterinary students who will practice in an environment in which the use of Spanish for accurate client communication is essential which includes much of our food animal industry in the state of Iowa. This is not a traditional Spanish language course. To be successful, students taking the course should have a basic knowledge of Spanish pronunciation, grammar and syntax.

VDPAM 309: Introduction to Production Animal Informatics
(1-0) Cr. 1. S.
The fundamentals of how clinical, diagnostic, production and financial information is obtained and used by production animal operations will be presented. Students will acquire skills to create and use spreadsheets for manipulating and summarizing data. They will also acquire knowledge of where to find inexpensive and readily available resources with information on how to use spreadsheets and other software. Students will also have the opportunity to work with different record keeping programs used by swine, beef and dairy operations.

VDPAM 310: Introduction to Production Medicine
Cr. 2. S.
Prereq: Second or third year classification in veterinary medicine or permission of instructor
The role of the veterinarian in the management of animal health and production in populations including evaluation tools in dairy and beef cattle herds, beef feedlots and swine herds will be described. Provides veterinary students with a starting point to understand the principles and techniques that are the basis of food-animal population health diagnosis management programs. Course available on-line, attendance is not required.

VDPAM 312: Introduction to Animal Welfare
(1-0) Cr. 1. S.
Prereq: First-year classification in veterinary medicine
A continuation of the Veterinarian in Society series. The objective of this course is to develop knowledge of the fundamental principles of animal welfare, in terms of science, ethics and cultural components.

VDPAM 340: Clinical Foundations
(0-30) Cr. 1. S.
Prereq: Classification in veterinary medicine
One week course at Iowa State University; introduction to food supply veterinary medicine covering overviews of major animal agriculture species (beef, dairy, pork, sheep and camelid), production systems, behavior, welfare, handling and restraint, examination techniques, biosecurity, epidemiology and food safety. Visits to production units are utilized to introduce the application of clinical skills. Biosecurity: All students must follow current college policies regarding animal contact following foreign travel. Required equipment includes coveralls and rubber boots.

VDPAM 351: Bovine Embryo Transfer and Related Technology
(2-0) Cr. 2. S.
Prereq: Second or third year classification in veterinary medicine
This course will meet for two hours once each week of the Spring Semester. The first hour will be traditional lecture and the second hour will be a combination of student projects, labs and demonstrations of applied clinical procedures. Bovine embryo transfer and closely related topics such as: female reproductive physiology, estrus synchronization, semen sexing and reproductive disease will be emphasized. In addition, several class periods will be devoted to the use of ultrasound for diagnosis of reproductive and non-reproductive conditions.

VDPAM 365: Animal Welfare Judging and Assessment
Cr. 1. Repeatable. F.
Preparation for competition in the Intercollegiate Animal Welfare Judging Contest. Development of critical appraisal and oral communication skills in regard to animal welfare. Animal behavior, physiology, health and performance parameters, basic husbandry, housing and preventive care will be explored for select farmed, companion and exotic species. Optional field trips.

VDPAM 402: Advanced Dairy Production Informatics
(1-1) Cr. 2. Repeatable. F.S.
Prereq: VDPAM 309 or permission of instructor
Advanced coverage of concepts related to collection, manipulation, analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 305 and PCDart as well as other dairy management and information software.

VDPAM 402A: Advanced Dairy Production Informatics: Lecture Series
(1-1) Cr. 2. S.
Prereq: Classification in veterinary medicine
Advanced coverage of concepts related to collection, manipulation, analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 305 and PCDart as well as other dairy management and information software.

VDPAM 402B: Advanced Dairy Production Informatics: Experience I
(1-1) Cr. 2. F.S.
Prereq: VDPAM 402A
Independent records analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 305 and PCDart.

VDPAM 402C: Advanced Dairy Production Informatics: Experience II
(1-1) Cr. 2. F.S.
Prereq: VDPAM 402A, VDPAM 402B
Independent records analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 305 and PCDart.

VDPAM 402D: Advanced Dairy Production Informatics: Experience III
(1-1) Cr. 2. F.S.
Prereq: VDPAM 402A, VDPAM 402B, VDPAM 402C
Independent records analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 305 and PCDart.

VDPAM 407: Evidence Based Clinical Decision Making
(Dual-listed with VDPAM 507). (1-0) Cr. 1. S.
Prereq: Permission of instructor
Discussion, lectures and laboratories to assess the quality and significance of medical evidence in making informed decisions about the treatment of individual animals and animal populations.

VDPAM 408: Poultry Diseases
(Dual-listed with VDPAM 508). Cr. 2. Alt. S., offered even-numbered years.
Prereq: Second or third year classification in veterinary medicine or permission of instructor
Bacterial, viral, parasitic, and nutritional diseases of domestic poultry and gamebirds; biosecurity, immunization, and management procedures to prevent poultry diseases.

VDPAM 409: Veterinary Practice Management and Organization
(2-0) Cr. 2. F.
An A to Z introduction to proven veterinary practice management methods and strategies. The student will follow a detailed hands-on workbook describing most of the processes and procedures of day to day veterinary practice. The class content will be composed of class room discussions, didactic presentations, a practical workbook, ancillary handouts, and both in and out of class assignments.

VDPAM 410: Llama Medicine
(1-0) Cr. 1. F.
Prereq: Second or third year classification in veterinary medicine
Introduction to basic camelid medicine, including anatomy, behavior, restraint, handling, husbandry, herd health, common diseases, surgical conditions, and anesthesia protocols.

VDPAM 414: Veterinary Practice Entrepreneurship
(Dual-listed with VDPAM 514). Cr. 2-3. S.
Prereq: Classification in veterinary medicine
Formal exposure to the entrepreneurial and business skills necessary to own and operate a successful veterinary practice or other small business opportunity. Personal finance, marketing, human resource management, general accounting, site assessment, location demographics, practice valuation, and a host of other issues which must be considered when purchasing or starting a new business are covered. Class instruction will be delivered by successful practice and business owners with examples from real world experience.

VDPAM 416: Bovine Reproduction Evaluation Laboratory
(0-4) Cr. 1. F.S.
Prereq: Third year classification in veterinary medicine. 10 students per section.
Bovine rectal palpation techniques will be repetitively taught in 7 four-hour sessions. Students will also learn techniques of epidural anesthesia, artificial insemination, pregnancy staging and ultrasonic imaging. University-owned cattle will be used. No Wednesday section in Spring semester. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 419: Advanced Swine Production Informatics
(1-0) Cr. 1. F.
Prereq: VDPAM 309 or permission of instructor
Advanced coverage of concepts related to collection, manipulation, analysis and reporting of information used by swine production companies. Production, financial, diagnostic and clinical data will be covered in the course. Hands-on experience with computer software and information systems used in swine production will be provided. Students will learn to objectively evaluate the validity of information that is presented to them and also be able to make practical and useful recommendations regarding the types of information tools that can/should be used. The students will learn what software and information systems are available and be able to critically evaluate them.

VDPAM 420: Applied Production Animal Medicine Preceptorship
(0-30) Cr. 1-6. Repeatable. F.S.SS.
Prereq: Fourth year classification in veterinary medicine
Advanced course in production animal medicine with emphasis on government, industry or veterinary practice settings. Requires 40 hours clinical experience per week. Assignments will be preceptorships with a practicing veterinarian, governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 420A: Applied Production Animal Medicine Preceptorship: Mixed Animal Practice with Food Animal Emphasis
(0-30) Cr. 1-6. Repeatable. F.S.SS.
Prereq: Fourth year classification in veterinary medicine
Advanced course in mixed animal production medicine with a food animal emphasis in veterinary practice settings. Requires 40 hours of clinical experience per week. Assignments will be preceptorships with a practicing veterinarian, governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 420B: Applied Production Animal Medicine Preceptorship: General Mixed Animal Practice

(0-30) Cr. 1-6. Repeatable. F.S.SS.

Prereq: Fourth year classification in veterinary medicine

Advanced course in production animal medicine with an emphasis on general mixed animal veterinary practice settings. Requires forty hours clinical experience per week. Assignments will be preceptorships with a practicing veterinarian, governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 420C: Applied Production Animal Medicine Preceptorship: Government Agency or Food Processing Company

(0-30) Cr. 1-6. Repeatable. F.S.SS.

Prereq: Fourth year classification in veterinary medicine

Advanced course in production animal medicine with emphasis on government agency or food processing company in veterinary practice settings. Forty hours clinical experience per week. Assignments will be preceptorships with a governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 421: Great Plains Veterinary Educational Center

Cr. 1. F.S.SS.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Great Plains Veterinary Education Center (GPVEC), located on the US Meat Animal Research Center (USMARAC) near Clay Center, Nebraska offers one week clinical training in production animal medicine species. All sections will be held at GPVEC. Students need to provide their own transportation to the site and overnight stays at or near GPVEC are required.

VDPAM 421A: Great Plains Veterinary Educational Center: Calving

Cr. 1. F.S.SS.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Calving Elective provides an opportunity to expand knowledge and experience in all phases of calving management. The program is structured around normal calving operations at USMARC including night calving at the polesheds. The GPVEC and USMARC veterinary staff will make an effort to involve students in veterinary activities that take place during the Calving Elective including the diagnosis, treatment, and management of many commonly encountered conditions in the dam and calf. However, participation in a caesarian section is not guaranteed.

VDPAM 421B: Great Plains Veterinary Educational Center: Bull Breeding Soundness

Cr. 1. S.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Bull Breeding Soundness Examination Elective involves training in all phases of the examination, collection, and semen evaluation for up to 350 bulls as recommended by the Society for Theriogenology. Chuteside training and hand-on experience are the primary training techniques for this elective with informal discussions held during the performance of the breeding soundness examinations.

VDPAM 421D: Great Plains Veterinary Educational Center: Feedlot Management

Cr. 1. F.S.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

Evaluation of production techniques and production efficiency including ration and feeding management, health management program development and evaluation, environmental management, quality assurance, feedlot necropsy and microbiology techniques, and break even analysis. Approaches to solve seasonal health problems within the management objectives for different feed yards are the strong emphasis of this elective. Students may have the opportunity to follow cattle to a packing plant to learn the methods for tracking animals into the food chain, identifying production problems that are not diagnosable at the feedlot level, and monitoring beef quality assurance. Biosecurity activities will be emphasized and practiced.

VDPAM 421E: Great Plains Veterinary Educational Center: Weaning Management

Cr. 1. F.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

This is a hands-on elective in which students participate in the weaning management at the USMARC. Students will be involved with processing, feeding, finding, and treating sick calves. Additionally, students will be introduced to developing weaning rations and managing feed delivery. Students will also learn how to develop vaccination and treatment protocols and each student will have as an objective the development of their own vaccination and treatment protocol template. As time allows, students will visit commercial feed yards and cover production management topics.

VDPAM 421F: Great Plains Veterinary Educational Center: Pregnancy Examination

Cr. 1. F.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Pregnancy Examination Elective involves students, the GPVEC faculty, and USMARC personnel during pregnancy examination. Activities involve rectal examinations for pregnancy, collecting data and entry into the CowCalf5 computer software program to evaluate the reproductive performance of the herd. This elective is designed for students who have some palpation experience and are interested in honing their skills. Pregnancy Examination occurs during yearly fall herd work at the USMARC, therefore, speed and accuracy will be stressed, rather than basic technique.

VDPAM 421J: Great Plains Veterinary Educational Center: Lambing

Cr. 1. S.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Lambing Elective involves students working with the USMARC lambing crew and GPVEC faculty in observations, assistance with delivery when necessary, and routine lambing duties. Students will work with veterinary personnel in sheep necropsy and health surveillance. Self-study material will be provided covering topics such as pre-breeding and breeding, pregnancy diagnosis, pregnant ewe management, pre-lambing ewe/lambing management, feeder lamb health and nutrition management, and replacement ewe and ram management.

VDPAM 421K: Great Plains Veterinary Educational Center: Equine Dentistry

(20-20) Cr. 1. S.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site

The Equine Dentistry Elective provides the opportunity for students to expand their knowledge and experience related to equine dentistry. The rotation consists of lectures on topics relevant to equine dental care and hands-on laboratories during which students practice routine dental care procedures on USMARC horses. Equine Dentistry will involve both lecture and lab time at about equal shares.

VDPAM 421M: Great Plains Veterinary Educational Center: Preconditioning

Cr. 1. F.SS.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Preconditioning Elective provides the opportunity for students to expand their knowledge and experience in the development and implementation of calf preweaning programs. Students will assist GPVEC and USMARC personnel during routine processing of USMARC spring-born calves prior to weaning. GPVEC faculty will also lead discussions related to vaccine and dewormer protocols, preweaning nutrition, and other topics related to preparing beef calves for weaning.

VDPAM 421P: Great Plains Veterinary Educational Center: Gomer Bull Surgery

Cr. 1. F.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Gomer Bull Surgery Elective is designed to give students interested in food animal surgery an opportunity to practice their surgical skills by performing penile translocations and epididymectomies on USMARC teaser bull candidates. Lectures specific to gomer bull surgery as well as other topics related to food animal surgery will be presented during this elective.

VDPAM 421Q: Great Plains Veterinary Educational Center: Swine Husbandry

Cr. 1. F.S.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

This elective provides students the opportunity to gain hands-on experience related to the daily activities of an intensively managed confinement swine unit. Rotation participants will work closely with USMARC Swine Unit personnel as they complete their daily routines in the farrowing and breeding areas of the USMARC Swine Unit and will participate in piglet delivery, neonatal pig processing, artificial and natural breeding, necropsies, and other activities as they arise.

VDPAM 421R: Great Plains Veterinary Educational Center: Sheep Weaning Management

Cr. 1. SS.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

This elective provides the opportunity for students to develop their skills in the area of health and nutritional management of sheep immediately before and after weaning. The rotation consists of lectures on pre- and post-weaning nutrition, clinical parasitology, and prevention and control of common ovine infectious diseases. Hands-on experience during the week will take place at the USMARC Sheep Unit and will consist of walk-through and hand-on examinations of recently weaned lambs, treatment of sick lambs, inspection of weaning pen environment, investigation of herd outbreaks, and post mortem examination of all sheep mortalities.

VDPAM 421S: Great Plains Veterinary Educational Center: Ultrasound Pregnancy Examination

Cr. 1. SS.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Ultrasound Pregnancy Examination Elective involves students, the GPVEC faculty, and USMARC personnel during pregnancy examination of USMARC yearling heifers. Activities involve transrectal ultrasonographic examinations for pregnancy, collecting data and entry into the CowHerd/CowCalf computer software program to evaluate the reproductive performance of the herd. This elective is designed for students who have some ultrasound experience and are interested in honing their skills. This elective occurs during yearly fall herd work at the USMARC, therefore, speed and accuracy will be stressed, rather than basic technique. Didactic instruction may include several topics in cow herd health, nutrition, management and reproductive decision making.

VDPAM 422: Beef Cattle Calving

Cr. 2. Repeatable. F.S.SS.

Prereq: VDPAM 310; fourth year classification in veterinary medicine

This elective provides students opportunity to assist cow-calf operations with calving in Nebraska, South Dakota or other locations. These operations typically calve 300-1,000 head each spring. Calving experience is not required, but a good understanding of working around cattle is necessary. Students will be actively participating in the day to day, normal calving routine including detecting and sorting off “springers”, calf “watch”, detecting when intervention is needed and assisting delivery, caring for and monitoring newborns and dams for good health and early disease detection, tagging/processing new calves, treating calves needing intervention and performing other routine calving chores. Students need to provide their own transportation to the site and overnight stays at or near the production sites are required. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 426: Veterinary Toxicology

(Dual-listed with VDPAM 526). (Cross-listed with TOX). (3-0) Cr. 3. S.

Prereq: Third year classification in veterinary medicine

Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials.

VDPAM 428: Principles of Epidemiology and Population Health

(Dual-listed with VDPAM 528). (Cross-listed with V MPM). (3-0) Cr. 3. S.

Epidemiology of disease in populations. Disease causality and epidemiologic investigations. Issues in disease prevention, control, and eradication. This course is available on campus and by distance.

VDPAM 436: Beef Records Analysis

(0-30) Cr. 1. F.S.

Prereq: First, second or third year classification in veterinary medicine, or permission of instructor

Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Lab activities will allow students an opportunity to work with individual beef cattle producers to identify areas for improving profitability, health, and sustainability. Each semester's content builds on the material from the previous semester. Enrolling in the class for multiple semesters will be encouraged.

VDPAM 436A: Beef Records Analysis: Introduction

(0-30) Cr. 1. F.

Prereq: First, second or third year classification in veterinary medicine, or special permission of instructor

Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Lab activities will allow students an opportunity to work with individual beef cattle producers to identify areas for improving profitability, health, and sustainability.

VDPAM 436B: Beef Records Analysis: Herd Management

(0-30) Cr. 1. S.

Prereq: First, second or third year classification in veterinary medicine, or special permission of instructor, VDPAM 436A

Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Lab activities will allow students an opportunity to work with individual beef cattle producers to identify areas for improving profitability, health, and sustainability.

VDPAM 436C: Beef Records Analysis: Cow/Calf Preventive Medicine
(0-30) Cr. 1. F.
Prereq: Second or third year classification in veterinary medicine, or special permission of instructor, VDPAM 436A, VDPAM 436B
Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Lab activities will allow students an opportunity to work with individual beef cattle producers to identify areas for improving profitability, health, and sustainability.

VDPAM 436D: Beef Records Analysis: Feedlot Production Medicine
(0-30) Cr. 1. S.
Prereq: Second or third year classification in veterinary medicine, or special permission of instructor, VDPAM 436A, VDPAM 436B, VDPAM 436C
Lectures will emphasize current production and evaluation techniques for feedlot production and students will develop a standard treatment protocol book. Topics include respiratory disease, receiving programs, nutrition, cattle handling and environmental issues.

VDPAM 445: Production Animal Clinical Medicine
(3-0) Cr. 3. S.
Prereq: Third year classification in veterinary medicine
Clinical diagnosis and treatment of diseases of swine, beef and dairy cattle, and small ruminants.

VDPAM 450: Disturbances of Reproduction
(4-0) Cr. 4. F.
Prereq: Third year classification in veterinary medicine
General principles of normal reproductive functions in addition to environment, management and diseases causing disturbances in reproduction. Cattle, Swine, Equine, Small Ruminant, and Small Animal species will be covered.

VDPAM 451: Clinical Embryo Transfer
Cr. 2. F.S.SS.
Prereq: Fourth year classification in veterinary medicine
Elective clinical assignment in techniques of embryo transfer. Primary species studied will be bovine but equine and small ruminant embryo transfer will be covered during appropriate seasons. Enrollment is limited to four students per two week session. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 455: Diagnostic Laboratory Practicum
Cr. 1. Repeatable. F.S.
Prereq: Fourth year classification in veterinary medicine
Practical experience and training in necropsy, recognition of gross lesions, diagnostic sample collection and test selection for the diagnosis of infectious, toxic, nutritional and metabolic diseases of small animal and production livestock species through exposure to diagnostic cases submitted to the ISU Veterinary Diagnostic Laboratory.

VDPAM 456: Veterinary Diagnostic Lab Methods & Applications
(16-0) Cr. 1. F.
Prereq: Second or third year classification in veterinary medicine
Case materials are used to develop diagnostic questions and to better understand the value of diagnostic tests. Testing methods and interpretation of diagnostic tests are coupled with sampling strategy and objective assessment of available evidence to provide accurate diagnosis.

VDPAM 465: Animal Welfare Clinical Rotation
Cr. 2. F.SS.
Prereq: Fourth year classification in veterinary medicine
Two-week course for senior veterinary students to gain skills for collecting and interpreting animal welfare data, aid clients with identifying and achieving welfare goals, and assisting law enforcement with animal cruelty response. Field trips to food animal and companion animal facilities are mandatory.

VDPAM 471: Theriogenology: Food Animal
Cr. 2. Repeatable.
Prereq: Fourth year classification in veterinary medicine.
Elective clinical assignment in Food Animal Theriogenology involving male and female breeding soundness exams, dystocia management, advanced diagnostic and surgical procedures, surgical and nonsurgical insemination programs in small ruminants, and semen cryopreservation. Medical and surgical correction of reproductive disorders in cattle, swine and small ruminants. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 476: Food Animal and Camelid Field Service
Cr. 1-2. Repeatable. F.S.SS.
Prereq: VDPAM 310; Fourth year classification in Veterinary Medicine
Elective course in food animal and camelid field services. Students will assist university veterinarians in delivering health care and production management services to the ISU livestock farms and other livestock farms in the local area. Focus will be on delivery of individual animal care and herd health. Focus on the establishment of best practices for herd management of production systems at the university and in the region. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 477: Food Animal and Camelid Medicine and Surgery
Cr. 2. Repeatable. F.S.SS.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment focused on the management of food animal and camelid medicine and surgery cases. Specific instruction in clinical evaluation of cases coupled with appropriate diagnostic testing and therapeutic intervention will be emphasized. Additional instruction will be provided in disease prevention, intensive care and management of food animal and camelid species. Particular emphasis will be placed on appropriate on-label and extra-label drug usage in food animal species. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 479: Applied Swine Production Medicine Preceptorship
(0-30) Cr. 1-6. Repeatable. F.S.SS.
Prereq: VDPAM 310; Fourth year classification in Veterinary Medicine
Preceptorship course in swine production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will be preceptorships with a practicing veterinarian and/or a production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 480: Swine Production Medicine
(15-25) Cr. 2. Repeatable. F.S.SS.
Prereq: VDPAM 310; Fourth year classification in Veterinary Medicine or permission of instructor
Two week clinical rotation in swine production medicine. Students will be assigned to take the lead in investigating field based client cases with supervision of the instructors. Development of critical thinking skills that will allow students to apply concepts of herd management, production analysis, economic analysis, and disease prevention in addressing client cases. Variable amounts of travel to farm sites will be required with the potential for rare overnight stays. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 481: Advanced Cow/Calf Production Medicine
(Dual-listed with VDPAM 581). (20-20) Cr. 2. S.
Prereq: Completion of two semesters of VDPAM 436 or UNL equivalent (V MED 596 Cattle Production), fourth year classification in veterinary medicine
Two-week senior elective that will focus on the economics of animal disease in cow/calf operations. Evidence based medicine and epidemiological principles will be used in investigation of disease outbreaks. Extensive partial budgeting used. Students will complete at least two disease investigations involving outbreaks in commercial cow/calf operations and communicate their findings to the class, the herd owner, and local practitioner. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 482: Applied Beef Production Medicine Preceptorship
Cr. 1-6. Repeatable. F.S.SS.
Prereq: VDPAM 310; Fourth year classification in veterinary medicine
Advanced course in beef production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will include preceptorships with a practicing veterinarian and/or a production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 483: Beef Production Medicine
(15-20) Cr. 2. F.
Prereq: VDPAM 310; fourth year classification in veterinary medicine
Two week advanced clinical rotation in beef production medicine. Fifteen hours recitation/discussion and 20 hours clinical experience per week. This course is designed to expose students to cow-calf and feedlot production concepts. The activities scheduled for the rotation depend greatly on the time of year. Whenever possible, the class incorporates field trips. Students should anticipate that travel, including overnight stays, may be required. These field trips can vary in length from several hours to several days and may include weekends. Typically, 3-4 days of the rotation are spent at the Great Plains Veterinary Education Center, Clay Center, NE. Students should, therefore, plan accordingly and contact the instructor, immediately, if they anticipate a conflict. Students should not schedule Grand Rounds during this rotation. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 484: Dairy Production Medicine
(15-20) Cr. 2. F.SS.
Prereq: VDPAM 310; fourth year classification in veterinary medicine
Two week course in dairy production medicine combining class time with multiple on-farm visits to learn various management aspects (DHIA, DC305 & PC Dart record analysis, calf rearing through lactating cows, reproduction programs, udder health and milk quality, biosecurity, welfare, nutrition and cow comfort) for a wide variety of dairy operations. Students will learn the latest in dairy management by reviewing current topic articles and gain experience in farm evaluation through a group project. Fifteen hours recitation/discussion and 20 hours clinical experience per week. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 485: Applied Dairy Production Medicine Preceptorship
(0-30) Cr. 1-6. Repeatable. F.S.SS.
Prereq: VDPAM 310; fourth year classification in veterinary medicine
Advanced course in dairy production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will include preceptorships with a practicing veterinarian and/or a production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 486: Introduction to Small Ruminant Production Medicine
(15-0) Cr. 1. S.
Prereq: Third year classification in veterinary medicine or permission of instructor.
Survey of small ruminant production systems, common management practices, and disease processes of small ruminants. This course is intended to give the student a background in small ruminant medicine. Herd health, disease monitoring and prevention, and typical management systems will be emphasized in lecture.

VDPAM 487: Livestock Disease Prevention
(3-0) Cr. 3. F.
The course is designed for both the pre-veterinary and animal science majors who have an interest in production animal health, disease prevention methods, epidemiology of economically important agents, and the ecology of currently important pathogens found in North American livestock industries. It will focus on disease prevention principles for individuals and large production population systems.

VDPAM 488: Laboratory in Clinical Microbiology
Cr. 1. Repeatable. F.S.
Prereq: Fourth year classification in veterinary medicine
Application of microbiological procedures to the diagnosis of infectious diseases.

VDPAM 489: Issues in Food Safety
(Cross-listed with AN S, FS HN, HSP M). (1-0) Cr. 1. S.
Prereq: Credit or enrollment in FS HN 101 or FS HN 272 or HSP M 233; FS HN 419 or FS HN 420; FS HN 403
Capstone seminar for the food safety minor. Case discussions and independent projects about safety issues in the food system from a multidisciplinary perspective.

VDPAM 490: Independent Study
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of department chair

VDPAM 491: Advanced Ruminant Nutrition
(30-10) Cr. 2. F.
Focus on dairy nutrition and balancing rations from the calf to the adult, lactating cow. Introduction to different feedstuffs and forage varieties to determine those that are best suited to bovine diets. This course is held the week immediately prior to the start of the fall semester. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 494: Advanced Dairy Production Medicine
(20-20) Cr. 2. S.
Prereq: VDPAM 484 or permission of instructor
Advanced course in investigating dairy herd problems relating to milk quality or nutrition. Milk quality and nutrition troubleshooting will be taught through the combination of lecture and on-farm investigations. Students will combine lecture knowledge, data acquired from on-farm investigations and record analysis to generate management plans. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 495: Advanced Small Ruminant Production Medicine
(15-20) Cr. 2. F.S.
Prereq: VDPAM 486, fourth year classification in veterinary medicine, or permission of instructor
Two week clinical rotation in small ruminant production medicine. Field trips (including overnight stays) will be incorporated when possible. Topics to be covered include small ruminant industries (milk, meat, and fiber), milk quality, nutrition, reproduction, and disease management of small ruminants. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 496: International Preceptorship
(Dual-listed with VDPAM 596). Cr. 1-12. Repeatable. F.S.SS.
Prereq: Second, third or fourth year classification in veterinary medicine
International Preceptorships and Study Abroad Group programs.
This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

VDPAM 507: Evidence Based Clinical Decision Making
(Dual-listed with VDPAM 407). (1-0) Cr. 1. S.
Prereq: Permission of instructor
Discussion, lectures and laboratories to assess the quality and significance of medical evidence in making informed decisions about the treatment of individual animals and animal populations.

VDPAM 508: Poultry Diseases
(Dual-listed with VDPAM 408). Cr. 2. Alt. S., offered even-numbered years.
Prereq: Second or third year classification in veterinary medicine or permission of instructor
Bacterial, viral, parasitic, and nutritional diseases of domestic poultry and gamebirds; biosecurity, immunization, and management procedures to prevent poultry diseases.

VDPAM 514: Veterinary Practice Entrepreneurship
(Dual-listed with VDPAM 414). Cr. 2-3. S.
Prereq: Classification in veterinary medicine
Formal exposure to the entrepreneurial and business skills necessary to own and operate a successful veterinary practice or other small business opportunity. Personal finance, marketing, human resource management, general accounting, site assessment, location demographics, practice valuation, and a host of other issues which must be considered when purchasing or starting a new business are covered. Class instruction will be delivered by successful practice and business owners with examples from real world experience.

VDPAM 526: Veterinary Toxicology
(Dual-listed with VDPAM 426). (Cross-listed with TOX). (3-0) Cr. 3. S.
Prereq: Third year classification in veterinary medicine
Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials.

VDPAM 527: Applied Statistical Methods in Population Studies
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 401
ANOVA, Linear Regression, Model Selection, Mixed Models, ANCOVA, Repeated Measurement Analysis, MANOVA, Nonparametric Methods, Diagnostic Test Evaluation, ROC Curve Analysis, Generalized Linear Models, Logistic Regression, Survival Analysis, Cox Proportional Hazards Regression. This course is available on campus and by distance.

VDPAM 528: Principles of Epidemiology and Population Health
(Dual-listed with VDPAM 428). (Cross-listed with V MPM). (3-0) Cr. 3. S.
Epidemiology of disease in populations. Disease causality and epidemiologic investigations. Issues in disease prevention, control, and eradication. This course is available on campus and by distance.

VDPAM 529: Epidemiological Methods in Population Research
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 401
Designing, conducting, and analyzing outcomes from field-based studies, including cross-sectional, case-control, cohort, and clinical trials with categorical outcomes. This course is available on campus and by distance.

VDPAM 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

VDPAM 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

VDPAM 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

VDPAM 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

VDPAM 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

VDPAM 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

VDPAM 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

VDPAM 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

VDPAM 546: Clinical and Diagnostic Toxicology
(Cross-listed with TOX). (0-3) Cr. 1-3. Repeatable. F.S.SS.
Prereq: D.V.M. degree or VDPAM 526
Advanced study of current problems and issues in toxicology. Emphasis on problem solving utilizing clinical, epidemiological, and laboratory resources.

VDPAM 551: Advanced Veterinary Diagnostic Medicine
(0-3) Cr. 1-3. Repeatable. F.S.SS.
Prereq: VDPAM 455
Laboratory diagnosis of animal diseases with emphasis on gross and microscopic lesion description. Caseload is focused heavily on infectious diseases of food animals.

VDPAM 570: Risk Assessment for Food, Agriculture and Veterinary Medicine
(Cross-listed with AGRON, TOX). (3-0) Cr. 3. F.
Prereq: Statistics 300-level or higher.
Risk assessment principles as applied to biological systems. Exposure and effects characterization in human and animal health and ecological risk assessment. Risk analysis frameworks and regulatory decision-making. Introduction to quantitative methods for risk assessment using epidemiological and distributional analysis. Uncertainty analysis. This course is available only by distance.

VDPAM 581: Advanced Cow/Calf Production Medicine
(Dual-listed with VDPAM 481). (20-20) Cr. 2. S.
Prereq: Completion of two semesters of VDPAM 436 or UNL equivalent (V MED 596 Cattle Production), fourth year classification in veterinary medicine
Two-week senior elective that will focus on the economics of animal disease in cow/calf operations. Evidence based medicine and epidemiological principles will be used in investigation of disease outbreaks. Extensive partial budgeting used. Students will complete at least two disease investigations involving outbreaks in commercial cow/calf operations and communicate their findings to the class, the herd owner, and local practitioner. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Topics in medicine, surgery, theriogenology; beef, swine, dairy, or sheep production medicine.

VDPAM 596: International Preceptorship
(Dual-listed with VDPAM 496). Cr. 1-12. Repeatable. F.S.SS.
Prereq: Second, third or fourth year classification in veterinary medicine
International Preceptorships and Study Abroad Group programs.
This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

VDPAM 599: Creative Component
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in nonthesis master's degree program

Courses for graduate students:

VDPAM 650: Swine Diagnostic Medicine
Cr. 4. Alt. S., offered even-numbered years.
Prereq: Permission of instructor
A detailed study of swine diseases emphasizing the pathogenesis and diagnosis of swine respiratory, enteric, reproduction, metabolic, and septicemic diseases. Course activities include interpretation of diagnostic case reports and development of diagnostic plans for specific disease objectives.

VDPAM 654: Comparative Antimicrobial Clinical Pharmacology
Cr. 2. S.
Prereq: Graduate student, resident, or intern in College of Veterinary Medicine
Initial antimicrobial selection for infectious diseases of domestic animals. The antimicrobial drug groups will be examined, stressing pharmacokinetics, minimal inhibitory concentrations, and the use of these parameters to select appropriate compounds and dosages for maximum efficacy.

VDPAM 655: Advanced Swine Production Medicine
Cr. 4. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Detailed overview of applied techniques used in swine production medicine; production modeling and record analysis, facility design and management, analysis of competing intervention options, design and evaluation of therapeutic and vaccination strategies, quality control procedures and food safety. Course activities include interpretation of diagnostic case reports and development of diagnostic plans for specific disease objectives.

VDPAM 699: Research
Cr. arr. Repeatable.

Veterinary Microbiology and Preventive Medicine (V MPM)

Courses primarily for professional curriculum students:

V MPM 378: Case Study IV
(2-0) Cr. 2. S.
Prereq: Second-year classification in veterinary medicine
Case-based applied learning that relates to the basic science courses. Emphasis on early integration of basic and clinical science concepts.

V MPM 380: Veterinary Immunology
(2-0) Cr. 2. S.
Prereq: First-year classification in veterinary medicine
Structure and function of the immune system in animals.

V MPM 386: Veterinary Microbiology
(3-5) Cr. 5. F.
Prereq: Second-year classification in veterinary medicine
Bacteria and fungi of veterinary importance with emphasis on mechanisms of disease production and laboratory diagnostic procedures.

V MPM 387: Veterinary Virology
(3-0) Cr. 3. S.
Prereq: Second-year classification in veterinary medicine
Basic principles of animal virology. Pathogenesis of viral infections. The nature and ecology of viruses of veterinary and zoonotic importance.

V MPM 388: Public Health and the Role of the Veterinary Profession
(3-0) Cr. 3. S.
Prereq: Second-year classification in veterinary medicine
Fundamental epidemiology, zoonotic diseases, occupational health, food safety, other public health topics.

V MPM 390: Topics in Veterinary History
(1-0) Cr. 1. F.S.
An overview of the history of veterinary medicine focused primarily on disease-specific events. A review of the historical aspects of the veterinary profession's accomplishments in the discovery of the etiological origins of disease and their subsequent control will provide students with insights that are applicable to understanding and solving today's animal and human health challenges.

V MPM 409: Infectious Diseases of Wild Animals
(0-2) Cr. 1. F.S.
Prereq: Second year classification in veterinary medicine
Infectious diseases (bacterial, viral, and mycotic) of non-human primates, birds, ruminants, cold-blooded animals, marine mammals, and carnivores.*Spring only offered to UNL students.

V MPM 428: Principles of Epidemiology and Population Health
(Dual-listed with V MPM 528). (Cross-listed with VDPAM). (3-0) Cr. 3. S.
Epidemiology of disease in populations. Disease causality and epidemiologic investigations. Issues in disease prevention, control, and eradication. This course is available on campus and by distance.

V MPM 437: Infectious Diseases and Preventive Medicine
(3-0) Cr. 3. S.
Prereq: Third-year classification in veterinary medicine
Etiology, epidemiology, laboratory diagnosis, regulatory control and preventive medicine aspects of the infectious diseases of swine, sheep, goats, cattle and horses.

V MPM 486: Laboratory in Public Health
Cr. 2. Repeatable. F.S.SS.
Prereq: Fourth-year classification in veterinary medicine
Discussions, lectures, exercises and field trips related to veterinary public health.

V MPM 490: Independent Study
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor and department chair

V MPM 491: CDC Epidemiology Elective Preceptorship
Cr. 6. F.S.SS.
Prereq: Written permission of instructor
Introduction to preventive medicine, public health and the principles of applied epidemiology within the working atmosphere of the Centers for Disease Control and Prevention.

V MPM 494: Zoo Preceptorship
Cr. 1-8. Repeatable. F.S.SS.
Prereq: Fourth year classification in veterinary medicine
Elective course in zoo veterinary practice under guidance of approved veterinarians.

V MPM 496: International Preceptorship
(0-40) Cr. 1-12. Repeatable. F.S.SS.
Prereq: Second-year classification in veterinary medicine
International Preceptorships and Study Abroad group programs. This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

V MPM 501: Basic Principles of Microbiology
Cr. 3. F.
The general principles of bacteriology, immunology and virology will be discussed. The structure and function of bacteria and viruses, the mechanisms of pathogenesis, and the host response to infectious agents will be reviewed. Vaccines, their failures, and new developments in vaccine development will be explored.

V MPM 502: Microbial Genetics and Genomics
(Cross-listed with MICRO). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MICRO 302, BIOL 313
The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of both vertical and horizontal genetic information transfer, gene regulation, and genetic approaches to study complex cellular processes. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics.

V MPM 520: Medical Immunology I
(4-0) Cr. 4. F.
Prereq: MICRO 310 or V MPM 386, 3 credits in biochemistry
Nature of the immune system and its role in health and disease. Credit for either V MPM 520 or 575, but not both may be applied toward graduation.

V MPM 525: Intestinal Microbiology
(Cross-listed with MICRO). Cr. 3. Alt. S., offered even-numbered years.
Prereq: Micro 302, BIOL 313
Overview of commensal microbiota in the health and well-being of vertebrates. Topics include diversity of intestinal structure, microbial diversity/function, innate immune development, community interactions and metabolic diseases associated with alterations of the intestinal microbiome.

V MPM 528: Principles of Epidemiology and Population Health
(Dual-listed with V MPM 428). (Cross-listed with VDPAM). (3-0) Cr. 3. S.
Epidemiology of disease in populations. Disease causality and epidemiologic investigations. Issues in disease prevention, control, and eradication. This course is available on campus and by distance.

V MPM 536: Zoonoses and Environmental Health
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: V MPM 386, VMPM 387 and V MPM 388 or equivalent or permission of instructor
Pathogensis and control of zoonotic diseases. Factors influencing transmission and survival of pathogenic microorganisms in the environment.

V MPM 540: Livestock Immunogenetics
(Cross-listed with AN S, MICRO). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: AN S 561 or MICRO 575 or V MPM 520
Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance.

V MPM 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

V MPM 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

V MPM 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

V MPM 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

V MPM 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

V MPM 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

V MPM 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

V MPM 575: Immunology
(3-0) Cr. 3. S.
Prereq: MICRO 310
An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. Micro 475L optional. Credit for either Micro 575 or V MPM 520, but not both, may be applied toward graduation.

V MPM 586: Medical Bacteriology
(Cross-listed with MICRO). (4-0) Cr. 4. F.
Prereq: Permission of instructor
Bacteria associated with diseases of vertebrates, including virulence factors and interaction of host responses.

V MPM 586L: Medical Bacteriology Laboratory
(0-6) Cr. 2. F.
Prereq: credit or enrollment in V MPM 586 or V MPM 625
Procedures used in isolation and identification of pathogenic bacteria, including molecular and genetic techniques used in research.

V MPM 587: Animal Virology
(4-0) Cr. 4.
Prereq: Permission of instructor
Principles of animal virology. Biology of viruses associated with diseases of veterinary importance, including mechanisms of pathogenesis.

V MPM 590: Special Topics
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

V MPM 596: International Preceptorship
(0-40) Cr. 1-12. Repeatable. F.S.SS.
Prereq: Admission to graduate college
International Preceptorships and Study Abroad Group programs. This course will provide opportunties for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunties. Offered on a satisfactory-fail basis only.

V MPM 599: Creative Component
Cr. arr.
Prereq: Nonthesis M.S. Option only
A written report based on laboratory research, library reading, or topics related to the student's area of specialization and approved by the student's advisory committee.

Courses for graduate students:

V MPM 604: Seminar
(1-0) Cr. 1. Repeatable. F.
Offered on a satisfactory-fail basis only.

V MPM 608: Molecular Virology
(Cross-listed with MICRO, PL P). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or GDCB 511
Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis.

V MPM 615: Molecular Immunology
(Cross-listed with BBMB, MICRO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function.

V MPM 625: Mechanisms of Bacterial Pathogenesis
(Cross-listed with MICRO). (4-0) Cr. 4. Alt. S., offered odd-numbered years.
Prereq: Credit in Biochemistry and Microbiology
Review of current concepts in specific areas of microbial pathogenesis including the genetic basis for bacterial disease, genetic regulation and control of virulence factors and their mechanisms of action, and host-pathogen interactions at the cellular and molecular levels. The application of microbial genetics to understanding pathogenesis will be included.

V MPM 629: Advanced Topics in Cellular Immunology
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: V MPM 520 or V MPM 575
Current topics and literature in cellular immunology. Topics include thymocyte development and selection, T cell interactions with antigen presenting cells, and lymphocyte effector functions.

V MPM 660: Pathogenesis of Persistent Infections
(Cross-listed with V PTH). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Study of current knowledge related to host pathogen interactions during persistent and chronic infections by bacteria, viruses and parasites.

V MPM 690: Current Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

V MPM 690A: Current Topics: Immunology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

V MPM 690B: Current Topics: Infectious Diseases
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

V MPM 698: Seminar in Molecular, Cellular, and Developmental Biology
(Cross-listed with BBMB, GDCB, MCDB, MICRO). (2-0) Cr. 1-2. Repeatable. F.S.
Student and faculty presentations.

V MPM 699: Research
Cr. arr. Repeatable.

Veterinary Pathology (V PTH)

Courses primarily for professional curriculum students:

V PTH 342: Anatomic Pathology I
(Dual-listed with V PTH 542). (2-2) Cr. 3. S.
Prereq: for V PTH 342, prereq: First-year classification in veterinary medicine. For V PTH 542, prereq: Graduate classification and BIOL 352 or equivalent for graduate credit, permission of instructor.
Basic pathology with emphasis on disease in animals and introduction to diseases by system.

V PTH 353: Introductory Parasitology
(Cross-listed with BIOL, MICRO). (3-0) Cr. 3. S.
Prereq: BIOL 212
Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites.

V PTH 372: Anatomic Pathology II
(Dual-listed with V PTH 572). (3-3) Cr. 4. F.
Prereq: for V PTH 372, prereq: V PTH 342. For V PTH 572, prereq: Graduate classification and V PTH 542.
Response to injury by each body system.

V PTH 376: Veterinary Parasitology
(Dual-listed with V PTH 576). (3-3) Cr. 4. F.
Prereq: For V PTH 376, prereq: Second-year classification in veterinary medicine. For V PTH 576, prereq: Graduate classification and V PTH 542.
Parasitic diseases of domestic animals and their control.

V PTH 377: Case Study III
(0-4) Cr. 2. F.
Prereq: Second-year classification in veterinary medicine
Clinical applications of the basic sciences taught concurrently in the fall semester of the second year curriculum in veterinary medicine.

V PTH 401: Basics of Medical Terminology
(1-0) Cr. 1. F.
Discussion of prefixes, suffixes, and roots (mostly from Latin and Greek) that comprise medical terms.

V PTH 402: Introduction to Pathology
(Cross-listed with BIOL). (3-0) Cr. 3. S.
Prereq: BIOL 211 and BIOL 212 with labs
Introductory exploration of pathology as a medical discipline. This includes study of disease mechanisms via an introduction to general pathology topics (cell degeneration, necrosis, disturbances of growth, disturbances of blood flow, inflammation, neoplasia) and organ system-specific response to injury.

V PTH 409: Introduction to Veterinary Cytology and Laboratory Techniques
(0-2) Cr. 1. S.
Prereq: Third-year classification in veterinary medicine
Description, interpretation, and techniques for cellular preparations from tissues and body fluids.

V PTH 425: Clinical Pathology
(2-4) Cr. 4. S.
Prereq: V PTH 372
Principles of clinical hematology, clinical chemistry, and urinalysis in domestic animals.

V PTH 456: Necropsy Laboratory Practicum
Cr. 1. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Practicum in postmortem examination and diagnosis.

V PTH 457: Clinical Pathology Laboratory Practicum
Cr. 1. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Methodology in clinical chemistry, hematology and cytology; practice in interpretation of laboratory data.

V PTH 490: Independent Study
Cr. arr. Repeatable.
Prereq: Permission of instructor and department chair

V PTH 492: Orientation for International Experience
(2-0) Cr. 1. Repeatable. S.
Prereq: Classification in veterinary medicine
8 weeks. Predeparture orientation for group study abroad. Cultural considerations for the study abroad experience and a conversational language introduction. Out of class work will be assigned. Offered on a satisfactory-fail basis only.

V PTH 495: Clinical Competency Skills Checklist/Remediation
Cr. R. S.
Prereq: 4th year classification in Veterinary Medicine
In order to graduate, all 4th year veterinary students are required to complete a checklist of clinical procedures and complete any assigned remediation (based on evaluation in core clinical rotations). These requirements are tied to the college's AVMA COE accreditation, and this course is used to document completion of those requirements. Offered on a satisfactory-fail basis only.

V PTH 496: International Preceptorship
(0-40) Cr. 1-12. Repeatable. F.S.SS.
Prereq: Second-year classification in veterinary medicine
International Preceptorships and Study Abroad Group programs. This course will provide opportunities for students to be involved in applied clinical, production, and/or research experience in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

V PTH 503: Principles of Pathology
(3-0) Cr. 3. S.
Prereq: Graduate classification; permission of instructor
Introductory exploration of pathology as a medical discipline. This includes study of disease mechanisms via an introduction to general pathology topics (cell degeneration, necrosis, disturbances of growth, disturbances of blood flow, inflammation, neoplasia) and organ system-specific response to injury.

V PTH 530: Teaching and Learning in Veterinary Medical Education
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Study of principles of teaching and learning as they relate to veterinary medical education. These include: theories of learning, analyzing content/learners/context, identifying goals, identifying appropriate instructional strategies (specific to medical education), matching assessment processes to goals and strategies, common curricular approaches and decision-making processes in medical education, and the scholarship of teaching and learning for veterinary medical educators.

V PTH 542: Anatomic Pathology I
(Dual-listed with V PTH 342). (2-2) Cr. 3. S.
Prereq: for V PTH 342, prereq: First-year classification in veterinary medicine. For V PTH 542, prereq: Graduate classification and BIOL 352 or equivalent for graduate credit, permission of instructor.
Basic pathology with emphasis on disease in animals and introduction to diseases by system.

V PTH 548: Diagnostic Parasitology Laboratory
Cr. 1-3. Repeatable. F.S.SS.
Prereq: V PTH 376 or V PTH 576
Contact hours are (0-3 to 0-9). A laboratory experience in the technical and applied aspects of veterinary parasitology.

V PTH 549: Clinical Pathology Laboratory
(0-3) Cr. 1. Repeatable. F.S.SS.
Prereq: V PTH 457; permission of instructor
Laboratory procedures and clinical interpretations with emphasis on hematology, cytology, and clinical chemistry. Offered on a satisfactory-fail basis only.

V PTH 550: Surgical Pathology Laboratory
Cr. 1-3. Repeatable. F.S.SS.
Prereq: V PTH 570 or V PTH 571; permission of instructor
Contact hours are (0-3 to 0-9). Diagnosis of lesions in biopsy specimens; classification of neoplasms. Course includes rotation through departmental biopsy service and review of selected cases from departmental archives. Offered on a satisfactory-fail basis only.

V PTH 551: Postmortem Pathology Laboratory
Cr. 1-3. Repeatable. F.S.SS.
Prereq: V PTH 542; permission of instructor
Contact hours are (0-3 to 0-9). Necropsy techniques of animals with emphasis on gross and microscopic lesions and diagnosis. Offered on a satisfactory-fail basis only.

V PTH 554: Ethics in Scientific Research and Writing
(1-0) Cr. 1. Alt. S., offered even-numbered years.
Prereq: Graduate classification
Ethical conduct in biomedical research, criticism, writing, and adherence to regulations. Offered on a satisfactory-fail basis only.

V PTH 570: Systemic Pathology I
(4-0) Cr. 4. Alt. F., offered even-numbered years.
Prereq: V PTH 342 or V PTH 542; permission of instructor
Pathology of the respiratory, reproductive, endocrine, musculoskeletal, and cardiovascular systems. Emphasis on pathogenesis and anatomic pathology correlated with interpretive clinical pathology where appropriate.

V PTH 571: Systemic Pathology II
(4-0) Cr. 4. Alt. F., offered odd-numbered years.
Prereq: V PTH 342 or V PTH 542; permission of instructor
Pathology of the integumentary, urinary, digestive, lymphoid, and nervous systems and special senses. Emphasis on pathogenesis and anatomic pathology correlated with interpretive clinical pathology where appropriate.

V PTH 572: Anatomic Pathology II
(Dual-listed with V PTH 372). (3-3) Cr. 4. F.
Prereq: for V PTH 372, prereq: V PTH 342. For V PTH 572, prereq: Graduate classification and V PTH 542.
Response to injury by each body system.

V PTH 576: Veterinary Parasitology
(Dual-listed with V PTH 376). (3-3) Cr. 4. F.
Prereq: For V PTH 376, prereq: Second-year classification in veterinary medicine. For V PTH 576, prereq: Graduate classification and V PTH 542.
Parasitic diseases of domestic animals and their control.

V PTH 590: Special Topics
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor

V PTH 590A: Special Topics: Veterinary Pathology
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor

V PTH 590B: Special Topics: Veterinary Parasitology
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor

V PTH 590C: Special Topics: Veterinary Toxicology
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor

V PTH 590D: Special Topics: Veterinary Clinical Pathology
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor

V PTH 590E: Special Topics: Other
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor

V PTH 596: International Preceptorship
(0-40) Cr. 1-12. Repeatable. F.S.SS.
Prereq: Admission to graduate college
International Preceptorships and Study Abroad Group programs. This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

V PTH 599: Creative Component Research
Cr. arr. Repeatable.
Course for departmental graduate research.

V PTH 599A: Creative Component Research: Veterinary Pathology
Cr. arr. Repeatable.
Course for departmental graduate research.

V PTH 599B: Creative Component Research: Veterinary Parasitology
Cr. arr. Repeatable.
Course for departmental graduate research.

V PTH 599C: Creative Component Research: Veterinary Toxicology
Cr. arr. Repeatable.
Course for departmental graduate research.

V PTH 599D: Creative Component Research: Veterinary Clinical Pathology
Cr. arr. Repeatable.
Course for departmental graduate research.

Courses for graduate students:

V PTH 604: Pathology Case Seminar
Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Description and interpretation of microscopic lesions and clinical pathology data collected from cases of natural and experimental disease. Offered on a satisfactory-fail basis only.

V PTH 605: Current Topics Seminar
Cr. 1. Repeatable. F.S.SS.
A seminar of graduate research at the time of thesis or dissertation defense.

V PTH 606: Diagnostic Interpretation
Cr. R. F.S.SS.
Prereq: permission of instructor
A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination.

V PTH 606A: Diagnostic Interpretation: Veterinary Pathology
Cr. R. F.S.SS.
Prereq: permission of instructor
A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination.

V PTH 606B: Diagnostic Interpretation: Veterinary Parasitology
Cr. R. F.S.SS.
Prereq: permission of instructor
A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination.

V PTH 606C: Diagnostic Interpretation: Veterinary Toxicology
Cr. R. F.S.SS.
Prereq: permission of instructor
A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination.

V PTH 606D: Diagnostic Interpretation: Veterinary Clinical Pathology
Cr. R. F.S.SS.
Prereq: permission of instructor
A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination.

V PTH 652: Pathologic Hematology
(2-2) Cr. 3.
Prereq: V PTH 425; permission of instructor
Pathologic changes in blood constituents of domestic animals.

V PTH 655: Cellular and Molecular Pathology I
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Graduate course in biochemistry, genetics, or cell biology
Cellular and molecular mechanisms of cell injury, cellular responses to injury, and inflammation.

V PTH 656: Cellular and Molecular Pathology II
(Cross-listed with TOX). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Graduate course in biochemistry, genetics, or cell biology
Cellular and molecular mechanisms of carcinogenesis.

V PTH 660: Pathogenesis of Persistent Infections
(Cross-listed with V MPM). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Study of current knowledge related to host pathogen interactions during persistent and chronic infections by bacteria, viruses and parasites.

V PTH 661: Comparative Immunology and Infectious Disease
(Cross-listed with IMBIO). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Graduate level Immunology or permission of instructor.
Discuss and define similarities and differences of varied host responses to infectious challenge. Learning will focus on comparative aspects of the host response and the unique aspects of immunity from different organisms, while highlighting molecular and mechanistic similarities of pathogen recognition, response and resolution.

V PTH 663: Clinical Chemistry
(2-2) Cr. 3.
Prereq: V PTH 425; permission of instructor
The pathophysiology, methodology, and clinical application of laboratory medicine.

V PTH 679: Histopathology of Laboratory Animals
(1-2) Cr. 2.
Prereq: V PTH 570 or V PTH 571; permission of instructor
Study of microscopic lesions in laboratory animals with emphasis on description, etiology, pathogenesis, and diagnosis.

V PTH 699: Research
Cr. arr. Repeatable.
Course restricted to graduate program within the department.

V PTH 699A: Research: Veterinary Pathology
Cr. arr. Repeatable.
Course restricted to graduate program within the department.

V PTH 699B: Research: Veterinary Parasitology
Cr. arr. Repeatable.
Course restricted to graduate program within the department.

V PTH 699C: Research: Veterinary Toxicology
Cr. arr. Repeatable.
Course restricted to graduate program within the department.

V PTH 699D: Research: Veterinary Clinical Pathology
Cr. arr. Repeatable.
Course restricted to graduate program within the department.

Wind Energy Science, Engineering and Policy (WESEP)

Courses primarily for graduate students, open to qualified undergraduates:

WESEP 501: Wind Energy Resources
(3-0) Cr. 3.
Prereq: Graduate standing
Forecasting, wind measurement and analysis, site placement, aerodynamic principles associated with blade design, power generation technologies, power electronic topologies used in wind energy conversion, collection circuits, and grid operation with high wind penetration.

WESEP 502: Wind Energy Systems
(3-0) Cr. 3.
Prereq: Graduate standing
Systems approach to wind turbine design, manufacturing, installation, integrated with wind economics and policy issues. Topics include manufacturing practices used to produce wind turbines, construction practices, sensing and inspection technologies used in monitoring wind farm health, and the impact of policy making on the wind energy industry.

WESEP 511: Wind Energy System Design
(3-0) Cr. 3.
Prereq: WESEP 501 and WESEP 502
Advanced design, control, and operation of wind plants. Topics include electromechanical energy conversion systems, aerodynamic and aeroelastic loads, optimal control of wind farms, life cycle management strategies, tall tower design, and prediction of component residual life.

WESEP 590: Special Topics
Cr. 1-3. Repeatable.
Advanced study of a research topic in the field of wind energy, science, engineering, and policy.

WESEP 594: Wind Energy Real-Time Research Collaborative Seminar
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Graduate standing
Identifying current wind energy research issues and conducting components of the research cycle in real-time, including proposal development, investigation/analysis/discovery, publication and presentation, ethical behavior, and leadership.

Women's Studies (W S)

Courses primarily for undergraduates:

W S 160: Gender Justice
(2-0) Cr. 1. F.S.
Half semester course. Examines the socialization process in the United States and how our perspectives are formed. An introduction to patriarchy, sexism, and ally development are explored. Skills to enhance communication and understanding among women and men will be developed. Offered on a satisfactory-fail basis only.
Meets U.S. Diversity Requirement

W S 201: Introduction to Women's Studies
(3-0) Cr. 3.
Introduction to the interdisciplinary field of Women's Studies. Contemporary status of women in the U.S. and worldwide from social, economic, historical, political, philosophical and literary perspectives. Analysis of intersection of gender, race, class, and sexuality. Subject matter includes work, health, sexuality, and violence. Foundation for the other courses in the program.
Meets U.S. Diversity Requirement

W S 203: Introduction to Lesbian Studies
(3-0) Cr. 3. S.
Study of contemporary and historic lesbian cultures and communities from a US and international perspective. Addresses issues of race, class, gender and sexuality as they intersect with the formation of lesbian identities. Explores who identifies as lesbian and how that dis/enables political resistance and formation of community.
Meets U.S. Diversity Requirement

W S 205: Introduction to Queer Studies
(3-0) Cr. 3. F.
Prereq: ENGL 150
Interdisciplinary study of issues relating to lesbian, gay, bisexual, transgender, and queer identities in the U.S. Attention will be given to race and socioeconomic class.
Meets U.S. Diversity Requirement

W S 301: International Perspectives on Women and Gender
(3-0) Cr. 3. F.S.
Prereq: W S 201 or 3 credits in Women's Studies at the 300 level or above
Study of women in a range of cultures, depending on faculty specialization. Special emphasis on women in development seen in postcolonial context.
Meets International Perspectives Requirement.

W S 307: Women in Science and Engineering
(Cross-listed with BIOL). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: a 200 level course in science, engineering or women's studies; ENGL 250
The interrelationships of women and science and engineering examined from historical, sociological, philosophical, and biological perspectives. Factors contributing to under-representation; feminist critiques of science; examination of successful strategies. Does not satisfy biology major advanced credit requirements.
Meets U.S. Diversity Requirement

W S 308: Write Like a Woman
(Cross-listed with ENGL). (3-0) Cr. 3. F.
Prereq: ENGL 250
Writing and reading interpretive fiction written by women. Emphasis on stories that embody a female literary life, gender-specific ways of creating characters and conflicts, analytical reading and writing, workshop criticism and shared commentaries. Includes multi-modal projects.

W S 320: Ecofeminism
(Cross-listed with ENV S). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: W S 201 or 3 credits in Women's Studies at the 300 level or above
Women's relationships with the earth, non-human nature, and other humans. The course explores the connections between society's treatment of women and nature; origins of ecofeminism and how it relates to the science of ecology, conventional and sustainable agriculture as well as how ecofeminism relates to other branches of feminist philosophy. Evaluation and critique of modern science, technology, political systems and SOLUTIONS will be included.

W S 321: Economics of Discrimination
(Cross-listed with ECON). (3-0) Cr. 3.
Prereq: ECON 101
Economic theories of discrimination. Analysis of the economic problems of women and minorities in such areas as earnings, occupations, and unemployment. Public policy concerning discrimination. Poverty measurement and antipoverty programs in the U.S.
Meets U.S. Diversity Requirement

W S 323: Gender and Communication
(Cross-listed with SP CM). (3-0) Cr. 3.
Examines how understanding and enactment of gender identity is shaped by communication. Verbal and nonverbal communication across various contexts including personal relationships and the media. Explores discourse of social movements aiming to transform cultural definitions of gender.
Meets U.S. Diversity Requirement

W S 325: Portrayals of Gender and Sexualities in the Media
(3-0) Cr. 3.
Prereq: Sophomore classification
Survey of how the media and popular culture portray gender and sexualities and the impact on individuals and society. Images of women, men, transgender as well as heterosexual, non-heterosexual and others. Studies both historical and emerging images in the media in terms of stereotypes and positive images.
Meets U.S. Diversity Requirement

W S 327: Sex and Gender in Society
(Cross-listed with SOC). (3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
How the biological fact of sex is transformed into a system of gender stratification. The demographics and social positions of women and men in the family, education, media, politics, and the economy. Theories of the social-psychological and sociological bases for behavior and attitudes of women and men. The relationship between gender, class, and race.
Meets U.S. Diversity Requirement

W S 328: Sociology of Masculinities and Manhood
(Cross-listed with SOC). (3-0) Cr. 3. S.
Prereq: SOC 134 or W S 201
Examination of socially constructed and idealized images of manhood, the nature of social hierarchies and relations constructed on the basis of imagery, ideologies, and norms of masculinity. Theories on gender (sociological, psychological, and biological). Particular attention given to theory and research on gender variations among men by race, class, ethnicity, sexual orientation, physical ability and age.
Meets U.S. Diversity Requirement

W S 333: Women and Leadership
(Cross-listed with LD ST). (3-0) Cr. 3.
Prereq: Sophomore classification
This course will examine historical and contemporary barriers to and opportunities for women's leadership in a variety of contexts, including professions and public service. It will examine theories of women's leadership, gender differences in leadership styles, and the perceptions and expectations about women's leadership. Multiple perspectives of women's leadership will be highlighted through lectures, readings, videos, guest speakers and group work.
Meets U.S. Diversity Requirement

W S 336: Women and Religion
(Cross-listed with RELIG). (3-0) Cr. 3. F.
Prereq: RELIG 205, RELIG 210 or W S 201 recommended
Examines the status of women in various religions, feminist critiques of religious structures and belief systems, and contemporary women's spirituality movements.
Meets U.S. Diversity Requirement

W S 338: Feminist Philosophy
(Cross-listed with PHIL). (3-0) Cr. 3. F.
Prereq: 3 credits in philosophy or women's studies recommended
A critical, theoretical examination of the oppression of women, especially as it relates to issues of race, class, and sexual orientation. How concepts such as sex and gender, self and other, nature and nurture, complicate our understanding of what it means to be a woman. Historical and contemporary feminist philosophers addressing topics such as violence, sexuality, pornography, political power, family structure and women's paid and unpaid labor.
Meets U.S. Diversity Requirement

W S 340: Women's Literature
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 250
Historical and thematic survey of literature by and about women. May include autobiographies, journals, letters, poetry, fiction, and drama.
Meets U.S. Diversity Requirement

W S 342: American Indian Women Writers
(Cross-listed with AM IN, ENGL). (3-0) Cr. 3.
Prereq: ENGL 250
Literature of American Indian women writers which examines their social, political, and cultural roles in the United States. Exploration of American Indian women's literary, philosophical, and artistic works aimed at recovering elements of identity, redescribing stereotypes, resisting colonization, and constructing femininity.
Meets U.S. Diversity Requirement

W S 344: Human Reproduction
(Cross-listed with BIOL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 212
Biology of human reproduction, including reproductive systems, hormones, and endocrinology of pregnancy, presented from a clinically-oriented perspective. Reviews health-related conditions such as infertility, sexually-transmitted diseases, and complicated pregnancy.

W S 345: Women and Literature: Selected Topics
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250
Literature by women and/or dealing with the images of women, e.g., study of individual authors or related schools of authors; exploration of specific themes or genres in women's literature; analysis of recurrent images of women in literature.
Meets U.S. Diversity Requirement

W S 346: Psychology of Women
(Cross-listed with PSYCH). (3-0) Cr. 3. S.
Prereq: 2 courses in psychology including PSYCH 101
Survey of theory and research related to major biological, interpersonal, and cultural issues affecting girls' and women's psychological development and behavior.
Meets U.S. Diversity Requirement

W S 350: Women of Color in the U.S
(Cross-listed with AF AM). (3-0) Cr. 3. S.
Prereq: 3 credits in Women's Studies or African American Studies
Economic, social, political and cultural roles of Women of Color in the U.S. Includes literary, philosophical, and artistic expressions. Myths and realities explored.
Meets U.S. Diversity Requirement

W S 352: Gay and Lesbian Literature
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 250
Literary portrayals of gay and lesbian lives and relationships from many different genres. Attention to changing definitions and representations of sexual orientation and gender identity over time.
Meets U.S. Diversity Requirement

W S 370: Studies in English Translation
(3-0) Cr. 3.
Readings, discussions, and papers in English.
Meets International Perspectives Requirement.

W S 370F: Studies in English Translation: French Topics on Women and Gender Studies
(Cross-listed with FRNCH). (3-0) Cr. 3. Repeatable.
Topics vary according to faculty interest. Readings, discussions, and papers in English.
Meets International Perspectives Requirement.

W S 370G: Studies in English Translation: German Topics on Women or Feminism
(Cross-listed with GER). (3-0) Cr. 3-4. Repeatable, maximum of 6 credits.
Prereq: Sophomore classification. For fourth credit, 6 credits in German at the 300 level
Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Three credits: English, open to all students. Four credits: Required for German concentration credit, supplementary readings and compositions in German.
Meets International Perspectives Requirement.

W S 370R: Studies in English Translation: Russian Topics on Women or Feminism
(Cross-listed with RUS). (3-0) Cr. 3. Repeatable.
Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English.
Meets International Perspectives Requirement.

W S 370S: Studies in English Translation: Hispanic Topics on Women or Feminism
(Cross-listed with SPAN). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English. May not be counted as a prerequisite.
Meets International Perspectives Requirement.

W S 374: Sex, Gender, and Culture in the Ancient Mediterranean World
(Cross-listed with CL ST, HIST). (3-0) Cr. 3. S.
Prereq: Any one course in Cl St, W S, Latin, or Greek
Chronological and topical survey of the status of women and men, focusing on sex and gender issues in the Ancient Mediterranean world; study of constructs of the female and the feminine. Readings from ancient and modern sources. Emphasis on ancient Greece, Rome, and Egypt.
Meets International Perspectives Requirement.

W S 380: History of Women in Science, Technology, and Medicine
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
History of women's relationship to the fields of science, technology, and medicine, as students and professionals, consumers, subjects and patients, family members, workers and citizens. Concentrates especially on 19th and 20th century United States, concluding with an examination of current issues of special interest to women in science, technology, and medicine.
Meets U.S. Diversity Requirement

W S 385: Women in Politics
(Cross-listed with POL S). (3-0) Cr. 3. S.
Examination of the entry and participation of women in politics in the United States and other countries including a focus on contemporary issues and strategies for change through the political process.
Meets U.S. Diversity Requirement

W S 386: History of Women in America
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
A survey of social, economic, and political aspects of women's role from colonial era to present; emphasis on employment, education, concepts of sexuality, and changing nature of the home.
Meets U.S. Diversity Requirement

W S 401: Feminist Theories
(3-0) Cr. 3.
Prereq: W S 201 or 3 credits in Women's Studies at the 300 level or above
Current theories of feminism, the feminine and sexual difference. Topics in race, class, sexuality, and ethnicity as they are addressed in diverse feminisms. May include readings in lesbian, Black, postcolonial, psychoanalytic and postmodern thought.

W S 402: Feminist Research in Action
(3-0) Cr. 3. S.
Prereq: W S 201 and W S 301
Feminist research methods and scholarship. Class collaborates on a community research and action project to improve women's lives.

W S 422: Women, Men, and the English Language
(Cross-listed with ENGL, LING). (3-0) Cr. 3. S.
Prereq: ENGL 219 or LING 219
The ways men and women differ in using language in varied settings and the ways in which language both creates and reflects gender divisions.
Meets U.S. Diversity Requirement

W S 425: Intersections of Race, Class and Gender
(Dual-listed with W S 525). (3-0) Cr. 3.
Prereq: W S 201 and one additional W S course
Race, ethnicity, class and gender distinctions and intersections lead to inequitable distributions of power, social well-being, and resources. Explores how inequities are institutionalized and how multiple identities are experienced by women in daily life.

W S 435: Women and Development
(Dual-listed with W S 535). (3-0) Cr. 3.
Prereq: W S 301
Cross-cultural study of development utilizing both case studies and theoretical works. Explores the nature of women's roles in developing countries and the ways women and their needs have been excluded/included in development approaches, policies, and projects. Includes discussion of actual development projects as well as women's organizing.

W S 439: Goddess Religions
(Cross-listed with RELIG). (3-0) Cr. 3.
Prereq: RELIG 205 recommended
Exploration of the foundational myths of Goddess spirituality, including historical and cross-cultural female images of the divine and their modern usage by American women.

W S 444: Sex and Gender in Cross-cultural Perspective
(Dual-listed with W S 544). (Cross-listed with ANTHR). (3-0) Cr. 3. S.
Prereq: ANTHR 201; ANTHR 306 recommended
Cross-cultural examination of the social construction of genders out of the biological fact of sex. Emphasis on non-western societies. Topics, presented through examination of ethnographic data, will include the range of gender variation, status and roles, the institution of marriage, and symbols of gender valuation.
Meets International Perspectives Requirement.

W S 450: Topics in Women's Studies
(Dual-listed with W S 550). (3-0) Cr. 3. Repeatable, maximum of 6 credits. S.
Prereq: W S 201 or 3 credits in Women's Studies at the 300 level or above
Special and/or experimental topics in a specific discipline, e.g., women and education, women and religion, women and the law, women and science.

W S 460: Seminar in Gender and Ethnicity
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Completion of 9 credits of surveys; completion of or concurrent enrollment in ENGL 339; junior classification
Selected readings of various authors, movements, eras, or genres. Readings in criticism; required research paper.

W S 488: Research on Women and Leadership
(Cross-listed with LD ST). (3-0) Cr. 3.
Research on women and leadership in selected content areas (e.g., business, education, politics and public service, and popular culture). Following an overview of quantitative and qualitative methods and critical analyses of journal articles on women and leadership, students will work in groups in selected content areas to research, write and present paper.

W S 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: Any two courses in Women's Studies
Independent study on a topic in Women's Studies.

W S 491: Senior Internship
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Senior classification
Internship designed to provide an application of Women's Studies principles and methods in a workplace. To be arranged with an internal or external employer and conducted under the supervision of a member of the Women's Studies faculty.

W S 494: Women/Gender in Art
(Cross-listed with ART H). (3-0) Cr. 3.
Issues of gender related to cultural environments from the Middle Ages to contemporary times in Europe and America. Feminist movement beginning in the 1970s and specifically gender issues in art that are becoming widespread in the artistic culture.
Meets U.S. Diversity Requirement

W S 499: Senior Thesis
(3-0) Cr. 3. F.S.SS.
Prereq: Senior classification
Senior thesis to be independently researched and written under the supervision of a member of the Women's Studies faculty.

Courses primarily for graduate students, open to qualified undergraduates:

W S 501: Contemporary Feminist Theories
(3-0) Cr. 3. F.
Advanced study of current theoretical developments in Women's Studies in the U.S. and around the world. Examination of the epistemological bases of feminist scholarship.

W S 502: Advanced Seminar in Feminist Research Methods
(3-0) Cr. 3. S.
Focus on feminist interdisciplinary research methods. Analysis of contemporary issues facing feminist scholars. Students conduct original research.

W S 525: Intersections of Race, Class and Gender
(Dual-listed with W S 425). (3-0) Cr. 3.
Prereq: W S 201 and one additional W S course
Race, ethnicity, class and gender distinctions and intersections lead to inequitable distributions of power, social well-being, and resources. Explores how inequities are institutionalized and how multiple identities are experienced by women in daily life.

W S 535: Women and Development
(Dual-listed with W S 435). (3-0) Cr. 3.
Prereq: W S 301
Cross-cultural study of development utilizing both case studies and theoretical works. Explores the nature of women's roles in developing countries and the ways women and their needs have been excluded/included in development approaches, policies, and projects. Includes discussion of actual development projects as well as women's organizing.

W S 544: Sex and Gender in Cross-cultural Perspective
(Dual-listed with W S 444). (Cross-listed with ANTHR). (3-0) Cr. 3. S.
Prereq: ANTHR 201; ANTHR 306 recommended
Cross-cultural examination of the social construction of genders out of the biological fact of sex. Emphasis on non-western societies. Topics, presented through examination of ethnographic data, will include the range of gender variation, status and roles, the institution of marriage, and symbols of gender valuation.
Meets International Perspectives Requirement.

W S 545: Women's Literature
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Primary texts by women writers; historical, thematic, formal, or theoretical approaches; secondary readings; e.g., Nineteenth-Century Women Writers; American Women's Personal Narratives; Southern Women Writers of the U.S.

W S 550: Topics in Women's Studies
(Dual-listed with W S 450). (3-0) Cr. 3. Repeatable, maximum of 6 credits. S.
Prereq: W S 201 or 3 credits in Women's Studies at the 300 level or above
Special and/or experimental topics in a specific discipline, e.g., women and education, women and religion, women and the law, women and science.

W S 586: Proseminar in Women's History and Feminist Theory
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Permission of instructor
Feminism as a movement and feminst theory from the early modern period to the present as it relates to the writing of women's history. Analysis of intepretations of European and U.S. women's history from patriarchal and postmodernist perspectives.

W S 590: Special Topics
Cr. arr.
Prereq: Permission of Women's Studies Program Director
Independent study on a topic in Women's Studies.

W S 594: Women/Gender in Art
(Cross-listed with ART H). (3-0) Cr. 3.
Prereq: Graduate classification or permission of instructor
Issues of gender related to cultural environments from the Middle Ages to contemporary times in Europe and America. Feminist movement beginning in the 1970s and specifically gender issues in art that are becoming widespread in the artistic culture.

Courses for graduate students:

W S 621: Pedagogies of Dissent
(Cross-listed with EL PS). (3-0) Cr. 3. S.
Prereq: EL PS 620
Critical examination of the philosophical foundations of education that seek to challenge the status quo and advance radical educational change. Exploration of macro-level (and some micro-level) issues relevant to educational change, in relation to how they inform practices of dissent and every day social relations.

World Languages and Cultures (WLC)

Courses primarily for undergraduates:

WLC 119: Introduction to World Languages
(Cross-listed with LING). (3-0) Cr. 3.
Study of language diversity and the personal, social and political effects of diversity. Language families, attitudes toward language and language use, language and culture, multilingualism, foreign language learning, written codes, official languages, and language policy.
Meets International Perspectives Requirement.

WLC 270: Cultures in Transition
(3-0) Cr. 3.
An interdisciplinary introduction to a world region in a state of rapid social and cultural transition. Discussion of the history, social and political institutions, arts, economy, agriculture, and environment of the new nations.
Meets International Perspectives Requirement.

WLC 278: Introduction to Global Film
(3-0) Cr. 3. F.
Introduction to the cinema of non-English speaking regions and cultures of the world through representative subtitled films, lectures, and readings. Topics vary according to faculty interest. Emphasis on selected national cinemas and film as a mode of cultural expression as well as on diverse cultural contexts of cinema.
Meets International Perspectives Requirement.

WLC 370: Topics in World Languages and Cultures in English Translation
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English.
Meets International Perspectives Requirement.

WLC 370A: Topics in World Languages and Cultures in English Translation: Global Sustainability
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English.
Meets International Perspectives Requirement.

WLC 370B: Topics in World Languages and Cultures in English Translation: Middle East
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English.
Meets International Perspectives Requirement.

WLC 370C: Topics in World Languages and Cultures in English Translation: Global Urban Cultures
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English.
Meets International Perspectives Requirement.

WLC 417: Student Teaching
Cr. 8-12. F.S.
Prereq: minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

WLC 417G: Student Teaching: World Language
(Dual-listed with WLC 517G). (Cross-listed with C I). Cr. arr. F.S.
Prereq: minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in world languages, secondary grades.

WLC 484: Technology, Globalization and Culture
(Dual-listed with WLC 584). (Cross-listed with M E). (3-0) Cr. 3. F.
Prereq: junior or senior classification for M E 484; graduate classification for M E 584
Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists.
Meets International Perspectives Requirement.

WLC 486: Methods in Elementary School World Language Instruction
(Cross-listed with C I, LING). (3-0) Cr. 3. F.
Prereq: 25 credits in a world language
Planning, implementation, and assessment of standards-based, student-centered, and thematic instruction in the elementary (K-8) classroom. Special emphasis on K-8 students' communicative skills, cultural knowledge, and content learning.

WLC 487: Methods in Secondary School World Language Instruction
(Cross-listed with C I, LING). (3-0) Cr. 3. F.
Prereq: 25 credits in a world language, admission to the teacher education program, OPI
Theories and principles of contemporary world language learning and teaching. Special emphasis on designing instruction and assessments for active learning.

WLC 491: Experiences Abroad: Learning to Think Globally
(Cross-listed with INTST). (1-0) Cr. 1. Repeatable, maximum of 2 credits.
Prereq: Minimum of 3 cr. study abroad and/or internship abroad
Students returning from study abroad gain perspective on the personal, academic, and professional impact of their time spent abroad through readings and discussions. Students will be expected to make one presentation about the culture they experienced to an audience outside ISU. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

WLC 517G: Student Teaching: World Language
(Dual-listed with WLC 417G). (Cross-listed with C I). Cr. arr. F.S.
Prereq: minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in world languages, secondary grades.

WLC 584: Technology, Globalization and Culture
(Dual-listed with WLC 484). (Cross-listed with M E). (3-0) Cr. 3. F.
Prereq: junior or senior classification for M E 484; graduate classification for M E 584
Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists.
Meets International Perspectives Requirement.

Youth (YTH)

Courses primarily for graduate students, open to qualified undergraduates:

YTH 501: Foundations of Youth Development
(1-0) Cr. 1. F.S.SS.
Fundamentals of youth development and the youth development profession. Through this introduction to the field, students will explore the ethical, professional, and historical elements of youth development as it has evolved toward professionalization. (on-line course offering via Distance Education).

YTH 508: Grant Development and Management
(3-0) Cr. 3. F.S.
Basic Grant Development and Management will introduce students to the grant-getting process and provide an overview of what happens after a project is funded. The following topics will be covered: researching funding sources, generating cutting edge ideas, assessing needs, planning a project, establishing credibility, formulating a sustainable budget, designing an evaluation plan, managing the funded project, and disseminating project results. (on-line course offering via Distance Education).

YTH 510: Adolescents and Their Families
(3-0) Cr. 3. F.S.
Adolescent development as it is related to and intertwined with family development; reciprocal influences between adolescents and their families are examined. Working with youth vis à vis the family system will be highlighted. (on-line course offering via Distance Education).

YTH 520: Community Youth Development
(3-0) Cr. 3. F.S.
Focus on the national emphasis of a strength-based or asset approach to community youth development, encompassing individual development (i.e., positive youth development) and adolescent interrelationships with environments. Emphasis is placed upon research, theory, and practice applied in communities throughout the U.S. Students will explore existing models, read theoretical and applied literature, and examine current community efforts as a basis for understanding community youth development. (on-line course offering via Distance Education).

YTH 530: Youth in Cultural Contexts
(3-0) Cr. 3. F.S.
Examination of the cultural context factors that affect youth from a holistic perspective within and outside the family unit. The course will provide an understanding of the cultural heritage of differing family structures and types. Students will explore the social and educational processes experienced by youth through in-depth reading, writing, discussion, critical listening, viewing of contemporary videos, and informal interviews with youth. Students will be encouraged to think critically about society and culture, gain further knowledge of how ethnic groups fit historically into society, and examine the results of how history has shaped the current cultural climate of the U.S. (on-line course offering via Distance Education).

YTH 540: Youth Professionals as Consumers of Research
(3-0) Cr. 3. F.S.
This course will help youth development professionals understand and evaluate research reports to reduce anxiety about applying research results and theories to practice. Specific emphasis will be on research and theory reports related to youth development. (on-line course offering via Distance Education).

YTH 550: Youth Policy
(3-0) Cr. 3. F.S.
Various federal and state policies designed specifically for youth. Students will examine how and why policies for youth are constructed. A guiding question that will be used to evaluate existing state and national policies is whether they contribute to, or act as, barriers to desired developmental outcomes. (on-line course offering via Distance Education).

YTH 570: Contemporary Youth Issues
(3-0) Cr. 3. Repeatable. F.S.SS.
Issues faced by youth today and associated risk and resiliency factors. A different topic will be presented each year, with the course rotating among participating universities. Past topics have included Youth Violence, Youth and Appearance, Adolescent Health, Global Perspectives and Volunteerism. The course may be taken more than once, as long as the content is different each time. (on-line course offering via Distance Education).

YTH 580: Administration and Program Management
(3-0) Cr. 3. F.S.
This course will introduce students to the development, administration and management of youth-serving organizations. (on-line course offering via Distance Education).

YTH 585: Program Design, Evaluation and Implementation
(3-0) Cr. 3. F.S.
Theoretical, methodological, and pragmatic issues involved in conducting programs and scholarship. Overview of the program development process and outcome evaluation of children and family programs. Modes of outcome scholarship and their implications for community-based programs are discussed. Students will develop knowledge through participating in a community-based project involving the practical application of program design and evaluation methods. (on-line course offering via Distance Education).

YTH 599: Creative Component
Cr. arr. Repeatable. F.S.SS.
Nonthesis students creative component (e.g., a special report, capstone course, integrated field experience, annotated bibliography, research project, design, or other creative endeavor). A minimum of five credits of independent work is required on the programs of study (POS). Creative component format determined cooperation with the POS committee. (on-line course offering via Distance Education). Offered on a satisfactory-fail basis only.

Courses for graduate students:

YTH 634: Youth Development
(3-0) Cr. 3. F.S.
Introduction to the developmental period of adolescence. The theory and research of positive youth development will be the lens through which this developmental period is examined. The course will emphasize how the developmental tasks of this life stage are influenced by (and influence) family and home, school, peers, and other contextual forces. The course will help students recognize and become familiar with the major issues and transitions adolescents face as they successfully navigate this developmental stage by critically examining the theoretical and research literature. (on-line course offering via Distance Education).

YTH 690: Advanced Topics
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor.
Advanced topics. (on-line course offering via Distance Education).

YTH 691: Internship
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor.
Supervised practice and experience in college teaching, research, professional experience. On-line course offering via Distance Education. Offered on a satisfactory-fail basis only.

ABOUT THE CATALOG

The Iowa State University Catalog is a one-year publication, which lists all academic policies, and procedures. Versions prior to 2011 were two-year publications and available in hard copy as well as online.

The catalog also includes information for fees; curriculum requirements; first-year courses of study for over 100 undergraduate majors; course descriptions for nearly 5000 undergraduate and graduate courses; and a listing of faculty members at Iowa State University.

New courses and programs take effect in the fall term. New courses developed and offered since catalog publication are called experimental courses. A list can be found on the Web at www.registrar.iastate.edu/faculty-staff/courses/explistings. (http://www.registrar.iastate.edu/faculty-staff/courses/explistings)

Every effort has been made to make the catalog accurate as of the date of publication. However, all policies, procedures, fees, and charges are subject to change at any time by appropriate action of the faculty, the university administration, or the Board of Regents, State of Iowa.

Updates to the Catalog

The curriculum process is governed by the Faculty Senate. The ad hoc committee, Faculty Senate Curriculum Committee (http://www.facsen.iastate.edu/councils/academicaffairs/curriculum) considers new curricula proposals, changes and discontinuations to the catalog. Additional information may be in the college governance documents.

The curriculum approval process generally consists of a proposal from the department/program level, approved by the department/program curriculum committee (if applicable), college curriculum committee, and the dean. Additional approvals are needed from the Graduate College if the program proposal is a graduate program. The program proposal is submitted to the Faculty Senate Curriculum committee for review. The Academic Affairs Committee reviews the proposal before passing it onto the Faculty Senate. The Board of Regents, State of Iowa approves all new programs and majors. For additional information about the approval process, see the link to Faculty Senate/Faculty Handbook Curriculum Approvals – Section 10.8. See the Office of the Provost (http://www.provost.iastate.edu) web site for more information.

Catalog updates are generally processed with approvals from department, college, and Faculty Senate Curriculum Committee (http://www.facsen.iastate.edu/councils/academicaffairs/curriculum) representatives. Editing begins in late February with course changes due to the Office of the Registrar by June 1. Curriculum and other general information is due to the Office of the Registrar by December 1. Publication is the following February.

See the catalog editing web site (http://www.registrar.iastate.edu/catalog-editing) for more details on how to make changes to the catalog.

ACADEMIC CONDUCT

Class Attendance

In order to attend a given class, a student must be registered for that class for credit or audit. Exceptions to this policy are at the discretion of the instructor of the course. See Validating Enrollment for regulations concerning attendance to validate students' enrollment in a class.

Students are expected to attend class meetings as scheduled. Each instructor sets his or her policy with respect to class attendance, and excuses for absence from class are handled between the student and instructor. The instructor is expected to announce his or her policy at the beginning of the course.

Additional information regarding discretionary accommodation for disability and religion are available at http://www.hrs.iastate.edu/AAO/eod/reasonaccom.shtml

Veteran Attendance

Students who receive benefits from the Veterans Administration are required by the V.A. to attend class regularly to maintain their V.A. eligibility. If the instructor knows that a student receiving V.A. benefits is not attending class, the instructor is obligated to notify the Office of the Registrar and a notification will be forwarded to the Veterans Administration. More information about veteran benefits is available at http://www.veterans.iastate.edu/.

Field Trips/Curricular-Related Activities

Trips away from campus as part of a course are often appropriate educational experiences. They may not, however, take place during the first or last week of the semester, nor may they extend over more than two consecutive class days (Monday -Friday); these regulations may be waived only by special permission of the dean of the college in which the course is offered. Students should consult with instructors whose classes will be missed. If a mutually satisfactory agreement between the instructors and the student cannot be reached, the student cannot be required to attend the curricular-related activity or be penalized by the instructor for missing the curricular-related activity.

Special fees are often charged to cover the costs of field trips. Field trip fees are noted in the Schedule of Classes (http://classes.iastate.edu).

Excusable Absences for Non-Curricular Reasons

Students who miss class for non-curricular reasons are responsible for completing all assigned course requirements in a timely manner. Instructors should provide timely opportunities for students to make-up or replace missed scheduled examinations and/or assignments resulting from an excusable absence. While instructors are free to change the format of make-up examinations or assignments, students will be evaluated by the same standards as other members of the class.

In all cases, the person responsible for the event or activity should provide participants with a letter explaining the proposed absence and its duration including travel times for off-campus events and activities. Students must provide this documentation to instructors at least 10 days in advance of the activity or event, except when such notice is not possible.

Course instructors retain final authority regarding student absences and how they impact course grades and the acceptability of a student's work toward passing their course. If a student must miss, for any reason, a portion of a course that, in the considered opinion of the course instructor, is critical to the student's ability to meet the course objectives, the instructor must recommend alternative actions to the student, which may include dropping the class.

Extra-Curricular Activities as a Representative of the University

Students may seek to or be asked to participate as an Iowa State University representative in non-credit events (competitions, conferences, presentations, programs, and performances) scheduled by academic or athletic units of the university at times that conflict with scheduled classes.

Instructors shall excuse students who miss class while representing Iowa State University in official department-or university-sponsored activities, including:

- academic or professional conferences and workshops
- intercollegiate athletic, academic,and judging competitions
- musical, theatrical, dance and other artistic performances
- presentations or programs given to external audiences

Other Extra-Curricular Activities

Instructors will determine whether other absences not officially sponsored by a unit of the University (e.g., conference attendance, job interviews), will be treated as excused.

Military Service

Instructors shall excuse absences due to performing required National Guard or other United States military service obligations (other than annual training). When a student is called to active duty for more than two weeks, instructors should meet with the student and the student's adviser to discuss the situation and academic options. University procedures are in place for such situations and should be followed.

Court Appearances

Instructors shall excuse absences due to officially mandated court appearances including jury duty.

Academic Dishonesty

Academic dishonesty occurs when a student uses or attempts to use unauthorized information in the taking of an exam; or submits as their own work themes, reports, drawings, laboratory notes, or other products prepared by another person; or knowingly assists another student in such acts; or plagiarism. Such behavior is abhorrent to the university and students found responsible for academic dishonesty face expulsion, suspension, conduct probation, or reprimand. Instances of academic dishonesty ultimately affect all students and the entire university community by degrading the value of diplomas when some are obtained dishonestly, and by lowering the grades of students working honestly.

Examples of specific acts of academic dishonesty include but are not limited to:

1. **Obtaining unauthorized information.** Information is obtained dishonestly, for example, by copying graded homework assignments from another student, by working with another student on a take-home test or homework when not specifically permitted to do so by the instructor, or by looking at your notes or other written work during an examination when not specifically permitted to do so.

2. **Tendering of information.** Students may not give or sell their work to another person who plans to submit it as his or her own. This includes giving their work to another student to be copied, giving someone answers to exam questions during the exam, taking an exam and discussing its contents with students who will be taking the same exam, or giving or selling a term paper to another student.

3. **Misrepresentation.** Students misrepresent their work by handing in the work of someone else. The following are examples: purchasing a paper from a term paper service; reproducing another person's paper (even with modifications) and submitting it as their own; having another student do their computer program or having someone else take their exam.

4. **Bribery.** Offering money or any item or service to a faculty member or any other person to gain academic advantage for yourself or another is dishonest.

5. **Plagiarism.** Unacknowledged use of the information, ideas, or phrasing of other writers is an offense comparable with theft and fraud, and it is so recognized by the copyright and patent laws. Literary offenses of this kind are known as plagiarism. Plagiarism occurs when a person does not credit the sources from which they borrow ideas, whether these ideas are reproduced exactly or summarized. The method of documentation will differ depending on whether the sources are written, oral, or visual. Ethically, communicators are responsible for providing accurate, detailed information about their sources. Practically, audiences need this information to comprehend and evaluate a message's content. The Student Guide: English 150 and 250, available for purchase at the University Book Store, describes the process of documenting source materials as do many other reference guides.

Academic dishonesty is considered to be a violation of the behavior expected of a student in an academic setting as well as a student conduct violation. A student found responsible for academic dishonesty or academic misconduct is therefore subject to appropriate academic penalty; to be determined by the instructor of the course, as well as sanctions under the university Student Disciplinary Regulations (http://www.policy.iastate.edu/policy/SDR). If an instructor believes that a student has behaved dishonestly in a course, the following steps are to be followed:

1. The instructor should confront the student with the charge of dishonesty and arrange a meeting with the student to discuss the charge and to hear the student's explanation.

2. If the student admits responsibility for academic misconduct, the instructor shall inform the student (a) of the grade on the work in which the dishonesty occurred, and (b) how this incident will affect subsequent evaluation and the final grade.

3. Because academic dishonesty is also a student conduct violation under **Section 4.2.1** of the Student Disciplinary Regulations, the instructor must report the incident in writing to the Dean of Students Office. After investigating the incident and discussing it with the instructor, the Dean of Students, or their designee, will meet with the student and depending on the severity of the offense as well as on the student's past conduct record, will handle the matter through an administrative hearing or schedule a hearing before the Student Conduct Hearing Board (SCHB).

4. This hearing, conducted according to the procedures outlined in the Student Disciplinary Regulations, is to determine the disciplinary action to be taken.

5. If the student claims to be not responsible for the alleged violation of academic misconduct, the instructor may not assign the student a grade for the work in question until the question of responsibility is resolved, unless circumstances require that an interim grade be assigned. The instructor shall consult with their department chair and report the incident in writing to the Dean of Students.

6. The Dean of Students will refer the case to the Office of Student Conduct (OSC) for investigation. After reviewing the report and completing an investigation, the Office of Student Conduct will file a formal complaint against the student if it is determined that there is cause to believe academic misconduct occurred. The case may be adjudicated through an administrative hearing or referred to a hearing before the Student Conduct Hearing Board (SCHB) depending

on the nature and severity of the violation as set forth in the Student Disciplinary Regulations.

7. If the case is referred to the SCHB both the student and instructor will be invited to attend an SCHB hearing and present pertinent information. If the OSC Administrator (in a level 2 case) or the SCHB (in a level 1 case) finds the student responsible for the charge of academic misconduct, the instructor will inform the student (a) of the grade on the work in which the dishonesty occurred, and (b) how this incident will affect subsequent evaluation and the final grade. The OSC Administrator or SCHB will determine the appropriate disciplinary action with respect to the nature of the violation.
8. If the OSC Administrator or SCHB finds the student "not responsible" for academic misconduct, the instructor will grade the student accordingly on the work in question and the student's grade in the course will not be adversely affected.
9. If a student either admits dishonest behavior or is found responsible for academic misconduct by the SCHB, the Office of Student Conduct or the Student Conduct Hearing Board may impose any of the following sanctions, depending on the severity of the misconduct:
    a. **Disciplinary Reprimand:** An official written notice to the student that their conduct is in violation of university rules and regulations.
    b. **Conduct Probation:** A more severe sanction than a disciplinary reprimand it is a period of review and observation during which the student must demonstrate the ability to comply with university rules, regulations, and other requirements stipulated for the probation period.
    c. **Deferred Suspension:** The suspension, but which is deferred subject to a definite or indefinite period of observation and review. If a student is found responsible for a further violation of the university Student Disciplinary Regulations or an order of a judiciary body, suspension will take place immediately.
    d. **Defined Length Suspension:** The student is dropped from the university for a specific length of time. This suspension cannot be for less than one semester or more than two years.
    e. **Indefinite Suspension:** The student is dropped from the university indefinitely. Reinstatement may be contingent upon meeting the written requirements of the SCHB specified at the time the sanction was imposed. Normally, a student who is suspended indefinitely may not be reinstated for a minimum of two years.
    f. **Expulsion:** The student is permanently deprived of the opportunity to continue at the university in any status.
    g. **Transcript Notation:** A notation is made on the student's academic transcript.

A student accused of academic misconduct has the option to stay in the class or to drop the class if the drop is made within the approved time periods and according to the regulations established by the university. If the student chooses to drop the class, the student will be required to sign a statement of understanding that if the student is later found responsible for academic misconduct, then the student will receive an "F" for the course.

In instances in which the student admits responsibility or is found to be responsible by OSC or the SCHB, a staff member of the Dean of Students Office will counsel with the student in an effort to deter any further such incidents.

Student records concerning academic dishonesty are maintained in the Dean of Students Office for a period of seven years, after which the file records are purged. These student records are confidential. However, when the student is expelled, suspended, or their admission is revoked, a notation will appear on the academic transcript that the student has been dropped due to disciplinary action is not eligible to enroll. In the event that an instructor is uncertain how to handle an incident of suspected academic dishonesty, the Dean of Students is available at any time to provide advice and assistance to the instructor in deciding a proper course of action to be taken.

Response to Classroom Disruption

Should any student officially enrolled for credit or audit in a class disrupt the instructor's ability to ensure a safe environment, control the class agenda, and/or deliver the approved curriculum, the instructor has the right to ask that the disruptive action cease immediately. The instructor may find it useful to include general guidelines about disruptive behavior on the course syllabus; and in the event of a classroom disruption, the instructor may, if they find it necessary, explain to the student and the class why the particular action is deemed disruptive. The instructor should also take into consideration complaints of disruptive behavior brought to their attention by students. The responsible student should cease the disruption and utilize non-disruptive means for expressing disagreement or concern. If the disruption continues, the instructor can pursue various forms of intervention, including suspension from class, use of student disciplinary regulations, or police intervention, as discussed in more detail in the Faculty Handbook. (http://www.provost.iastate.edu)

Although most situations are best resolved without resorting to requests for police intervention, the Department of Public Safety should be called when the disruptive behavior prohibits the continuation of the class. The

Department of Public Safety may also be called if any person enters or remains in the classroom after being asked by the instructor to leave.

Other violations related to academic misconduct may include subsection 4.1.11 Misuse of Computers and subsection 4.2.20 Unauthorized Sale of Others' Intellectual Works. These subsections are located in the Iowa State University Student Disciplinary Regulations under section 4 of the Conduct Code.

Course Ownership

Ownership of Course-related Presentations

The presenter owns course-related presentations, including lectures. Individuals may take written notes or make other recordings of the presentations for educational purposes, but specific written permission to sell the notes or recordings must be obtained from the presenter. Selling notes by students without the required permission is a violation of the Conduct Code as published on the Policy Library web site at http://policy.iastate.edu/policy/SDR#a4222.

Recording and Transmission of Classes

Recordings and transmission of classes may take place for a variety of legitimate reasons, including providing educational opportunities for those who cannot attend classes on campus, assisting students with disabilities that impair classroom note taking, and giving the instructor feedback on his or her classroom performance.

Because the lectures of faculty represent their intellectual labors, individuals are expected to obtain permission to make recordings of lectures and other classroom interactions. Recordings may be used for the purposes of the particular class, although in some cases the recordings may be preserved and used for other classes as well.

ACADEMIC LIFE

Academic Life Topics–also see individual listings in the A-Z Index.

- Academic Conduct
- Academic Credit for Activity (on or off campus)
- Academic Dishonesty
- Academic Dismissal
- Academic Grievances
- Academic Help, Sources
- Academic Probation Policy
- Academic Progress
- Academic Reinstatement-Renewal
- Registration

Grading

Grading System

Grades represent the permanent official record of a student's academic performance. The grading system at Iowa State University operates according to regulations outlined on the Grade Policies tab. The following provides quality points assigned for each letter grades:

Grade	Quality Points
A	4.00
A-	3.67
B+	3.33
B	3.00
B-	2.67
C+	2.33
C	2.00
C-	1.67
D+	1.33
D	1.00
D-	0.67
F	0.00

Grade	Description
P	Passing mark obtained under the Pass-Not Pass system.*
NP	Non-passing mark obtained under the Pass-Not Pass system.*
S	Satisfactory completion of a course offered on a Satisfactory-Fail grading basis. May also be reported to indicate satisfactory performance in R (required-credit) courses, and in courses numbered 290, 490, 590, and 690.
T	Satisfactory performance (equivalent to a grade of C or better in courses numbered 100-499, and a grade of B or better in courses numbered 500-699) in a special examination for academic credit.
X	The course was officially dropped by the student after the first week of the term.
N	No report was submitted by the instructor. An N is not a recognized grade or mark, it merely indicates the instructor has not submitted a grade and that a grade report has been requested. A nonreport (N) will automatically change to a grade of 'F' after one calendar year whether or not the undergraduate student enrolled during that period. If the N is outstanding at the time of graduation, it will be converted to a grade of 'F'. Undergraduate students will not graduate with N on their permanent record. Repeating a course will not resolve the N.
I	Incomplete. An incomplete mark may be assigned when the student is passing at the time of the request, but special circumstances beyond the student's control prevent completion of the course. In general, failing the final exam or project or not submitting course work as a result of inadequate preparation or learning are not valid excuses.***

*See Pass Not Pass Grading.

***See Incomplete Marks in the Grade Policies tab.

Policy Information

Grades represent the permanent official record of a student's academic performance. The grading system at Iowa State operates according to the following regulations:

1. Student performance or status is recorded by the grades and marks described below. A student's grade point average is calculated on the basis of credits earned at Iowa State with the grades and quality points shown below. Credits earned with P, S, or T are not used in calculating the grade point average but may be applied toward meeting degree requirements. A cumulative grade point average of 2.00 is required for a bachelor's degree.

2. Students who want to **protest a grade submitted by an instructor** should follow the procedures described in the section, Appeal of Academic Grievances.

3. Incomplete Marks - If the instructor and student agree that an Incomplete is appropriate, they should complete an Incomplete (I) Contract (http://www.registrar.iastate.edu/forms) (downloadable from the Office of the Registrar forms (http://www.registrar.iastate.edu/forms) web site) to document the reason for the I, the requirements for resolving it, and the date by which it must be resolved, not to exceed one calendar year or the student's graduation term (whichever is earlier). If the student is not available to sign the Incomplete (I) Contract, the instructor must document the conditions for the Incomplete by communicating directly with the student by e-mail or postal mail. A copy of this communication must be retained by the instructor until after the I is resolved in case there are any questions in the future regarding the terms of the Incomplete. The instructor also needs to enter the Incomplete (I) electronically as part of the end of term final grade submission.

Resolving an Incomplete: When a student completes the requirements specified on the Incomplete Contract, the instructor submits the appropriate grade, which becomes part of the student's cumulative, but not term, grade-point average. The grade does not replace the I on the record. The I remains on the record for the applicable term.

A final course grade, once submitted to the registrar, **may not** be changed to an Incomplete except to correct an error at the request of the instructor, and with the approval of the instructor's department head and the dean of the instructor's college. The Incomplete (I) Contract should be used by the instructor to document the conditions for the Incomplete as specified above. The Grade Report to the Registrar form should be used to initiate the request to change the grade to an Incomplete. The Grade Report form should be completed and forwarded by the instructor to his/her Dean for approval. The Dean will forward the Grade Report form to the Office of the Registrar if approved.

Incompletes in all courses must be resolved by the middle of the student's term of graduation. Repeating a course will not resolve an I mark. A mark of I will automatically change to a grade of F after one calendar year (whether or not the student was enrolled during the period).

4. To change a grade or mark already reported to the registrar, the instructor submits the Grade Report to the Registrar form. This form is used for resolving an I with a grade, for correcting an instructor error, or for the late report of a grade.

5. Midterm Grades. The registrar will collect C-, D, and F midterm grades and nonattendance notifications from the instructor and report this information to students and their advisers using AccessPlus. In addition to submitting the midterm grades, the instructor is responsible for informing the class of the basis on which they were calculated.

The purpose of midterm grades is to provide the student and adviser with a timely warning that the student's academic performance to that point in the course may be lower than desirable. Students who receive midterms are encouraged to discuss their academic performance with the course instructor and their adviser.

6. Grades in all courses attempted remain on each student's record. If a course is repeated, the record will show the grade obtained on the initial attempt as well as grades received on subsequent attempts.

7. The cumulative grade point average is calculated by dividing the total number of quality points earned by the total number of credits in all courses attempted. Grades of S, P, NP, and T are not counted in calculating the grade point average.

8. Repeating Courses.

- The most recent grade for a course a student repeats will be used in computing the student's cumulative grade point average rather than the previous grade(s), up to a limit of 15 credits. (This could result in a lowered grade point average if the second grade is lower than the first, or even loss of credit if the grade is lowered to an F.) All grades will remain on the student's record.
- Students may repeat any course for which an F grade, an NP grade, or any passing grade was received.
- Beyond 15 credits of repeats, all grades will be included in computing the cumulative grade point average. Please refer to items #1 and #7 above regarding how to calculate the grade point average.
- Courses should be repeated as soon as possible, preferably within three semesters in residence, because of changes that occur with course updating, change in course number, or revision in the number of credits.

- Approval to repeat a course in which the course number or number of credits has changed must be noted on a Designation of Repeated Course form, which can be obtained from departmental offices. This form must be signed by the head of the department offering the course and by the student's adviser, and then taken to the Office of the Registrar. Deadlines for filing repeated course forms for full-semester and half-semester courses are published in the university calendar.
- Transfer students may repeat courses at Iowa State University for which a D or F was received at another institution. They must process a Designated Repeat Form indicating they are repeating the course to reduce a transfer deficiency. Such repeated credits will count toward the 15-credit request limit and will affect only their transfer deficiency.
- A student who has earned an F at Iowa State University may repeat the course at another institution and the credits earned may be applied toward graduation at Iowa State, but the grade earned will not be used in computing a cumulative grade point average.
- Repeated courses may affect any federal financial aid. See the Financial Aid web site (http://www.financialaid.iastate.edu) for further information.

Pass-Not Pass Grading

Students may choose to take a maximum of 9 semester credit hours on a Pass-Not Pass basis, meaning that only a P or NP will be recorded as their final grade in the course. The purpose of P-NP grading is to encourage students to broaden their education by taking courses outside the usual program of study for their major and minor disciplines. The following policies apply:

1. Undergraduate students who are not on academic probation (P) at the beginning of the semester are eligible. A special (nondegree) student must obtain approval from their academic adviser and college dean.
2. Only elective courses may be taken on a P-NP basis. In specific majors, some restrictions may apply, so students should consult with their academic adviser.
3. Except for restrictions on its own undergraduate majors, a department may not deny the availability of any of its course offerings on a P-NP basis.
4. Courses offered on a satisfactory-fail basis may not be taken P-NP.
5. Students should register for a P-NP course in the same manner and at the same time that they register for their other courses. Students should then change to P-NP by processing a schedule change form with their academic adviser's signature in the P-NP approval section of the form.
6. Students who elect to change back to a graded basis should process the change using the P-NP section of the schedule change form.
7. Changes to or from a P-NP basis must be made before the last day to drop (usually the Friday of week 10 of the term).
8. Registration on a P-NP basis is not indicated on the instructor's class list. Students will receive a P if their grade is D minus or better and an NP if their grade was F.
9. Neither P (earned grade of D minus or better) nor NP (earned grade of F) is counted in calculating a student's grade point average (GPA).
10. When students change their curriculum, any P credits that they have accumulated will be accepted by the new department if such credits are in courses normally accepted by the department.
11. Credits taken on a P-NP basis at another institution and transferred to Iowa State may be applied as electives in a student's degree program if the credits are otherwise acceptable in that program. The number of P-NP transfer credits that can be accepted depends on the number permitted by the institution from which the student is transferring. If a student transfers more than nine semester P-NP credits, no additional Iowa State P-NP credits can be applied to the student's degree program.

Examinations

Examinations are one of the most common ways instructors assess student performance. In order that examinations can be a useful part of the educational process, the following policies have been instituted:

1. One purpose of examinations is to help students' learning. Therefore, examinations should be evaluated as soon as possible after they are given and the results should be made available to the students in a timely way to enhance learning.
2. All tests and examinations administered between the beginning of the term and final examination week shall be held during a regularly scheduled lecture or laboratory class period for that course. A department may obtain approval to administer a separately scheduled examination if all of the following criteria are met:
   a. The course is multi-sectioned.
   b. A common departmentally developed examination will be administered to all students in all sections at the same time.
   c. The test scores will be used as a basis for a uniform grading procedure for all sections of the course. Requests to hold separately scheduled examinations must be made to the registrar and approved by the provost in time to be announced in the Schedule of Classes to allow students to plan in advance. Only under unusual circumstances will a course be approved for separately scheduled examinations if the deadline is past to include notification in the Schedule of Classes. Whenever a separately scheduled examination is administered, a regular class meeting during that week shall be omitted.
   Students who are unable to take a separately scheduled examination at the scheduled time indicated in the Schedule of

Classes, because of a course conflict or other legitimate reason must notify the instructor in advance and must be given the opportunity to be examined at another time mutually convenient for the student and the instructor. The instructor shall determine whether to administer the same examination or an alternate examination, or use an alternate assessment procedure.

3. At the end of the semester, a week is set aside for final examinations or other term evaluations, with a two-hour period normally scheduled for each course. The following policies govern the responsibilities of students and faculty members during this week:
   a. Final exams may not be given at a time other than that for which the exam is scheduled by the registrar. An instructor may not give a final exam prior to final exam week nor change the time of offering of the final examination as it appears in the final exam schedule. Permission to change the time for which an exam is scheduled may be given only by the dean of the college. If the instructor elects not to give a final exam in a course of two or more credits, the class is required to meet at the scheduled final exam period for other educational activity such as a review of the course or feedback on previous exams.
   b. Final exam periods are determined according to the regularly scheduled meeting time of the class. However, certain courses are assigned special group exam times so that several sections of the same course may be tested together. The criteria for establishing special group exams are similar to those listed for separately scheduled exams listed in number 2 above. If this results in conflicting group examination periods, students should inform the instructor in charge of the first of the two conflicting courses as listed on the final exam schedule within the special groups in question; that instructor is responsible for arranging a special examination or making some other adjustment.
   c. Evening courses with lectures scheduled at 6:00 p.m. or later should give their examinations during finals week from 7:00-9:00 p.m. on the day the class normally meets. If this exam conflicts with an evening group exam, the instructor responsible for the latter must arrange a special examination for any students who have a conflict.
   d. If unusual circumstances involve the need for students to change the time of their final examination, they must obtain the approval of the instructor of the course.
   e. If a student has three examinations scheduled on the same calendar day and wishes to change one to another day, the instructor of the course having the smallest number of students is responsible for arranging an alternate examination time for the student unless make-up exam times are available in one of the other courses.
   f. All faculty members and teaching assistants with instructional or grading responsibilities are considered to be on duty throughout the entire final examination week and are expected to be available to students during that week for discussion of any matters pertaining to the final examination and final grade or to other aspects of the course.

Dead Week

For each Fall and Spring semester, the last full week of classes before final examinations is designated as Dead Week. The intent of this policy is to establish a one-week period of substantial and predictable study time for undergraduate students. During the Dead Week period, regular lectures are expected to continue, including the introduction of new content, as deemed appropriate by the instructor. The restrictions established by this Dead Week policy are:

- Due dates for mandatory graded submissions of any kind that fall within Dead Week must be listed on the syllabus provided at the start of the course.
- Mandatory final examinations may not be given during the Dead Week period except for laboratory courses or courses that meet weekly and for which there is no contact during the normal final examination week.
- Registered ISU Student Organizations may not hold any meetings, functions, or sponsored events during the Dead Week period. Any exception to these restrictions must be authorized in advance by the director of Student Activities

Scholastic Recognition

The university recognizes those students who are doing exceptionally well in several ways, including the following.

1. **Dean's List.** Each semester the university issues a dean's list made up of those students who have carried at least 12 credit hours of graded or S-F courses with a 3.50 grade-point average or above for the semester. Courses taken on a P-NP basis do not count as part of the 12-credit hour requirement. No dean's list is issued for summer school. The list can be viewed from the Office of the Registrar web site (http://www.registrar.iastate.edu).
2. **Top 2 Percent.** Each spring semester, undergraduate students in the top 2% of their class (freshman, sophomore, junior, and senior) within their college, based on cumulative grade point average, are recognized. In addition to a congratulatory letter from the university president, a notation of the accomplishment is recorded on the student's permanent record.
3. **Graduation with Distinction.** Undergraduates who have a cumulative grade point average of 3.50 or higher at the beginning of their final term are eligible to graduate "with distinction" provided they have completed 60 semester credits of coursework at Iowa State

University at the time they graduate, including a minimum of 50 graded credits.

Students who graduate with a cumulative grade point average of 3.90 or higher will graduate Summa Cum Laude; those who graduate with a cumulative grade point average of 3.70 to 3.89 will graduate Magna Cum Laude; and those who graduate with a cumulative grade point average of 3.50 to 3.69 will graduate Cum Laude. This recognition appears on the student's official transcript and diploma and in the commencement program.

Candidates for the bachelor of liberal studies degree may be graduated with distinction providing that they (a) have completed 45 semester credits of coursework at the three Iowa Regent universities at the time of graduation, (b) have earned at least a 3.50 cumulative grade point average at ISU, and (c) their combined grade point average for coursework taken at the three Iowa Regent universities meets the honors cutoff specified above.

4. **Honors Program.** Students who are full members of the University Honors Program need a cumulative grade point average of 3.5 at the beginning of their final term. In addition to meeting the appropriate grade point requirement, students will have completed an approved honors program of study and an honors project prior to graduation. This recognition appears on the student's permanent record and diploma, and in the commencement program.

Evaluation Procedures

It is university policy that the instructor shall inform the students at the beginning of each course of the evaluation procedures planned for use in the course.

Retention of Records

Records of all graded work must be retained by the instructors until midterm of the semester following completion of a course or until all pending appeals and incompletes are resolved, whichever is later. Instructors leaving the university must file records of all graded work with their department office before departure.

Progress and Probation

Additional Academic Standards Regulations

Each college has an academic standards committee that is responsible for monitoring the academic progress of all undergraduate students in that college, based on policies and minimum requirements set by the Faculty Senate Committee on Academic Standards and Admissions and ratified by the Faculty Senate.Individual college faculties may, with the approval of the Faculty Senate Committee on Academic Standards and Admissions, set additional program admission and curriculum requirements that are more stringent than those established for the university.These additional requirements must be reviewed at least every third catalog by the college academic standards committee to determine if the requirements should be continued.Requirements approved by the college academic standards committees will then be forwarded to the Faculty Senate Committee on Academic Standards and Admissions for final approval.The college committees are responsible for actions involving individual students with respect to placing students on academic probation, dismissing students from the university for unsatisfactory academic progress, and reinstating students who have been dismissed.

Changing colleges: A student on academic probation (P) may transfer to another program in the university before period 3 begins (before the last day to drop a course.) For students on academic probation (P), transfer during period 3 (after the last day to drop a course) can only occur under exceptional circumstances and with the approval of the chair of the new program and the dean of the new college. A student who is in dismissal status at the end of spring and chooses to exercise the Summer Option may not change colleges during the summer.

Withdrawal: A student on academic probation (P) who withdraws during period 3 will be academically dismissed at the end of the term the student withdraws, except under extenuating circumstances as judged by the college academic standards committee.

Reinstated students: Reinstated students should also see the section on Reinstatement.

Veterinary Medicine: Additional rules for minimum satisfactory progress are in effect.

Special (nondegree) students: Students matriculated in this classification category are governed by the regular academic progress regulations. Furthermore, by special action of their college academic standards committee, additional standards may be required.

For questions concerning interpretation and application of the rules governing academic progress, students should contact the chair or secretary of their college academic standards committee in their college office.

The university's academic standards rules are presented below. In addition to taking action based on these rules, a college academic standards committee may also place a student on academic probation or dismiss a student from enrollment in the university when, in the college committee's judgment, the student's academic performance or progress toward a degree is exceptionally deficient. Likewise, a college committee may, under exceptional circumstances, exempt individual students from the application of these rules. Students who participate in the Regent Universities Student Exchange Program, or in a similar program where the credit taken at the other school will be considered as resident credit and

the grades included in the student's ISU cumulative grade point average, are subject to Iowa State University's academic standards.

Maintaining Satisfactory Progress

Continued enrollment at Iowa State University depends upon an undergraduate student maintaining satisfactory academic progress toward attaining a degree. To assist students in maintaining satisfactory progress, Iowa State University has adopted academic standards designed to provide early identification of students who are experiencing academic difficulty, and to provide timely intervention through academic advising and academic support programs.

Academic standing at Iowa State University is dependent upon the total number of credits a student has attempted or earned, the student's semester grade point average (GPA), the student's cumulative ISU GPA, and the student's transfer GPA (if below 2.00.)

Academic Warning

While a warning (W) is the least severe of the negative academic actions, it serves as a reminder that future academic performance below 2.00 could result in more serious consequences. In fact, a student on warning whose subsequent term GPA is below a 2.00 will be placed on probation (P) the following term.

Students who receive an academic warning are required to develop a plan for academic improvement in consultation with their academic adviser or the Academic Success Center. A student who is subject to both academic warning and academic probation will be placed on academic probation. The academic warning is not a part of the student's permanent academic record.

Students will receive an academic warning (W) at the end of any fall or spring semester when they earn a GPA of 1.00 – 1.99 for that semester. At the end of the next fall or spring semester of enrollment, one of the following actions will be taken for students on academic warning status:

- Students will be placed on academic probation if they earn less than a 2.00 GPA for the next fall or spring semester, or
- They will be removed from warning status if they earn at least a 2.00 semester GPA for the next fall or spring semester and they are not subject to academic probation based on cumulative GPA (over 75 credits).

See Summer Academic Standards Regulations section for how summer grades affect warning, probation, or dismissal status.

Academic Probation

Students are placed on academic probation status as a warning that their academic progress is not satisfactory and that they should take steps to improve their academic performance to avoid dismissal from the university. Academic probation is an indication of very serious academic difficulty. Students may be placed on academic probation as a result of either semester GPA, cumulative GPA, or both. Academic probation status is not a part of the student's permanent academic record.

Students on academic probation and warning are required to meet with their adviser and to complete the Academic Intervention Self Assessment form, which can be accessed here: http://www.dso.iastate.edu/asc/ai/students/

Students will be placed on academic probation (P) at the end of a semester/term for either of the following two reasons:

1. Semester GPA: Students who earn less than a 1.00 at the end of any fall or spring semester, or less than a 2.00 two consecutive semesters, will be placed on academic probation. Students will not be placed on academic probation at the end of the summer term due to summer term GPA only.
2. Cumulative GPA: Students with 75 or more credits attempted or earned, whichever is greater, will be placed on academic probation at the end of any fall or spring semester or summer term when their cumulative GPA is less than 2.00. Students with 75 or more credits attempted or earned who have a transfer GPA < 2.00 will be placed on academic probation at the end of any fall or spring semester or summer term when their combined transfer/ISU cumulative GPA is less than 2.00.

At the end of the next fall or spring semester of enrollment, one of the following actions will be taken for students on academic probation status:

- Students will be academically dismissed if they fail to earn at least a 2.00 semester GPA. At the end of any spring semester, students in dismissal status may enroll for summer term. (See Summer Option for Students in Dismissal Status in the Summer Academic Standards Regulations section.)
- Students will continue on academic probation if they earn at least a 2.00 semester GPA but are subject to continued academic probation based on their cumulative GPA (over 75 credits).
- Students will be removed from probation if they earn at least a 2.00 semester GPA and are not subject to continued academic probation based on their cumulative GPA (over 75 credits).

See Academic Dismissal for dismissal policy.

Summer Academic Standards Regulations section for how summer grades affect warning, probation, or dismissal status.

Academic Dismissal

Students who do not meet the requirements of their academic probation are academically dismissed from the university. Each College Academic Standards Committee is responsible for final decisions regarding

the academic status of students in that college, and any appeals to academic dismissal actions are considered by the college committee. Once dismissed, students are not allowed to reenroll at Iowa State University until they have been academically reinstated. (See section on reinstatement.) Academic dismissal is placed on the student's academic record as a permanent notation. The official transcript of a student who has been dismissed includes a "Not Permitted to Register" notation.

Summer Academic Standards Regulations

Students who are newly placed or continued on academic probation (P) at the end of the previous semester may enroll for the summer term without being in jeopardy of academic dismissal from the university at the end of that summer term.

Summer Combined Term GPA:

All students who attend summer session will have their academic status reassessed at the end of the summer based on the combined (not averaged) grade summaries of their previous term of attendance and summer term. Academic status (warning or probation) after summer session will be based on the resulting combined term GPA. The academic status resulting from the summer combined term GPA supersedes the academic status at the end of the previous term.

For students who have remaining designated repeat credits, courses taken in the previous semester and repeated in summer will be calculated as designated repeats in the combined term GPA.

The combined term GPA (summer plus preceding term) will not appear on the student's grade report or permanent record.

Summer term GPA alone cannot determine academic status. Students who initiate enrollment at Iowa State during the summer will not be placed on warning or probation regardless of their academic performance.

Summer Cumulative GPA:

A student who was on academic probation (P) at the beginning of summer term based only on cumulative GPA, who raises his or her cumulative GPA to over a 2.0 at the end of the summer term shall be removed from probation status at the end of the summer term.

A student with 75 or more credits attempted or earned, whichever is greater, will be placed on academic probation (P) at the end of the summer term if his or her cumulative GPA is less than 2.00.

A student with 75 or more credits attempted or earned who has a transfer GPA < 2.00 will be placed on academic probation (P) at the end of any summer term if his or her combined transfer/ISU cumulative GPA is less than 2.00.

Summer Option for Students in Dismissal Status:

A student considered for academic dismissal at the end of spring semester will be permitted to enroll for the summer term. The combined spring/summer GPA will be used to determine whether the student should be permitted to continue his/her enrollment after the summer term. If the resulting combined term GPA is not 2.00 or greater, the student will be academically dismissed.

Reinstatement and Renewal

Reinstatement

The procedures delineated in this section apply to students who were dismissed from Iowa State for academic reasons. Students who left Iowa State in good academic standing and who are seeking reentry should see Index, Reentry for more information.

1. Reinstatement is not automatic. Students who have been dismissed for academic reasons should contact the dean's office in the college they wish to enter for instructions specific to that college.
   The college Academic Standards Committee reviews each petition and other relevant information, and reinstatement is based upon that review. As part of the petition process, students must submit a plan for academic success that identifies the causes of their poor academic performance and demonstrates that they have taken actions to avoid or eliminate these causes.
2. Students can only be reinstated after at least one academic semester has elapsed since they were academically dismissed. The summer session is not a semester for the purpose of being out of school one semester.
3. Students who have been dismissed from enrollment two or more times are not eligible for reinstatement until at least two academic semesters have elapsed since their last academic dismissal.
4. Students who were dismissed by one college and subsequently reinstated by another college cannot transfer back to the original college unless permission is granted by the Academic Standards Committee of the original college. This procedure applies regardless of the student's academic standing when the transfer is requested.
5. To be considered for reinstatement to the university, students must submit a petition to the Academic Standards Committee of the college in which they desire to enroll at least 45 days before the beginning of the semester. Students who have not been enrolled for a period of 12 or more months or who are international students must also file a reentry form prior to their return. For more information see the Reentry web site at http://www.registrar.iastate.edu/info/reentry.html. (Students dismissed for the second time and requesting reinstatement in the College of Liberal Arts and Sciences must submit their petition 70 days before the beginning of the semester.)

6. As a condition of reinstatement, students will reenter on academic probation and must accept whatever additional requirements are stipulated by the college Academic Standards Committee. Examples include full- or part-time status, specified credit hours, specific courses, specific GPAs, restriction on choice of major, and required counseling.

Student Appeal

Students may appeal a decision regarding their academic status if they believe that new information can be provided or extenuating circumstances exist that would alter the application of any rule in this section. The appeal should be made in writing to the Academic Standards Committee of the college in which the student is enrolled. The written appeal must include the reasons for the appeal and the evidence to substantiate these reasons.

The student should initiate the appeal process by contacting the secretary of the college Academic Standards Committee in the administrative office of her or his college immediately upon receipt of notification of the committee's action, and at least ten calendar days before the beginning of the semester. The secretary will then inform the student of the deadline for submission of the written appeal.

If the student is dissatisfied with the committee's action, he or she may submit an appeal in writing to the dean of her or his college within seven calendar days after they are notified of the committee's action. The dean must respond in writing within seven calendar days of receipt of the appeal.

If the issue is not resolved within the college, further appeals may be made in writing to the provost and subsequently to the president of the university. Appeals beyond the college level will, however, be considered only if based on one or both of the following contentions: (a) appropriate procedures were not followed at the college level; (b) academic rules were not applied correctly at the college level.

Academic Renewal Policy

Students who are returning to Iowa State University to pursue an undergraduate degree after an extended absence may request permission to remove one or more of their complete academic terms from future degree and GPA considerations.

1. Eligibility. To be eligible for academic renewal consideration, students must meet these requirements:
   a. Students must not have enrolled at Iowa State University for five or more consecutive years.
   b. Students must not have graduated from Iowa State University.
   c. Students must currently be in good academic standing. (If the student was previously dismissed, he or she must be reinstated.)
2. Conditions. Academic renewal is based on the following conditions:
   a. All courses and credits that were taken during the chosen terms will be removed from consideration for GPA and degree requirements. Students may not combine courses from multiple terms to comprise the semester(s) or quarter(s) dropped. Degree requirements met during the dropped terms will ordinarily have to be repeated.
   b. Renewal may be applied only to academic terms completed prior to the students' extended absence.
   c. All courses and grades for the chosen terms will remain on the students' academic record.
   d. Designated repeats, drops and P/NP options will be reinstated for the terms dropped.
   e. Students who have used all of their drop options will be given one extra drop.
   f. Students may be granted only one academic renewal. To be eligible for a degree after academic renewal is granted, students must complete a minimum of 24 credit hours after re-enrolling at Iowa State University.
3. Procedures.
   a. Students should discuss their desire to pursue academic renewal with an adviser in the college they wish to enter.
   b. The student must complete the Academic Renewal Petition form available from www.registrar.iastate.edu/forms (http://www.registrar.iastate.edu/forms).
   c. After the form is signed by the student and academic adviser, it is submitted to the Records area in the Office of the Registrar, 214 Enrollment Services Center.

ACADEMICS

Classification

Classification (year in school) is determined by the number of credits completed and reported to the registrar, and is based on credit hours earned, not merely credit hours attempted. The grades F and NP and the marks I and X do not contribute toward credit hours earned and thus are not considered in determining year in school. See Grades for information about the grading system at Iowa State University.

Classification in all colleges except Veterinary Medicine is as follows:

Sophomore: 30 credit hours earned

Junior: 60 credit hours earned

Senior: 90 credit hours earned

Students who have a bachelor's degree and are working toward another undergraduate degree, licensure, or admission to a specific graduate or professional program, are typically classified as a senior.

Transfer students without a degree are classified on the basis of credits accepted by Iowa State University.

Veterinary medicine students are promoted from the first- to the second-, third-, and fourth-year classes based upon satisfactory completion of the required courses for each year. To be promoted to the second-year class, students must have a cumulative grade-point average of at least 1.67 for all courses in the first year of the veterinary medicine curriculum. To be promoted to the third- and fourth-year classes, students must have a cumulative grade point average of at least 2.00 for all courses in the professional curriculum.

A student, who is attending Iowa State and decides not to work toward an undergraduate degree, will be classified as a special (nondegree) student. Admission requirements and academic standards regulations are the same as regular students. Credits taken as a special (nondegree) student are applicable for undergraduate degree purposes if the student is admitted later as a regular undergraduate. Credits obtained as an undergraduate special student may not, however, be applied toward a graduate degree.

Students enrolled in the Intensive English and Orientation Program (IEOP) are classified as special (nondegree) students in the College of Liberal Arts and Sciences and usually are not permitted to enroll in academic courses until they have satisfied requirements for admission as regular students. Permission to enroll in one academic course may be granted under special circumstances.

Degree Planning

ISU Degree Audit

In addition to being properly registered, students are responsible for knowing the requirements for their degree and planning their schedule to meet those requirements. One way to monitor progress toward a degree is with the ISU degree audit.

Students may access their ISU degree audit through AccessPlus (https://accessplus.iastate.edu/frontdoor/login.jsp). The degree audit shows courses that have been completed, courses in which the student is currently enrolled, and graduation requirements that need to be completed for the student's curriculum.

Students should use the degree audit information to help them review progress towards their degrees(s), plan their course of study to complete degree requirements, and select courses for the next term. Graduation evaluators in the Office of the Registrar use the degree audit during the term a student will graduate to determine if the student will meet all degree requirements upon successful completion of the courses on the student's schedule that term.

In addition, through AccessPlus (https://accessplus.iastate.edu/frontdoor/login.jsp), students may request a degree audit for any major available at Iowa State. The audit results will show how their completed and in-progress course work applies toward other majors or options offered at the University.

For further information about how completed courses fulfill degree requirements or how other courses will apply toward their degree requirements, students should see their adviser.

Two Bachelor's Degrees

Students may receive two bachelor's degrees if the requirements for each major (curriculum) are met and the total number of semester credits earned is at least 30 more than the requirements of the curriculum requiring the greater number of credits. This rule applies whether or not the degrees are awarded at the same time. Students should have an academic adviser in each major (curriculum), with one adviser being designated as the registration adviser. Students should request approval to pursue two degrees by completing the form, Request for Double Major/Curriculum or Two Degrees. This form is available from advisers and classification offices. Each adviser will have access to the student's information after this form has been processed. The appropriate department and college must approve each degree program.

Students who have earned advanced degrees and wish to earn a second Bachelor's Degree may be eligible for a college waiver of certain basic and general education requirements. Students should contact the department offering the major for advice and appropriate planning.

Double Major/Curriculum

A double major is a program for a single degree in which all requirements for two or more majors (curricula) have been met. The majors (curricula) may be in different colleges or within the same college or department. The diploma and permanent record will designate all majors (curricula) that are completed at the same time.

To declare a double major (curriculum), students should complete the form, "Request for a Double Major/Curriculum or Two Degrees." This form, available from advisers and classification offices, should be completed at least one term prior to graduation. One major (curriculum) should be designated as primary and the other secondary for purposes of record keeping, but the student's rights and responsibilities are the same in both majors. The adviser of the primary major will serve as the student's registration adviser, but both advisers will have access to the student's information. Degree programs must be approved for each major (curriculum) by the appropriate department and college. One of the majors may subsequently be canceled using the same form.

Students in the College of Engineering are able to earn a degree with a second major/curriculum as long as the second major/curriculum is within another college, meets all requirements of the additional programs and contains a minimum of 15 additional credits beyond the requirements for a B.S. degree in engineering for each additional area of study. A student with multiple curricula within the College of Engineering is permitted to earn only multiple degrees. All requirements for each curricula must be met plus an additional 30 credits for each curricula being pursued beyond the curriculum which requires the most credits.

Students with a primary major in another college who wish to take a second major in the College of Liberal Arts and Sciences are not required to meet the Liberal Arts and Sciences General Education requirements. They must, however, meet all requirements for the major, including complementary courses. Students in the B.L.S. curriculum in the College of Liberal Arts and Sciences do not have majors.

Second Major (Curriculum) Completed after the Bachelor's Degree

After receiving a bachelor's degree, a person may wish to complete all requirements for another major (curriculum). Approval of the department of the second major (curriculum) is needed before study for the program is begun. At the completion of the program a notation will be made on the permanent record (transcript), but no change will be made on the diploma received at the time of graduation. A degree program must be approved for the second major/curriculum by the department and by the dean's office.

Changing Curriculum or Major

A student's freedom to change their major, and the procedure that should be followed, depend on the student's academic standing and on policies of individual colleges as approved by the provost.

1. If students have never been dismissed and reinstated, they may change their major by consulting first with their adviser. Procedures for changing curriculum or major are as follows:
    a. If the change involves majors within the same college, they should check with the college office to obtain instructions as to how to make the change.
    b. If the change involves majors in different colleges, they should obtain a Change of Curriculum/Major form and their file from their adviser, present these materials to the student services office of their present college, then to the student services office of the college to which they are transferring, and finally to the office of their new major.
2. Students on academic probation (P) may be restricted by rules outlined in the section on Additional Academic Standards Regulations.
3. Students who have been reinstated may not transfer to another college within the university during the first term following reinstatement, and they may not at any time transfer back to the college that originally dismissed them without the permission of the academic standards committee of that college.

Declaring a Minor

Many departments and programs in the university specify requirements for an undergraduate minor. A record of requirements completed appears on students' transcripts. All minors require at least 15 credits, including at least 6 credits in courses numbered 300 or above taken at Iowa State University. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement. Courses taken for a minor may not be taken on a pass-not pass basis. See /collegescurricula/#minors for additional information regarding policies which govern minors. To declare a minor, students must submit a completed Request for a Minor form to their college office at least one term before graduation. The minor may be from the catalog under which the student is graduating or a later catalog.

Undergraduate Certificates

An undergraduate certificate provides a way to give formal recognition of focused study in a specialized area that is less comprehensive than required for an undergraduate major.

An undergraduate certificate has the following requirements and understandings:

1. A minimum of 20 credits, with at least 12 credits taken at ISU which are applicable towards the undergraduate certificate requirements
2. At least 9 of the credits taken at Iowa State University must be in courses numbered 300 or above
3. At least 9 credits used for a certificate may not be used to meet any other department, college, or university requirement for the baccalaureate degree except to satisfy the total credit requirement for graduation and to meet credit requirements in courses numbered 300 or above
4. A student may not receive both an undergraduate major and a certificate of the same name
5. For students earning an ISU baccalaureate degree, a certificate is awarded concurrent with or after the ISU baccalaureate degree
6. A certificate is not awarded if the baccalaureate requirements are not finished
7. After receiving a baccalaureate degree from any accredited institution, a student may enroll at ISU to earn a certificate
8. Courses taken for a certificate may not be taken on a pass-not pass basis
9. A cumulative grade point average of at least 2.00 is required in all courses taken at ISU towards the certificate
10. A notation of a completed certificate will be made on a student's transcript and a printed certificate will be awarded.

Appeal of Academic Grievances

Students who believe a faculty member (in his or her academic capacity) has behaved unfairly or unprofessionally may have their grievance reviewed through the procedure described below. A student may not initiate an appeal more than one year following completion of the course, and may not initiate the appeal of a course grade beyond midterm of the semester following completion of the course.

Prior to initiating a formal appeal, a student may wish to discuss the situation informally with the Dean of Students or designee, who can offer advice as to the most effective way to deal with it.

Grievances arising out of classroom or other academic situations should be resolved, if at all possible, with the student and the instructor involved. If resolution cannot be reached, or if the grievance involves sexual or racial harassment and the student prefers not to deal directly with the instructor, the student should discuss the grievance with the instructor's department chair and submit it in writing to him or her. The department chair will investigate the grievance, including discussing it with the instructor involved and/or referring it to a departmental grievance committee. The department chair should respond in writing within five class days of receipt of the written notice of the grievance.

If the student is not satisfied with the resolution of the grievance proposed by the department chair, the student may appeal in writing to the dean of the instructor's college. (In the case of a grievance involving a Graduate College policy or procedure, an appeal of the chair's decision should be directed to the Dean of the Graduate College rather than to the dean of the instructor's college.)

The dean will hear the explanations of the department chair and instructor, and should respond to the student in writing within ten class days of receipt of the written notice of the appeal. If the grievance cannot be resolved with the dean, the student may forward a written appeal to the provost, who will convene a Committee to Review Student Grievances (see below) to consider the appeal within ten class days of receipt of the written notice of the appeal.

Within five class days following the convening of the committee, the provost will make a decision with regard to the grievance and will transmit this decision in writing to the grievant, the dean, the department chair, and the instructor. An appeal of the provost's decision may be made to the president of the university. The time limit specified at each level may be extended by mutual agreement of all parties concerned.

The Committee to Review Student Grievances is composed of faculty members named by the president of the Faculty Senate and students named by the president of the Government of the Student Body. The provost may serve as a chairperson for the committee, or may designate another chairperson for a specific grievance hearing. A minimum of two faculty members, two students, and the chairperson shall constitute a quorum for the convening committee.

Graduation

Seniors must file a graduation application with the Graduation Office, 214 Enrollment Services Center. Students will be notified of their graduation status approximately mid semester of their graduation term. For graduation application instructions and deadlines, go to the Graduation and Commencement web site (http://www.graduation.iastate.edu).

Iowa State University commencement ceremonies are held at the end of fall and spring semesters. Undergraduate students expected to graduate at the end of summer semester are invited to participate in the spring ceremony preceeding their graduation term or the fall ceremony following their graduation term. In addition to the formal University commencement ceremony, the undergraduate colleges host graduation activities take place at the end of fall and spring semesters. For

more information see www.registrar.iastate.edu/graduation/ (http://www.registrar.iastate.edu/graduation)

Verification of satisfactory final grades will be completed approximately two weeks after the end of the semester and diplomas will be mailed to all successful degree candidates.Students must ensure the following before they can graduate:

1. Registration for the term has been completed and the date of graduation is correct on the degree audit printout.
2. Sufficient credits, acceptable toward graduation, have been earned to meet the minimum requirements for their curriculum. (Some examples of credit not acceptable toward graduation are: elective credits beyond those allowed in a curriculum, credits earned in passing the same course more than once, more than four credits of Athletics 101, and credit in two courses for which the catalog states that only one may count toward graduation.)
3. They have achieved a set of communication competencies established by the department as appropriate for the major.
4. A cumulative grade point average of at least 2.00 was earned in all work taken at Iowa State; and student has met all special grade point average requirements established by their college, department, or program in specified courses.
    a. Students admitted from another college or university with a quality-point deficiency, must have earned sufficient quality points above a 2.00 at Iowa State to offset their transfer grade point deficiency.
    b. Students who have taken work at another college or university prior to or after having been a student at Iowa State, must have submitted a transcript of all such college study attempted to the Office of Admissions. This work must average 2.00 or the deficiency of quality points will be assessed against the student. Failure to submit such a transcript is grounds for dismissal.
5. Incompletes in courses required for graduation have been removed by midterm of the term of graduation.
6. At least 32 credits have been earned in residence at Iowa State University, and the final 32 credits were taken at Iowa State. (Six of the last 32 credits may be transferred to Iowa State, with prior permission of their major department.) Iowa State University must receive an official transcript of all transfer work by midterm of the term of graduation.
7. Outstanding financial obligations owed the university have been paid in full. Students who owe an outstanding obligation to the university will have a hold placed on their records and they will not receive their diploma or transcript. If students have questions about this policy, they should contact the graduation area of the Office of the Registrar.

Class Attendance

In order to attend a given class, a student must be registered for that class for credit or audit. Exceptions to this policy are at the discretion of the instructor of the course. See Index, Validation of Enrollment for regulations concerning attendance to validate students' enrollment in a class.

Students are expected to attend class meetings as scheduled. Each instructor sets his or her policy with respect to class attendance, and excuses for absence from class are handled between the student and instructor. The instructor is expected to announce his or her policy at the beginning of the course.

Additional information regarding discretionary accommodation for disability and religion are available at http://www.hrs.iastate.edu/AAO/eod/reasonaccom.shtml

Veteran Attendance

Students who receive benefits from the Veterans Administration required by the V.A. to attend class regularly to maintain their V.A. eligibility. If the instructor knows that a student receiving V.A. benefits is not attending class, the instructor is obligated to notify the Office of the Registrar and a notification will be forwarded to the Veterans Administration. More information about veteran benefits is available at http://www.registrar.iastate.edu/veterans/.

Field Trips/Curricular-Related Activities

Trips away from campus as part of a course are often appropriate educational experiences. They may not, however, take place during the first or last week of the semester, nor may they extend over more than two consecutive class days (Monday -Friday); these regulations may be waived only by special permission of the dean of the college in which the course is offered. Students should consult with instructors whose classes will be missed. If a mutually satisfactory agreement between thee instructors and the student cannot be reached, the student cannot be required to attend the curricular-related activity or be penalized by the instructor for missing the curricular-related activity.

Special fees are often charged to cover the costs of field trips. Field trip fees are noted in the Schedule of Classes (http://classes.iastate.edu).

Excusable Absences for Non-Curricular Reasons

Students who miss class for non-curricular reasons are responsible for completing all assigned course requirements in a timely manner. Instructors should provide timely opportunities for students to make-up or replace missed scheduled examinations and/or assignments resulting from an excusable absence. While instructors are free to change the format of make-up examinations or assignments, students will be evaluated by the same standards as other members of the class.

In all cases, the person responsible for the event or activity should provide participants with a letter explaining the proposed absence and its duration including travel times for off-campus events and activities. Students must provide this documentation to instructors at least 10 days in advance of the activity or event, except when such notice is not possible.

Course instructors retain final authority regarding student absences and how they impact course grades and the acceptability of a student's work toward passing their course. If a student must miss, for any reason, a portion of a course that, in the considered opinion of the course instructor, is critical to the student's ability to meet the course objectives, the instructor must recommend alternative actions to the student, which may include dropping the class.

Extra-Curricular Activities as a Representative of the University

Students may seek to or be asked to participate as an Iowa State University representative in non-credit events (competitions, conferences, presentations, programs, and performances) scheduled by academic or athletic units of the university at times that conflict with scheduled classes.

Instructors shall excuse students who miss class while representing Iowa State University in official department-or university-sponsored activities, including:

- academic or professional conferences and workshops
- intercollegiate athletic, academic,and judging competitions
- musical, theatrical, dance and other artistic performances
- presentations or programs given to external audiences

Other Extra-Curricular Activities

Instructors will determine whether other absences not officially sponsored by a unit of the University (e.g., conference attendance, job interviews), will be treated as excused.

Military Service

Instructors shall excuse absences due to performing required National Guard or other United States military service obligations (other than annual training). When a student is called to active duty for more than two weeks, instructors should meet with the student and the student's adviser to discuss the situation and academic options. University procedures are in place for such situations and should be followed.

Court Appearances

Instructors shall excuse absences due to officially mandated court appearances including jury duty.

Examinations and Evaluation

Evaluation Procedures

It is university policy that the instructor shall inform the students at the beginning of each course of the evaluation procedures planned for use in the course.

Retention of Records

Records of all graded work must be retained by the instructors until midterm of the semester following completion of a course or until all pending appeals and incompletes are resolved, whichever is later. Instructors leaving the university must file records of all graded work with their department office before departure.

Examinations

Examinations are one of the most common ways instructors assess student performance. In order that examinations can be a useful part of the educational process, the following policies have been instituted:

1. One purpose of examinations is to help students' learning. Therefore, examinations should be evaluated as soon as possible after they are given and the results should be made available to the students in a timely way to enhance learning.
2. All tests and examinations administered between the beginning of the term and final examination week shall be held during a regularly scheduled lecture or laboratory class period for that course. A department may obtain approval to administer a separately scheduled examination if all of the following criteria are met:
    a. The course is multi-sectioned.
    b. A common departmentally developed examination will be administered to all students in all sections at the same time.
    c. The test scores will be used as a basis for a uniform grading procedure for all sections of the course. Requests to hold separately scheduled examinations must be made to the registrar and approved by the provost in time to be announced in the Schedule of Classes to allow students to plan in advance. Only under unusual circumstances will a course be approved for separately scheduled examinations if the deadline is past to include notification in the Schedule of Classes. Whenever a separately scheduled examination is administered, a regular class meeting during that week shall be omitted.
    Students who are unable to take a separately scheduled examination at the scheduled time indicated in the Schedule of Classes, because of a course conflict or other legitimate reason must notify the instructor in advance and must be given the opportunity to be examined at another time mutually convenient for the student and the instructor. The instructor shall determine

whether to administer the same examination or an alternate examination, or use an alternate assessment procedure.

3. At the end of the semester, a week is set aside for final examinations or other term evaluations, with a two-hour period normally scheduled for each course. The following policies govern the responsibilities of students and faculty members during this week:

   a. Final exams may not be given at a time other than that for which the exam is scheduled by the registrar. An instructor may not give a final exam prior to final exam week nor change the time of offering of the final examination as it appears in the final exam schedule. Permission to change the time for which an exam is scheduled may be given only by the dean of the college. If the instructor elects not to give a final exam in a course of two or more credits, the class is required to meet at the scheduled final exam period for other educational activity such as a review of the course or feedback on previous exams.

   b. Final exam periods are determined according to the regularly scheduled meeting time of the class. However, certain courses are assigned special group exam times so that several sections of the same course may be tested together. The criteria for establishing special group exams are similar to those listed for separately scheduled exams listed in number 2 above. If this results in conflicting group examination periods, students should inform the instructor in charge of the first of the two conflicting courses as listed on the final exam schedule within the special groups in question; that instructor is responsible for arranging a special examination or making some other adjustment.

   c. Evening courses with lectures scheduled at 6:00 p.m. or later should give their examinations during finals week from 7:00-9:00 p.m. on the day the class normally meets. If this exam conflicts with an evening group exam, the instructor responsible for the latter must arrange a special examination for any students who have a conflict.

   d. If unusual circumstances involve the need for students to change the time of their final examination, they must obtain the approval of the instructor of the course.

   e. If a student has three examinations scheduled on the same calendar day and wishes to change one to another day, the instructor of the course having the smallest number of students is responsible for arranging an alternate examination time for the student unless make-up exam times are available in one of the other courses.

   f. All faculty members and teaching assistants with instructional or grading responsibilities are considered to be on duty throughout the entire final examination week and are expected to be available to students during that week for discussion of any matters pertaining to the final examination and final grade or to other aspects of the course.

Dead Week

For each Fall and Spring semester, the last full week of classes before final examinations is designated as Dead Week. The intent of this policy is to establish a one-week period of substantial and predictable study time for undergraduate students. During the Dead Week period, regular lectures are expected to continue, including the introduction of new content, as deemed appropriate by the instructor. The restrictions established by this Dead Week policy are:

- Due dates for mandatory graded submissions of any kind that fall within Dead Week must be listed on the syllabus provided at the start of the course.
- Mandatory final examinations may not be given during the Dead Week period except for laboratory courses or courses that meet weekly and for which there is no contact during the normal final examination week.
- Registered ISU Student Organizations may not hold any meetings, functions, or sponsored events during the Dead Week period. Any exception to these restrictions must be authorized in advance by Office of the Dean of Students.

Scholastic Recognition

The university recognizes those students who are doing exceptionally well in several ways, including the following.

1. **Dean's List.** Each semester the university issues a dean's list made up of those students who have carried at least 12 credit hours of graded or S-F courses with a 3.50 grade-point average or above for the semester. Courses taken on a P-NP basis do not count as part of the 12-credit hour requirement. No dean's list is issued for summer school. The list can be viewed from the Office of the Registrar web site (http://www.registrar.iastate.edu).

2. **Top 2 Percent.** Each spring semester, undergraduate students in the top 2% of their class (freshman, sophomore, junior, and senior) within their college, based on cumulative grade point average, are recognized. In addition to a congratulatory letter from the university president, a notation of the accomplishment is recorded on the student's permanent record.

3. **Graduation with Distinction.** Undergraduates who have a cumulative grade point average of 3.50 or higher at the beginning of their final term

are eligible to graduate "with distinction" provided they have completed 60 semester credits of coursework at Iowa State University at the time they graduate, including a minimum of 50 graded credits.

4. **Cumulative grade point recognition.** Students who graduate with a cumulative grade point average of 3.50 or higher are recognized as follows:

- Summa Cum Laude: cumulative grade point average of 3.90 or higher.
- Magna Cum Laude: cumulative grade point average of 3.70 to 3.89.
- Cum Laude: cumulative grade point average of 3.50 to 3.69.

This recognition appears on the student's official transcript and diploma and in the commencement program.

5. **Candidates for the bachelor of liberal studies degree** may be graduated with distinction providing that they (a) have completed 45 semester credits of coursework at the three Iowa Regent universities at the time of graduation, (b) have earned at least a 3.50 cumulative grade point average at ISU, and (c) their combined grade point average for coursework taken at the three Iowa Regent universities meets the honors cutoff specified above.

6. **Honors Program.** Students who are full members of the University Honors Program prior to Fall Semester 2011 must have a cumulative grade point average of 3.35 or higher at the beginning of their final term. Students becoming full members during Fall Semester 2011 or later need a cumulative grade point average of 3.5 at the beginning of their final term. In addition to meeting the appropriate grade point requirement, students will have completed an approved honors program of study and an honors project prior to graduation. This recognition appears on the student's permanent record and diploma, and in the commencement program.

ACCREDITATION AND ADMINISTRATION

Accreditation

Iowa State University is accredited by the Higher Learning Commission.

Higher Learning Commission
230 South LaSalle St., Suite 7-500
Chicago, IL 60604-1411
(800) 621-7440; (312) 263-0456
Fax: (312) 263-7462

info@hlcommission.org

www.ncahlc.org (http://www.ncahlc.org)

Board of Regents, State of Iowa

www.regents.iowa.gov/ (http://www.regents.iowa.gov)

The laws of the United States and of the State of Iowa provide for resident academic instruction, research, and extension education, and for the management of Iowa State University of Science and Technology. The university and two other state educational institutions of higher learning are governed by the Board of Regents, State of Iowa, which is composed of nine members nominated by the Governor of Iowa and confirmed by the Senate of Iowa. The immediate regulation and direction of the academic, research, and extension activities of the university are delegated by the Board of Regents, State of Iowa, to the president and faculty of the university. The board appoints an executive director with overall responsibility for the administration of the central office of the board located in Urbandale, Iowa.

Officers of Administration

Interim President, Benjamin J. Allen, Ph.D.
President of the University

Jonathan A. Wickert, Ph.D.
Senior Vice President and Provost

Ann Marie Vanderzanden, Ph.D.
Associate Provost for Academic Programs

Miles Lackey, M.B.A.
Chief Financial Officer and Chief of Staff

Kate Gregory, M.S.
Senior Vice President for University Services

Martino Harmon, Ph.D.
Senior Vice President for Student Affairs

Wendy K. Wintersteen, Ph.D.
Dean of the College of Agriculture and Life Sciences

David P. Spalding, M.B.A.
Dean of the College of Business

Luis Rico-Gutierrez, M.S.
Dean of the College of Design

Sarah Rajala, Ph.D.
Dean of the College of Engineering

Laura D. Jolly, Ph.D.
Dean of the College of Human Sciences

Beate Schmittmann, Ph.D.
Dean of the College of Liberal Arts and Sciences

Patrick G. Halbur, D.V.M., Ph.D.
Interim Dean of the College of Veterinary Medicine

William R. Graves, Ph.D.
Dean of the Graduate College

Vernon J. Hurte, Ph.D.
Dean of Students

M. Beth McNeil, M.S.
Dean of the Library

ADMISSIONS

Office of Admissions

Director

Katharine Johnson Suski

Admission

When to Apply

Applicants for the fall semester are encouraged to apply during the fall of the year preceding their entry to Iowa State University. Applications for other terms should be submitted well in advance of the desired entry date.

Application deadlines are available at www.admissions.iastate.edu. (http://www.admissions.iastate.edu)

Completed applications for admission to the professional curriculum in the College of Veterinary Medicine, together with the required supporting transcripts, must be received by an established deadline. See College of Veterinary Medicine, Application and Admission.

How to Apply

Applications for admission are available online at www.admissions.iastate.edu. (http://www.admissions.iastate.edu)

Iowa State University operates on a rolling admissions basis. Admission of applicants for fall semester begins in July of the preceding year. Admission for other terms begins approximately 12 months prior to the beginning of the term. Admission offers are issued for a specific term and are valid only for the term specified.

Undergraduate Admission Directly from High School

Admission decisions are made by admissions officers in accordance with the entrance requirements as set forth in the Iowa Administrative Code as well as the admission policies established by the Faculty Senate.

Students who seek admission must meet the following requirements and also any special requirements for the college or curriculum of their choice.

Applicants must submit an application for admission and the appropriate application fee (see www.admissions.iastate.edu (http://www.admissions.iastate.edu) for current application fee information). In addition applicants must have their secondary school provide an official final transcript of their academic record, including cumulative grade point average, rank in class, and certification of graduation.

Applicants must also arrange to have their ACT or SAT scores reported to Iowa State directly from the testing agency. U.S. citizen and immigrant applicants who will not graduate from an approved U.S. high school and whose primary language is not English must meet university communication proficiency requirements. This can be accomplished by achieving satisfactory scores on the TOEFL, IELTS, PTE, ACT, or SAT. Detailed information concerning test score requirements can be found at http://www.admissions.iastate.edu/intl/index.php.

Applicants may be required to submit additional information or data to support their applications.

A. Graduates of approved Iowa high schools who have the subject-matter background required by Iowa State University and who achieve a Regent Admission Index (RAI) score of at least 245 will be offered admission. Graduates of approved Iowa high schools who have the subject-matter background required by Iowa State University and who achieve less than a 245 RAI score will be considered for admission on an individual basis.

The RAI score will be calculated for each applicant based upon one of two mathematical formulas: the Primary RAI Formula (for students whose high school provides class rank) and the Alternative RAI Formula (for students whose high school does not provide class rank). The mathematical equation for each formula is listed below:

Primary RAI Formula (for students whose high school provides class rank):

Percentile class rank x 1

\+ (ACT composite score x 2)

\+ (Cumulative GPA x 20)

\+ (Number of years of core courses in high school x 20)

= RAI Score

Alternative RAI Formula (for students whose high school does not provide class rank):

(ACT composite score x 3)

\+ (Cumulative GPA x 30)

\+ (Number of years of core courses in high school x 5)

= RAI Score

Note: For purposes of calculating the RAI, SAT scores will be ACT composite equivalents; high school rank is expressed as a percentile with 99% as the top value; high school GPA is expressed on a 4-point scale: and number of high school courses completed in the core subject areas is expressed in terms of years or fractions of years of study.

Applicants from high schools that do not present all of the factors required for calculation of the RAI score will be considered for admission on an individual basis.

B. Nonresidents of Iowa, including international students, may be held to higher academic standards, but must meet at least the same requirements as resident applicants.

C. Applicants who are graduates of nonapproved high schools will be considered for admission in a manner similar to applicants from approved high schools, but additional emphasis will be given to scores earned on standardized examinations.

D. Applications may be considered from students who did not graduate with their high school classes. They will be required to submit all academic data to the extent that it exists and achieve scores on standardized examinations which will demonstrate that they are adequately prepared for academic study.

E. Students with satisfactory academic records may be admitted, on an individual basis, for part-time university study while enrolled in high school or during the summers prior to high school graduation.

F. Exceptional students may be admitted as full-time students before completing high school. Early admission is provided to serve persons whose academic achievement and personal and intellectual maturity clearly suggest readiness for college-level study.

High School Preparation

Graduation from an approved high school shall ordinarily precede entrance into Iowa State University.

Students who wish to enter Iowa State University directly from high school (or transfer from another college or university with less than 24 semester hours of graded transferable college credit) must meet the level of academic performance described above and show evidence of the following high school preparation:

English/Language Arts

Four years, emphasizing writing, speaking, and reading, as well as an understanding and appreciation of literature

Mathematics

Three years, including one year each of algebra, geometry, and advanced algebra

Science

Three years, including one year each of courses from two of the following fields: biology, chemistry, and physics

Social Studies

Two years

Additional Requirements for the College of Liberal Arts and Sciences and the College of Engineering

In addition to the high school preparation requirements described above, students applying to the College of Liberal Arts and Sciences must have completed an additional year of social studies, for a total of three years, and two years of a single foreign language. Students applying to the College of Engineering must have completed two years of a single foreign language.

Students who do not meet the high school course preparation requirements listed here, but who are otherwise well qualified, may be admitted after individual review of their applications.

Undergraduate Admission - Nondegree Undergraduate

Students who wish to attend Iowa State University to take undergraduate courses but who do not plan to seek an undergraduate degree from Iowa State University should apply as nondegree undergraduate students. Credit taken under the nondegree undergraduate classification is applicable for undergraduate degree purposes for those who are later admitted as degree-seeking undergraduate students. Nondegree undergraduates who have already earned an undergraduate degree may not enroll in graduate credits. To take courses listed as available for graduate credit, a student must enroll as a nondegree graduate and pay graduate fees. Credit obtained under the nondegree undergraduate classification may not be applied toward a graduate degree.

Nondegree applicants are held to the same standards of admission as degree-seeking applicants, including English language proficiency.

Students enrolled in the Intensive English and Orientation Program (IEOP) are classified as nondegree undergraduate students in the College of Liberal Arts and Sciences. Permission to enroll in one academic course in addition to full-time intensive English study may be granted under special circumstances.

Reentering Students - Undergraduate and Graduate

Reentering students are those who have previously attended Iowa State University and are returning after an absence of at least one full year. See Index, Reentry Students.

International students need to reapply after an absence of one full semester, exclusive of summer session. International reentries must also contact the International Students and Scholars office to request the necessary visa application forms.

Reentering graduate students do not need to complete a reentry form but should notify their department and the Office of the Registrar of their intent to reenter Iowa State University. See Index, Reentry Students for more information.

Undergraduate Admission by Transfer from Other Educational Institutions

Students who seek admission must meet the following requirements and also any special requirements for the college and curriculum of their choice.

Applicants must submit an application for admission, and the appropriate application fee (see www.admissions.iastate.edu (http://

www.admissions.iastate.edu) for current application fee information). Applicants must also request that each college they have attended send an official transcript of record to the Office of Admissions. Failure to provide transcripts from all colleges or universities attended may result in denial of the application or dismissal from the university. If less than 24 semester hours of graded transferable college credit is completed prior to entry at Iowa State University, applicants must also request that their official high school transcript and ACT or SAT scores be sent to the Office of Admissions. Other transfer applicants are encouraged to provide high school academic information. Students who do not do so may be asked to take course placement examinations during orientation.

U.S. citizen and immigrant applicants who have not graduated from an approved U.S. high school and whose primary language is not English must meet the university's English communication requirement. This can be accomplished by achieving satisfactory scores on the Test of English as a Foreign Language (TOEFL), the International English Language Testing System (IELTS) or the SAT. Contact the Office of Admissions for minimum score requirements for each examination.

A. Transfer applicants with a minimum of 24 semester hours of graded transferable credit from regionally accredited colleges or universities, who have achieved for all college work previously attempted the grade point average required by Iowa State for specific programs, will be admitted. A 2.00 grade point average (on a 4.00 grading scale) is the minimum transfer grade point average requirement. Some programs may require a transfer grade point average higher than this minimum. Higher academic standards may be required of students who are not residents of Iowa, including international students.

Applicants who have not maintained the grade point average required by Iowa State University for specific programs or who are under academic suspension from the last college attended generally will be denied admission.

B. In addition to meeting the minimum transfer grade point average requirement described above, applicants who have completed fewer than 24 semester hours of graded transferable college credit prior to their enrollment at Iowa State must also meet the admission requirements for students entering directly from high school.

C. Transfer applicants under disciplinary suspension will not be considered for admission until information concerning the reason for the suspension has been received from the college assigning the suspension. Applicants granted admission under these circumstances will be admitted on probation.

D. Transfer applicants from colleges and universities not regionally accredited will be considered for admission on an individual basis, taking into account all available academic information.

Transfer Credit Practices

Iowa State University endorses the Joint Statement on Transfer and Award of Academic Credit approved by the American Council on Education (ACE) and the American Association of Collegiate Registrars and Admissions Officers (AACRAO). The current issue of Transfer Credit Practices of Designated Educational Institutions, published by AACRAO is an example of a reference used in determining transfer credit.

The acceptance and use of transfer credit are subject to limitations in accordance with the educational policies of Iowa State University.

A. Students from regionally accredited colleges and universities.

Credit earned at regionally accredited colleges and universities is acceptable for transfer, except for the following, which may not be accepted, or may be accepted to a limited extent:

—credit in courses determined by Iowa State University to be of a developmental, vocational, or technical nature

—credit in courses or programs in which the institution granting the credit is not directly involved.

No more than 65 semester or 97 quarter credits earned at two-year colleges can be applied to a bachelor's degree from Iowa State University. While there is no limit to the number of credits that may be transferred from a four-year institution, the last 32 semester credits must be completed at Iowa State University.

B. Students from colleges and universities which have candidate status.

Credit earned at colleges and universities which have become candidates for accreditation by a regional association is acceptable for transfer in a manner similar to that from regionally accredited colleges and universities if the credit is applicable to the bachelor's degree at Iowa State University.

Credit earned at the junior and senior classification from an accredited two-year college which has received approval by a regional accrediting association for change to a four-year college may be accepted by Iowa State University.

C. Students from colleges and universities not regionally accredited.

Courses completed at colleges and universities that are not regionally accredited will be evaluated according to the recommendations made by the American Association of Collegiate Registrars and Admissions Offices or the American Council on Education.

In determining the acceptability of transfer credit from private colleges in Iowa which do not have regional accreditation, the Regent Committee on Educational Relations, upon request from such institutions, evaluates the

nature and standards of the academic program, faculty, student records, library, and laboratories.

In determining the acceptability of transfer credit from colleges in states other than Iowa which are not regionally accredited, acceptance practices indicated in the current issue of Transfer Credit Practices of Designated Educational Institutions will be used as a guide. For institutions not listed in the publication, guidance is requested from the designated reporting institution of the appropriate state.

D. Students from foreign colleges and universities.

Transfer credit from foreign educational institutions may be granted after a determination of the type of institution involved, its recognition by the educational authorities of the foreign country, and an evaluation of the content, level, and comparability of the study to courses and programs at Iowa State University. Credit may be granted in specific courses or assigned to general areas of study. Extensive use is made of professional journals and references which describe the educational systems and programs of individual countries.

Additional Transfer Credit Policies

A. Students with credit obtained during military service.

Credit will be awarded for successful completion of technical or specialized schools attended while on active duty with the armed forces to the extent that the material is applicable toward degree requirements at Iowa State University. Application for such credit is made at the Office of Admissions, which follows many of the recommendations in the American Council on Education (ACE) publication A Guide to the Evaluation of Educational Experiences in the Armed Services.

B. Students with credit obtained through non-college sponsored instruction.

Credit will be awarded for successful completion of learning acquired from participation in formal courses sponsored by associations, business, government, industry, and unions to the extent that the material is applicable toward degree requirements at Iowa State University. Application for such credit is made at the Office of Admissions, which follows many of the recommendations in the American Council on Education (ACE) publication The National Guide to Educational Credit for Training Programs.

C. Students with credit obtained through correspondence courses.

Although Iowa State does not offer correspondence courses, college level courses taken by correspondence from accredited colleges or universities are acceptable for transfer at the undergraduate level if the courses taken are those that do not require laboratory study.

D. College Level Examination Program (CLEP).

Iowa State University will award credit for each of the following 15 examinations: Financial Accounting, Principles of Accounting, American Government, Biology, Calculus, French Language, German Language, Humanities, Principles of Macroeconomics, Principles of Microeconomics, Natural Sciences, Introductory Psychology, Social Sciences and History, Introductory Sociology, Spanish Language.

Application of CLEP credit to a degree program varies with the department, so students should consult with their department before they register for CLEP examinations. Additional information is available at www.admissions.iastate.edu/cbe/cbe_clep.php (http://www.admissions.iastate.edu/cbe/cbe_clep.php).

E. Students with "test-out" credit.

Students who have earned credit at other colleges or universities through Advanced Placement (AP), College Level Examination Program (CLEP), or International Baccalaureate (IB) examinations may qualify for credit at Iowa State University. Scores from these examinations should be sent directly to the Office of Admissions; credit will be awarded provided the scores satisfy Iowa State's requirements.

Credit earned at another college through locally designed test-out examinations may transfer to Iowa State University if accompanied by at least 12 transferable semester credits earned through coursework taken at that institution.

Articulation/Transfer Agreements

A. Iowa Regent Universities General Education Articulation Agreement.

Iowa State University participates in an articulation agreement with the other two Iowa Regent universities concerning the acceptance of their general education programs into the Iowa State University College of Liberal Arts and Sciences. Under the terms of this agreement, students who have satisfied general education requirements at the University of Northern Iowa or in the College of Liberal Arts at the University of Iowa may transfer to Iowa State's College of Liberal Arts and Sciences with their general education requirements met (with the possible exception of the foreign language and library requirements).

B. Associate of Arts (A.A.) Articulation Agreement with Iowa public community colleges.

Students who plan to enter the College of Liberal Arts and Sciences or the College of Business at Iowa State University with an associate of arts degree from an Iowa public community college, and who have at least 60 prescribed semester (90 quarter) credits acceptable for transfer and at least a 2.00 cumulative grade point average, will be considered to have met the general education requirements of that college. College of Business students will still be required to take an ethics and a global

course to satisfy general education requirements unless they are taken as part of the associate of arts degree.

C. Associate of Science (A.S.) Articulation Agreement with Iowa public community colleges.

Students who plan to enter the College of Liberal Arts and Sciences at Iowa State University with an associate of science degree from an Iowa public community college, and who have at least 60 prescribed semester credits acceptable for transfer and at least a 2.00 cumulative grade point average, will be enrolled at junior level status upon entry to Iowa State University, College of Liberal Arts and Sciences. Transfer students with AS degrees will have their transfer credits evaluated course-by-course to determine how the courses will be applied to their intended Iowa State major/degree program requirements.

D. Career-technical credit from Iowa public community colleges.

Iowa State University will accept up to 16 semester (24 quarter) credits earned in career-technical courses where the sending Iowa public community college will accept such courses toward its associate of arts or associate in science degree. Certain career-technical courses at Iowa community colleges may be articulated to Iowa State University as academic credit. The credit hours earned in these articulated courses would transfer in addition to the 16 semester hour career-technical maximum. Please refer to the course equivalency guides on the Web (www.admissions.iastate.edu/equiv) or contact the Office of Admissions for more information.

E. AP and CLEP credit from Iowa public colleges and universities.

Iowa State University has an agreement with the Iowa public colleges and universities which allows credit earned through AP and CLEP examinations to transfer directly to Iowa State University if accompanied by at least 12 transferable semester credits earned through coursework taken at the sending institution.

On-line Transfer Articulation System (TRANSIT)

TRANSIT is Iowa State's online system, which displays how credits from a community college or another university may transfer to a degree program at Iowa State. In TRANSIT, prospective or current students can generate a transfer credit evaluation showing how their courses and degrees from a community college or university transfer to Iowa State University. In addition, students can request an unofficial degree audit, which will display how their transfer courses are applied within a particular Iowa State major/degree program. TRANSIT is easy to use and can be accessed by going to http://transit.iastate.edu.

Transfer of Credits

Credits presented from another institution are evaluated initially by the Office of Admissions to determine whether the courses are acceptable for transfer credit. In addition, credits applied toward a particular degree will be determined by the student's college, based on relevance to the students' program requirements as well as the level of performance deemed necessary for successful progress in that program. For example, courses that are deemed important to a program but were earned with less than a C grade may or may not be approved for a program. This policy also applies to students already enrolled at Iowa State University and to new transfer students. Grades earned in courses transferred to Iowa State University will not be used in calculating a transfer student's Iowa State cumulative grade point average.

A student who is admitted as a transfer from another college or university is required to have at least a 2.00 cumulative grade-point average for all transferable work taken elsewhere. If, due to special circumstances, a student is admitted with less than a 2.00 average, that student will have a transfer quality-point deficiency.

This deficiency will be added to any deficiency accumulated at Iowa State University and will be used to determine whether satisfactory progress toward a degree is being made. To graduate, students must earn sufficient quality points above a 2.00 at Iowa State University to offset any quality-point deficiency, including a transfer quality-point deficiency.

Students should consult with their academic advisers and the Office of Admissions before taking coursework at other colleges and universities to be certain the credits will transfer and will be applicable to their program of study. Students who believe that any transfer credits have not been correctly evaluated should consult with their academic adviser and with the Office of Admissions. Questions concerning how transfer credits are applied toward a degree program should be referred to the academic adviser and college office.

No more than 65 semester or 97 quarter credits earned at two-year colleges can be applied to a bachelor's degree from Iowa State University. While there is no limit to the number of credits that may be transferred from a four-year institution, the last 32 semester credits before receiving a degree from Iowa State University must be completed at Iowa State University.

Iowa State University students who attend one of the other Iowa Regent universities under the Regent Universities Student Exchange Program will have the credits earned at the other university counted as resident credit and grades received included in their Iowa State University cumulative grade point average, even if the credits are included in the last 32 semester credits. For information on applying to the program see Index, Regent Universities Student Exchange Program.

Credit by Examination (CBE)

It is Iowa State University policy to grant academic credit by examination in many of the undergraduate courses listed in the university bulletin. Credit is awarded primarily in the introductory level classes in mathematics, natural, physical, and social sciences, and the liberal arts.

Students with superior high school backgrounds or those with college-level proficiency in certain subject areas are strongly encouraged to investigate and attempt testing in the CBE programs available.

Types of Credit By Examination Programs (CBE)

Students may earn academic credit in any of four ways and have that credit recorded on their academic record when they enroll. Programs accepted at Iowa State include the Advanced Placement (AP) Program, the International Baccalaureate (IB) Examinations, departmental examinations, and the College Level Examination Program (CLEP). Iowa State's policies for awarding credit for each of these programs may be found at www.admissions.iastate.edu/cbe (http://www.admissions.iastate.edu/cbe).

Advanced Placement (AP) Program of the College Board

This program allows students, while still in high school, to take examinations for credit at the college level. Iowa State University awards credit or advanced placement through the Advanced Placement Program in art, biology, chemistry, computer science, economics, English, environmental science, foreign languages, geography, government and politics, history, mathematics, music, physics, psychology and statistics. High school counselors and teachers will assist with testing arrangements.

Generally, students scoring 3 or better on the exams will be considered for course credit based on departmental review of the exams. In some departments, only scores of 4 or better will be considered for credit.

Detailed information concerning the Advanced Placement Program can be found at https://apstudent.collegeboard.org/home.

International Baccalaureate Examinations

The International Baccalaureate (IB) Program, offered at many high schools in the United States and abroad, allows students the opportunity to take examinations for credit at the college level. These examinations are offered at standard and higher levels.

Iowa State University awards credit for most higher level examinations and some standard level examinations. Students must receive a minimum score of 4 to qualify for academic credit in most subject areas. Some departments require higher scores. Official IB examination results must be sent directly to the Office of Admissions from the International Baccalaureate Americas Office. Results listed on high school transcripts are not considered official.

Detailed information concerning the IB Program can be found at http://ibo.org/iba/.

Departmental Examinations

Students may take locally constructed departmental examinations for undergraduate credit in specified subject areas for which they and the department feel they have the necessary preparation. These exams are generally administered by the department which offers the course (for exceptions, see CLEP offerings below). Students interested in taking departmental (or CLEP) examinations should contact the appropriate department for specific information on the course covered by the exam and the exam itself. A nonrefundable fee is charged for each departmental examination requested.

If an acceptable exam score is achieved, a grade of T will be reported to the Office of the Registrar. The T grade represents performance equivalent to a C or better in the course. T grades are not used in computing students' grade point averages; however, the credit does become part of their official academic record and may be applied toward their graduation requirements. For a listing of common departmental test-out exams, refer to http://counseling.iastate.edu/testing-services/test-outs.

Most examinations for credit are prepared by the departments offering the courses. In some cases, the examination used is part of the College Level Examination Program (CLEP), where the content of the CLEP test has been judged to be an equivalent to the content of the course.

College Level Examination Program

CLEP is available on computer only and Iowa State University only accepts the CLEP tests listed in this section, and does not accept College Mathematics, College Algebra, Precalculus, College Composition, College Composition Modular, American Literature, Analyzing and Interpreting Literature, or English Literature. Up to six semester credit hours in each of these three CLEP general tests is awarded: Social Sciences and History, Humanities, and Natural Sciences. In addition, the College of Engineering does not allow credit earned from CLEP Social Sciences and History, Humanities, and Natural Sciences tests to be used in their students' degree programs.

CLEP tests accepted at Iowa State University include American Government (Pol S 215); Financial Accounting (Acct 284; engineering majors should consult with their academic adviser before registering for this examination); Biology (Biol 101, not for biology or engineering majors); Calculus (Math 165); Introductory Psychology (Psych 101); Introductory Sociology (Soc 134); Principles of Macroeconomics (Econ 102); and Principles of Microeconomics (Econ 101).

In addition, Iowa State University will award up to 16 semester credit hours for CLEP French Language, up to 16 semester credit hours for CLEP German Language, and up to 16 semester credit hours for CLEP Spanish Language. Please note that native or near native speakers of French, German, or Spanish may not test out of the beginning or intermediate levels in these languages.

Information about testing centers and registration can be found at https://clep.collegeboard.org/search/test-centers. For information on whether to take any of the CLEP tests, contact your academic

adviser. Additional information on the CLEP exam is available at https://clep.collegeboard.org/.

Policies and Procedures Governing CBE Tests

1. Departmental and CLEP tests are offered to newly admitted or currently enrolled students at Iowa State University. Former and future students will receive credit only if they enroll sometime during the twelve months immediately following the test(s).

2. Permission to take a departmental examination is obtained from the department. Students may be denied permission because (a) the nature of the course is such that proficiency cannot be measured by such a test, (b) the student does not appear to have adequate background to pass the examination for the course, or (c) the student would not otherwise be allowed to enroll in the course. Students may appeal such a denial to the dean of the college in which the department is administered and subsequently to the provost.

3. Students may ordinarily attempt a CBE test only once in any course or area. Under special circumstances a retest may be taken upon approval of the department in which the course is offered.

4. Credit by examination will not be granted if it duplicates courses previously passed or failed.

5. Departmental examinations and CLEP subject tests cover only a single course and students may not test out of independent study or special topic courses.

6. There is a nonrefundable fee for all departmental tests. The fee is set by the Board of Regents, State of Iowa, and is subject to change.

7. Departmental examinations are usually given just prior to, or within two weeks of, the beginning of fall and spring semesters. For more information, students should contact the department that offers the class. CLEP tests are given throughout the year.

8. Credit for the CLEP examinations Social Sciences and History, Humanities, and Natural Sciences is not evaluated as equivalent to any specific course and cannot be used in place of specific course requirements for the major. All colleges (except Engineering, which does not accept these tests) allow these CLEP credits to be used for either general requirements (not in Liberal Arts and Sciences) or elective credit. Students are responsible for checking with their academic advisers to determine whether such credit is to their benefit.

9. Listed below are policies for transferring CBE from another college or university to Iowa State University:

   a. AP or CLEP credit which is earned at an Iowa public college or university may be transferred directly to Iowa State University provided it is accompanied by at least 12 semester credits earned in residence at the sending institution. AP or CLEP credit which is earned at any other college or university may not be transferred directly to Iowa State. However, the scores from these examinations may be sent to Iowa State University from the testing agency, and credit will be awarded based on Iowa State's AP and CLEP policies.

   b. IB credit earned at another college or university may not be transferred directly to Iowa State University. However, the scores from IB examinations may be sent to Iowa State from the testing agency, and credit will be awarded based on Iowa State's IB policies.

   c. Credit earned at another college or university through local test-out examinations may be transferred directly to Iowa State University provided it is accompanied by at least 12 semester credits earned in residence at the sending institution.

10. Credit earned from CBE will be posted to the student's academic record at the end of the term. CBE credits will be counted toward the projected year in school classification used to establish registration start dates.

11.Some professional programs do not accept T (test-out) credit in preprofessional courses. Students who anticipate applying to such programs should inquire about the acceptability of such credit before registering for such CBE tests.

12. Credit established at Iowa State University will usually transfer to other colleges and universities; however, the final decision rests with the institution reviewing the transcript.

Below is detailed information concerning Iowa State University admission policies and procedures. Prospective students are also encouraged to visit the following websites for additional information:

Office of Admissions: www.admissions.iastate.edu (http://www.admissions.iastate.edu)
Apply: www.admissions.iastate.edu/apply/online/ (https://www.admissions.iastate.edu/apply/online)
Visits to Campus: http://www.admissions.iastate.edu/visit/index.php
Freshman Admissions: www.admissions.iastate.edu/freshman/ (https://www.admissions.iastate.edu/freshman)
Transfer Admissions: https://www.admissions.iastate.edu/transfer_credit.php
International Admissions: www.admissions.iastate.edu/intl/ (http://www.admissions.iastate.edu/intl)
Graduate Admissions: www.admissions.iastate.edu/graduate/ (http://www.admissions.iastate.edu/graduate)
Veterinary Medicine Admissions: www.vetmed.iastate.edu/students/future-dvm-students (http://www.vetmed.iastate.edu/students/future-dvm-students)
Orientation: www.admissions.iastate.edu/orientation (https://www.admissions.iastate.edu/orientation)

Destination Iowa State: https://www.admissions.iastate.edu/destination/index.php
Admissions Partnership Program: www.admissions.iastate.edu/partnership/ (http://www.admissions.iastate.edu/partnership)
On-line Transfer Articulation System (TRANSIT): www.transit.iastate.edu/ (https://transit.iastate.edu)
Credit by Exam (CLEP, AP, IB): www.admissions.iastate.edu/cbe/ (https://www.admissions.iastate.edu/cbe)
Veterans and Military Students: www.admissions.iastate.edu/military/ (https://www.admissions.iastate.edu/military)

CAREER KEYS

Career Keys

Career keys are based on *Holland's Theory of Career Choice.*

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    - Honors Program
    - Iowa Lakeside Laboratory
  - Undergraduate Interdisciplinary Programs
    - Interdisciplinary Studies
    - Seed Science
    - University Studies

- Iowa State Faculty
- Plan of Study - Soar in 4
- Preprofessional Study
- Previous Catalogs
- Registration
- Student Financial Aid
- Student Housing and Dining
- Student Life
- Student Records
- Student Services
- Tuition, Fees and Expenses
- Undergraduate Majors, Minors, Certificates

CHOOSE YOUR ADVENTURE

Alpha listing of undergraduate majors, minors, certificates.

COLLEGES AND CURRICULA

Undergraduate and Professional Degree Programs

The university is organized into eight colleges, including the Graduate College. Six colleges offer undergraduate degree programs, and the College of Veterinary Medicine offers the Doctor of Veterinary Medicine degree. For a listing of the more than 100 majors offered by the Graduate College, see the summary at the end of the Graduate College section of this publication.

Iowa State University is accredited by the Higher Learning Commission.

Bachelor's Degree Requirements

To receive a degree, a student must meet the requirements of the curriculum in which the degree is to be awarded. Verification that the student has met those requirements is made by the dean of the college, who also has the authority to waive a requirement under exceptional circumstances.

A cumulative grade point average of at least 2.00 in all work taken at Iowa State University is required for graduation.

A student admitted as a transfer from another college or university is normally required to have a 2.00 cumulative average at the time of entrance. A student may, however, be admitted with a quality-point deficiency, but will be required to earn sufficient quality-points above a 2.00 at Iowa State to offset the quality-point deficiency at the time of entrance.

No more than 65 semester or 97 quarter credits earned at two-year colleges can be applied to a bachelor's degree from Iowa State University. There is no limit to the number of credits that may be transferred from a four-year institution.

A student who takes work at another college or university after having been enrolled at Iowa State must submit transcripts of all work attempted to the Office of Admissions at Iowa State. This work must average a 2.00 or the deficiency of quality points will be assessed against the student. Failure to submit such transcripts will be grounds for dismissal.

In unusual circumstances, the Academic Standards Committees of the respective colleges may review and give further consideration to the records of students who, except for grade-point average, have satisfactorily completed all graduation requirements. If the appropriate college Academic Standards Committee considers that the educational and professional needs of such a student have been satisfactorily met, or can be satisfactorily met by imposing further conditions, the committee may recommend to the dean of the college that the student be graduated or that a supplemental program be accepted in place of the fully unqualified grade point average. The college Academic Standards Committee chairperson reports such exceptional actions to the Faculty Senate Committee on Academic Standards and Admissions.

To qualify for a bachelor's degree, a student must take a minimum of 32 credits in residence at Iowa State University. Also required is that the last 32 credits must be taken in residence, although under special circumstances, with prior written approval of the student's major department, six of the last 32 credits may be transferred and applied toward a degree at Iowa State University.

A student may receive two bachelor's degrees if he or she meets the requirements of each curriculum and earns at least 30 credits beyond the requirements of the curriculum requiring the greater number of credits. Each degree program must be approved by the appropriate department chair or head.

A student fulfilling the requirements of two separate curricula in different colleges may, in certain cases, receive a degree from one of the colleges with double majors crossing college lines. The permission of both deans must be obtained and each degree program must be approved by the appropriate department and dean.

Undergraduate Certificates

All undergraduate certificates require at least 20 credits, including at least 12 credits taken at Iowa State University. At least 9 of the credits taken at Iowa State University must be in courses numbered 300 or above. The undergraduate certificate must include at least 9 credits that are not used to meet any other department, college, or university requirement except to satisfy the total credit requirement for graduation and to meet credit requirements in courses numbered 300 or above. Courses taken for an undergraduate certificate may not be taken on a pass-not pass basis. A cumulative grade point average of at least 2.00 is required in courses taken at Iowa State University for an undergraduate certificate. Specific requirements and/or restrictions are available from the department or program offering the undergraduate certificate (see Index or individual colleges for information).

Communication Proficiency Policy

Basic Principles: The faculty of Iowa State University believe that all educated people should be able to communicate effectively in a variety of settings and media, including electronic. Consequently, Iowa State University graduates are expected to develop competence in three interrelated areas of communication: written, oral, and visual.

This communication competence can best be achieved through the following five principles:

- Communication instruction and practice are distributed over the student's entire undergraduate experience, both in and out of the classroom, from the first year through the senior year.

- Communication instruction and practice are distributed across the curriculum, both in communication courses and in courses in the student's major.
- Active learning and higher-order thinking are fostered through communication.
- Faculty across the university share responsibility for the student's progress in communication practices.
- Both faculty and students engage in ongoing assessment for continuous improvement of the student's communication practices.

Iowa State University's communication curriculum, based on these five principles, seeks to enrich the student's understanding of the various subjects studied as well as prepare the student to communicate successfully in professional, civic, and private life.

Foundation Courses

To ensure that broad communication competence is addressed and developed at the beginning of a university career, all students will earn six credits in the two-course introductory sequence (ENGL 150 Critical Thinking and Communication and ENGL 250 Written, Oral, Visual, and Electronic Composition), normally taken in the first and second years. Students will focus on writing and critical reading, with complementary instruction in visual, oral, and electronic communication; they will concentrate on civic and cultural themes; and they will enter work in a communication portfolio to document their current level of proficiency.

Communication Proficiency Grade Requirement: At a minimum, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 250; some majors/degree programs may set higher requirements for communication proficiency.

Upper-Level Curricula

Continuing development of communication skills will be directed by the student's major department. Using the university's basic principles as a guide, each department will specify a set of intended learning outcomes and design communication experiences by which students in the major can achieve the desired level of communication proficiency.

Departments may select from or combine a variety of communication options that best match their faculty, students, and curriculum:

- designated communication-intensive courses that integrate written, oral, and visual communication into a course in the major;
- a sequence of courses within the major that incorporates communication tasks of increasing complexity;
- linked courses—one in communication, one in the major—that integrate readings and assignments;
- advanced composition course(s) appropriate to the student's major and offering instruction in written, oral, and visual communication;
- communication-intensive activities within or beyond course work, such as communication portfolios, discipline- or course- specific student tutoring, community service projects, internships, electronic presentations, informational fairs, juried competitions, entrepreneurial projects, newsletters, Web sites.

Departments will retain the authority for regularly assessing the degree to which their students achieve the specified learning outcomes and for making curricular improvements based on departmental assessment data.

Non-Native Speakers of English: Students admitted to the university who are graduates from non-U.S. high schools and whose first language is not English are required to take the English Placement Test before the beginning of their first semester of enrollment as students at Iowa State. This requirement includes freshmen as well as those who have transferred credit from other institutions. The test is administered by the English Department and is offered before the beginning of each semester. Students whose performance on this placement examination is satisfactory will follow the regular university communication proficiency requirements. Students who have deficiencies will enroll in special English classes, as determined by the test results.

Library Study

Independent study and investigation through the use of books, journals, and libraries enable students to grow intellectually and professionally in college and afterward. For this reason, all students receive instruction in the use of the University Library, including practice in how to locate the published literature of their respective fields of study.

For undergraduate students, LIB 160 Information Literacy is a one-credit graduation requirement course that provides a foundation of information literacy and library research skills and concepts. Librarians also work each semester with ISU course instructors to teach course-related instruction sessions for undergraduate students in the effective use of library resources in course-relevant fields of study.

Each semester librarians work with ISU course instructors to teach course-related instruction sessions for graduate students in library research skills, information literacy concepts, and the effective use of library resources and research tools in course-relevant fields of study. For more information, call the Library at 515 294-4527.

U.S. Diversity and International Perspective Requirements

One of Iowa State University's goals is to prepare its students to meet the challenges of responsible citizenship and effective professional roles in a culturally diverse global community. To help achieve this goal, all undergraduate students must fulfill graduation requirements in two areas: U.S. Diversity and International Perspectives. The specific standards used to certify students' fulfillment of these requirements

vary from major to major, but all require three credits of course work (or the equivalent in some alternative academic experience) for each of the requirements. In most cases, courses used to meet the U.S. Diversity and International Perspectives requirements can also be used to fulfill general education requirements of the student's college or requirements of the student's major. Students should consult with advisers for details of the requirements in particular majors.

The focus of the U.S. Diversity requirement is the multicultural society of the United States. Courses or alternative academic work used to meet the requirement address significant manifestations of human diversity and provide students with insights that enhance their understanding of diversity among people in the U.S.

Through completion of the U.S. Diversity requirement, students will achieve at least two learning outcomes such as those listed below.

Students will be able to:

- articulate how their personal life experiences and choices fit within the context of the larger mosaic of U.S. society, indicating how they have confronted and critically analyzed their perceptions and assumptions about diversity-related issues.
- analyze and evaluate the contributions of various underrepresented social groups in shaping the history and culture of the U.S.
- analyze individual and institutional forms of discrimination based on factors such as race, ethnicity, gender, religion, sexual orientation, class, etc.
- analyze the perspectives of groups and individuals affected by discrimination
- analyze how cultural diversity and cooperation among social groups affect U.S. society.

The focus of the International Perspectives requirement is the global community. Its objective is to promote students' understanding of cultural diversity and interdependence on a global scale. A period of immersion in a foreign culture is often a particularly effective way of meeting these objectives, so Iowa State University encourages the use of study-abroad experiences as a means of fulfilling the International Perspectives requirement. International students, because they are "studying abroad" from their home country's perspective, are normally deemed to have met the International Perspectives requirement. The International Perspective requirement shall be waived for U.S. military veterans who have completed at least three months of service stationed outside of the United States.

Through completion of the International Perspectives requirement, students will achieve at least two learning outcomes such as those listed below.

Students will be able to:

- analyze the accuracy and relevancy of their own worldviews and anticipate how people from other nations may perceive that worldview.
- describe and analyze how cultures and societies around the world are formed, are sustained, and evolve.
- analyze and evaluate the influence of global issues in their own lives.
- describe the values and perspectives of cultures other than their own and discuss how they influence individuals' perceptions of global issues and/or events.
- communicate competently in a second language.

Curriculum Requirements

The curriculum requirements, both in number of credit hours and specific courses, are guidelines for the student and his or her adviser in planning an academic program. The curriculum is subject to change and because of these changes, adjustments may need to be made.

Catalog in Effect

A student may choose to graduate under the catalog in effect at the time of graduation or a catalog for the previous five years, provided it covers a period of his or her enrollment. Full requirements of the chosen catalog must be met except that adjustments will be made in instances where courses are no longer available or where programs have been changed.

Special Programs

Honors Program

The Iowa State University Honors Program is designed for students who have demonstrated the ability and motivation to assume more than the usual responsibility for their undergraduate education. The program enables honors students to gain the maximum benefit from their undergraduate education. Students who graduate in the Honors Program receive the honors designation on their transcripts and diplomas.

Special educational opportunities. Students in the Honors Program determine their educational objectives and devise an individualized program of study to meet them. An honors program may include substitutions for required courses, a combination of courses from several departments to form a new major or minor, Honors courses or seminars, independent study and research, and other forms of innovation. Information about honors courses and seminars for the current academic year can be obtained from the Honors Program Office, 2130 Jischke Honors Building.

Other benefits. Members of the Honors Program have 24-hour access to the Jischke Honors Building as a quiet place to study, use the computers, and visit with other honors students. Students also have off-campus opportunities such as attending honors semesters and

conferences. Members receive extended loan privileges at the Library, priority scheduling, and the opportunity to apply for research funds.

ISU students who have a cumulative grade-point average of at least 3.5 become eligible to apply for admission to the Honors Program during their second semester in residence and continue to be eligible as long as they have at least 48 semester credits remaining before graduation. Transfer students with a G.P.A. of 3.5 or higher and more than 60 credits remaining are also eligible to apply.

First-Year Honors Program

Entering first-year students with outstanding high school records and academic ability may be eligible to participate in the First-Year Honors Program (FHP). The FHP, which introduces students to an honors education, consists of honors sections of English 250 and Library 160, an FHP seminar, and honors advisers. Students may also choose to participate in the Honors Mentor Program, which introduces students to scholarship and research. Participants are matched with faculty members conducting research in an areas of mutual interest. Admission to the FHP is limited, and is based on past academic achievement, potential, and interest in an honors education.

Further information concerning the University Honors Program and the First-Year Honors Program can be obtained from the Honors Program Office, 2130 Jischke Honors Building or www.honors.iastate.edu (http://www.honors.iastate.edu).

Dual-degree Programs

Students who complete the first three years in certain curricula at Iowa State and who satisfactorily complete the first year in a recognized medical, dental, veterinary medical, or law curriculum may then be awarded a bachelor's degree from Iowa State. (See Index, Preprofessional Study.)

Iowa Lakeside Laboratory

Iowa Lakeside Laboratory is an off-campus teaching and research facility situated on a 140-acre campus on West Okoboji Lake in Northwest Iowa. It is run cooperatively by Iowa State University, the University of Iowa, the University of Northern Iowa, and Drake University. Each summer Iowa State University students can take up to three undergraduate and/or graduate courses in archaeology, biology, ecology, environmental science, and/or geology for credit at Lakeside (see course listings under Iowa Lakeside Laboratory). All Lakeside courses are small, full-immersion, field-oriented courses that run for 1-4 weeks. Lakeside also offers a variety of short courses for teachers and a series of nontechnical short courses on various aspects of the natural history of Iowa. Information about Lakeside courses as well as registration and housing information can be obtained from the Biology Program Office, 103 Bessey Hall or on the Lakeside Web site, www.continuetolearn.uiowa.edu/lakesidelab (http://www.continuetolearn.uiowa.edu/lakesidelab).

Regent Universities Student Exchange Program

Iowa State University students may take courses at either of the other two Regent universities for Iowa State resident credit. Regular, degree-bound students in good standing at any of the three Regent universities may attend another Regent university for a maximum of two semesters, and the credits earned at the other university will be counted as resident credit at the home institution. Approval for participation and credit in the exchange program must be obtained well in advance of registration since the department head must approve the acceptance of such credits if these are to apply to the major, and to ensure complete processing of the application between the cooperating universities within specified dates for enrollment. Detailed information and application forms for the exchange program are available from the Office of the Registrar.

National Student Exchange (NSE)

Iowa State University is a member of National Student Exchange. The NSE Consortium has 200 colleges and universities throughout North America providing academic and experiential exchange opportunities. Iowa State students with a cumulative GPA of at least 2.50 are eligible to apply. Credits earned as an NSE participant will be recorded on the students Iowa State transcript. Approval for credit in the NSE program should be sought from a student's academic adviser in advance of application. Detailed information and applications forms are available from:

National Student Exchange
1080 Hixson-Lied Student Success Center
(515) 294-6479
nse@iastate.edu

www.dso.iastate.edu/nse (http://www.dso.iastate.edu/nse)

Study Abroad

Our planet is in a constant state of change, and occurrences in remote corners of the globe can profoundly impact our lives. It is clear from the effects of global warming, international trade, terrorism, and pandemics of one nature or the other that we cannot ignore what is happening beyond our shores and borders. Students who graduate without an understanding of other cultures, languages, business practices, and political systems are disadvantaged both educationally and professionally. Studying abroad helps prepare students to meet the challenges of an increasingly interdependent global community. Further, study abroad is an adventure that challenges the student academically and provides real opportunities to interact with other cultures, languages, and lifestyles.

As a leading international university, Iowa State has a major commitment to study abroad, and the Study Abroad Center is the central administrative office responsible for providing these opportunities. We offer advising on study abroad, international internships, work, volunteer opportunities, and service-learning, and scholarships. The Center's library

has a fine selection of travel books, information on international careers, cross-cultural orientation, social and business customs around the world, and travel bargains. The International Student Identity Card and passport photographs can also be obtained at the Center.

With over 250 study abroad programs available, from one week to an academic year in length and in nearly every major, students are able to find a program that meets their needs and interests so they can discover for themselves why study abroad is the most exciting academic adventure.

Exchange Programs offer students the opportunity to study abroad at a partner university while paying Iowa State tuition.

Semester in Australia, Canada, Greece, Ireland, Italy, New Zealand, or UK offers unlimited placement opportunities for students to study at some of our most popular destinations for the fall, spring, and in some cases summer.

Intensive Language Programs offer students a total immersion experience in French, German, Russian, or Spanish by studying in Québec, Canada (French), France, Germany, Russia, Mexico, Peru, or Spain. Summer and semester programs are available.

Group Programs led by our faculty offer Iowa State courses around the world. Short-term options can take you from the Antarctic to England and to more than 40 other destinations.

For additional information, contact:

Study Abroad
3224 Memorial Union
(515 294-6792)
www.studyabroad.iastate.edu (http://www.studyabroad.iastate.edu)

The main undergraduate academic programs of each college are listed below, together with the degrees awarded upon completion. In many cases certain majors, minors, options, or electives allow for increased specialization within the programs. Programs which are administered jointly by two colleges are listed within both colleges.

College of Agriculture and Life Sciences

- Agricultural Biochemistry, B.S.
- Agricultural Business, B.S.
- Agricultural and Life Sciences Education, B.S.
- Agricultural Studies, B.S.
- Agricultural Systems Technology, B.S.
- Agriculture and Society
- Agronomy, B.S.
- Animal Ecology, B.S.
- Animal Science, B.S.
- Biology, B.S.
- Culinary Science, B.S.
- Dairy Science, B.S.
- Diet and Exercise, B.S./M.S.
- Dietetics, B.S.
- Environmental Science, B.S.
- Food Science, B.S.
- Forestry, B.S.
- Genetics, B.S.
- Global Resource Systems, B.S.
- Horticulture, B.S.
- Industrial Technology, B.S.
- International Agriculture, B.S.*
- Microbiology, B.S.
- Nutritional Science, B.S.
- Seed Science, B.S.*

* A secondary major must be taken in conjunction with a primary major.

College of Liberal Arts and Sciences

- Advertising, B.A.
- Anthropology, B.A., B.S.
- Biochemistry, B.S.
- Bioinformatics and Computational Biology B.S.
- Biological/Pre-Medical Illustration, B.A.
- Biology, B.S.
- Biophysics, B.S.
- Chemistry, B.A., B.S.
- Classical Studies (See Interdisciplinary Studies, below)
- Communication Studies, B.A.
- Computer Science, B.S.
- Criminal Justice Studies, B.A. (https://currentcatalog.registrar.iastate.edu/collegeofliberalartsandsciences/criminaljusticestudies)
- Earth Science, B.A., B.S.
- Economics, B.S.
- English, B.A., B.S.
- Environmental Science, B.S.
- Environmental Studies, B.A., B.S.*
- French (see World Languages and Cultures, below)
- Genetics, B.S.
- Geology, B.S.
- German (see World Languages and Cultures, below)
- History, B.A., B.S.

- Interdisciplinary Studies, B.A., B.S.
  - Classical Studies
  - Criminal Justice Studies
  - U.S. Latino/a Studies
- International Studies, B.A., B.S.*
- Journalism and Mass Communication, B.A., B.S.
- Liberal Studies, B.L.S.(a general studies degree)
- Linguistics, B.A.
- Mathematics, B.S.
- Meteorology, B.S.
- Music, B.A., B.Mus.
- Performing Arts, B.A.
- Philosophy, B.A.
- Physics, B.S.
- Political Science, B.A.
- Psychology, B.A., B.S.
- Public Relations, B.S.
- Religious Studies, B.A.
- Sociology, B.A., B.S.
- Software Engineering, B.S.
- Spanish (See World Languages and Cultures, below)
- Speech Communication, B.A., B.S.
- Statistics, B.S.
- Technical Communication, B.S.
- U.S. Latino/a Studies (See Interdisciplinary Studies, above)
- Women's Studies, B.A., B.S.
- World Languages and Cultures B.A.:
  - French
  - German
  - Spanish

*A secondary major must be taken in conjunction with a primary major.

College of Business

- Accounting, B.S.
- Business Economics, B.S.
- Entrepreneurship, B.S.
- Finance, B.S.
- Management, B.S.
- Management Information Systems, B.S.
- Marketing, B.S.
- Supply Chain Management, B.S.

College of Design

- Architecture, B.Arch.
- Art and Design, B.A.
- Community and Regional Planning, B.S.
- Design, B Des
- Graphic Design, B.F.A.
- Industrial Design, B.I.D.
- Integrated Studio Arts. B.F.A.
- Interior Design, B.F.A.
- Landscape Architecture, B.L.A.
- Biological / Pre-Medical Illustration (BPMI) B.A.*

* The College of Design participates in this interdepartmental major.

College of Engineering

- Aerospace Engineering, B.S.
- Agricultural Engineering, B.S.
- Biological Systems Engineering, B.S.
- Chemical Engineering, B.S.
- Civil Engineering, B.S.
- Computer Engineering, B.S.
- Construction Engineering, B.S.
- Electrical Engineering, B.S.
- Industrial Engineering, B.S.
- Materials Engineering, B.S.
- Mechanical Engineering, B.S.
- Software Engineering, B.S.

College of Human Sciences

- Apparel Merchandising, Design B.S.
- Athletic Training
- Child, Adult, and Family Services, B.S.
- Culinary Food Science, B.S.
- Diet and Exercise, B.S./M.S.
- Dietetics, B.S.
- Early Childhood Education, B.S.
- Early Childhood Education and Programming, B.S.
- Elementary Education, B.S.
- Event Management, B.S.
- Family and Consumer Sciences Education and Studies
- Financial Counseling and Planning, B.S.
- Food Science, B.S.
- Hospitality Management, B.S.
- Kinesiology and Health, B.S.

- Nutritional Science, B.S.

College of Veterinary Medicine

- Veterinary Medicine, D.V.M.

Minors

1. All minors require at least 15 credits, including at least 6 credits taken at Iowa State University in courses numbered 300 or above.

2. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

3. Credits used to meet the minor requirements may also be used to satisfy the credit requirement for graduation and to meet credit requirements in courses numbered 300 or above.

4. Some students may have to exceed the graduation credit requirement set by their college in order to meet the requirements of both the minor and the curriculum/major.

5. Courses taken for a minor may not be taken on a pass-not pass basis.

Requirements for an undergraduate minor are specified by many departments and programs in the university; a record of completion of such requirements appears on a student's transcript. Lists of undergraduate minors offered by each college appear in the college description. Specific requirements and/or restrictions are available from the department or program offering the minor.

Minors by College

This list may not be inclusive. Check the college web sites for more information.

Agriculture and Life Sciences

- Agricultural Biochemistry
- Agricultural Business
- Agricultural Education and Studies
- Agricultural Systems Technology
- Agronomy
- Animal Ecology
- Animal Science
- Biology
- Emerging Global Diseases* (http://www.ent.iastate.edu/dept/undergrad/egd)
- Entrepreneurial Studies*
- Environmental Studies
- Food and Society
- Food Safety*
- Food Science
- Forestry
- Genetics
- Horticulture
- Industrial Technology
- Insect Science
- International Agriculture
- Meat Science
- Microbiology
- Nutrition
- Sustainability*

*The College of Agriculture and Life Sciences participates in these interdepartmental minors.

Liberal Arts and Sciences:

- Advertising
- African American Studies
- American Indian Studies
- Anthropology
- Astronomy
- Biochemistry
- Bioinformatics and Computational Biology
- Biological Illustration
- Biology
- Chemistry
- Chinese Studies
- Classical Studies
- Communication Studies
- Computer Science
- Criminal Justice Studies
- Economics
- Emerging Global Disease*
- English
- Entrepreneurial Studies*
- Environmental Studies
- French
- Genetics
- Geology
- German
- Gerontology
- History
- International Studies
- Journalism and Mass Communication
- Latin

- Leadership Studies
- Linguistics
- Mathematics
- Meteorology
- Military Studies (Army Reserve Officers' Training Corps)*
- Music
- Music Technology
- Performing Arts
- Philosophy
- Physics
- Political Science
- Public Relations
- Psychology
- Religious Studies
- Russian Studies
- Sociology
- Spanish
- Speech Communication
- Statistics
- Sustainability*
- Teaching English as a Second Language
- Technical Communication
- Technology and Social Change
- U.S. Latino/a Studies
- Wind Energy*
- Women's Studies
- World Film Studies

*The College of Liberal Arts and Sciences participates in these interdepartmental minors.

Business

- Accounting (http://www.business.iastate.edu)
- Finance (http://www.business.iastate.edu)
- Management
- Management Information Systems (http://www.business.iastate.edu)
- Marketing (http://www.business.iastate.edu)
- Supply Chain Management
- International Business

Design

- Critical Studies (http://www.design.iastate.edu/programs-minors/minors/critical-studies-design)
- Design Studies (http://www.design.iastate.edu/designstudies.php)
- Digital Media
- Entrepreneurial Studies (http://www.business.iastate.edu)*
- Environmental Studies*
- Gerontology*
- International Studies*
- Sustainability* (http://www.las.iastate.edu/sustainability)
- Technology and Social Change*

*The College of Design participates in these interdepartmental secondary majors and minors.

Engineering

For Engineering Majors:

- Biomedical Engineering
- Energy Systems
- Engineering Sales
- Nondestructive Evaluation
- Nuclear Engineering
- Sustainability* (http://www.las.iastate.edu/sustainability)
- Wind Energy*

*The College of Engineering participates in these interdisciplinary minors.

Human Sciences

- Apparel Merchandising, and Design (http://www.aeshm.hs.iastate.edu/majors/amd/#minor)
- Child, Adult, and Family Services
- Culinary Food Science
- Dance (http://www.kin.hs.iastate.edu/programs/dance/minor)
- Educational Services in Family and Consumer Sciences
- Event Management (http://www.aeshm.hs.iastate.edu/majors/event-management/#minor)
- Exercise Science (http://www.kin.hs.iastate.edu/h/programs/minors/exercise-science)
- Financial Counseling and Planning
- Food Science
- Food Safety (interdepartmental minor)
- Gerontology (interdisciplinary minor)
- Health Promotion (http://www.kin.hs.iastate.edu/programs/minors/health-promotion)
- Hospitality Management
- Learning and Leadership Sciences
- Learning Technologies (http://www.education.iastate.edu/undergraduate-studies/learning-technologies-minor)
- Kinesiology (http://www.kin.hs.iastate.edu/programs/minors/kinesiology)

- Nutrition

Undergraduate Certificates

An undergraduate certificate provides a way to give formal recognition of focused study in a specialized area that is less comprehensive than required for an undergraduate major. See undergraduate majors, minors, certificates for more information.

An undergraduate certificate has the following requirements and understandings:

1. A minimum of 20 credits, with at least 12 credits taken at ISU which are applicable towards the undergraduate certificate requirements
2. At least 9 of the credits taken at Iowa State University must be in courses numbered 300 or above
3. At least 9 credits used for a certificate may not be used to meet any other department, college, or university requirement for the baccalaureate degree except to satisfy the total credit requirement for graduation and to meet credit requirements in courses numbered 300 or above
4. A student may not receive both an undergraduate major and a certificate of the same name
5. For students earning an ISU baccalaureate degree, a certificate is awarded concurrent with or after the ISU baccalaureate degree
6. A certificate is not awarded if the baccalaureate requirements are not finished
7. After receiving a baccalaureate degree from any accredited institution, a student may enroll at ISU to earn a certificate
8. Courses taken for a certificate may not be taken on a pass-not pass basis
9. A cumulative grade point average of at least 2.00 is required in all courses taken at ISU towards the certificate
10. A notation of a completed certificate will be made on a student's transcript and a printed certificate will be awarded.

Iowa State University also offers certificates from the Graduate College.

Preprofessional Study

Requirements for admission to most professional academic programs can be met by study at Iowa State University. These requirements may be met in the course of obtaining a bachelor's degree from Iowa State or at a level below that of a degree, depending on the intended field of study. The specific courses taken in a preprofessional program will depend primarily upon the admission requirements of the professional schools to which a student wants to apply. In some programs requiring three years of preprofessional work, a student may, by careful planning, complete requirements for the bachelor's degree upon transferring to Iowa State up to 32 semester credits of professional coursework. Generally these credits will be counted as electives, but a maximum of 24 may be used as major credits in interdisciplinary studies and a smaller number as major credits in appropriate departments.

Students who have not declared a major upon entry should enter as preprofessional students, i.e., premedical, prelaw, PHP (preprofessional health programs), or GENPV (General Undergraduate Studies Pre Vet), until they choose a major or transfer to a professional school. All students, whether they have selected a major or not, are encouraged to identify their interest in a professional career by designating it on their application.

Information about preprofessional program admissions requirements and career opportunities in human health or law may be obtained in the Liberal Arts and Sciences Advising Center. Information about veterinary medicine admissions requirements and career opportunities may be obtained from the coordinator of the preveterinary program in the Office of the Dean of the College of Veterinary Medicine.

Clinical Laboratory Science/Medical Technology

Clinical laboratory scientists, still commonly referred to as medical technologists, are important members of health-care teams. They perform the chemical, microscopic, radio-assay, and microbiological tests that are necessary in disease diagnosis, and they type and cross-match blood samples to facilitate blood transfusions. They usually work under the supervision of a physician in a hospital or clinic laboratory, but may also be employed by a pharmaceutical company or by manufacturers of analytical instruments. The professional training requires 12 months in a hospital-based CLS/MT program following at least 3 years of college study that emphasizes chemistry and the biological sciences. Students may earn a bachelor's degree in specific ISU majors, by completing the admissions requirements of the CLS/MT program and most of the degree requirements in 3 years on campus, then spending their fourth year in one of the hospital programs that are affiliated with Iowa State University. Before beginning the off-campus studies, students must earn at least 88 credits; the 32 most recent credits must have been earned in residence at ISU. A maximum of 32 semester credits earned in pro-fessional CLS/MT school can be used to partially fulfill the requirements for the bachelor's degree. Students who complete all degree requirements in residence at the university may apply to any school of medical technology for which the admission requirements have been met.

The following CLS/MT program is affiliated with Iowa State University:

St. Luke's Methodist Hospital, Cedar Rapids, Iowa. Program Director: Carol Collingsworth. Medical Director: Lileah Harris, MD

Dentistry

Dentists diagnose, treat, and try to prevent diseases and injuries of the teeth, jaws, and mouth. Usually a general practitioner will have spent 3

or 4 years taking preprofessional courses at the undergraduate level and 4 years in dental school earning the degree of doctor of dental surgery (D.D.S.) or doctor of dental medicine (D.M.D.). Learning a specialty requires at least 2 more years. The courses necessary for admission to most dental schools include English, biology, general and organic chemistry, and physics. Students may earn a degree in any major that Iowa State University offers as they meet the admission requirements; they should choose their major to reflect their own interests and abilities. Highly qualified students may be accepted into dental school after 3 years of preprofessional study without earning a baccalaureate degree..

Health Information Management

Health information managers serve as supervisors of medical records departments in hospitals, clinics, nursing homes, and other healthcare institutions. Certified registered record administrators (R.R.A.) must have completed a program leading to a bachelor's degree in medical record administration. Most professional programs are 2 years in length and follow 2 years of college study in chemistry, biology, the humanities, social sciences, languages, and philosophy. Students may take the preprofessional courses at Iowa State University and then transfer to a university offering the professional program or they may earn a bachelor's degree at Iowa State University before entering a health information management program.

Hospital and Health Administration

Administrators of health care organizations manage and guide the varied activities in hospitals, clinics, nursing homes, and mental health facilities. The professional requirement may be for a master's degree or a bachelor's degree, depending upon the size of the institution and whether an upper or middle entry-level position is desired. Students at Iowa State may take general education courses for two or more years and then transfer to a university offering a bachelor's degree in health administration, or they may spend four years earning a bachelor's degree in any department before entering a master's degree program at the University of Iowa or other university. Courses required for admission to master's degree programs in hospital and health administration vary, but may include introductory accounting, management, statistics, and economics.

Human Medicine

Physicians study, diagnoses, and treat illness and injury. They may work in offices, clinics, hospitals, or laboratories, in private practice or for government or industry. Their professional training usually consists of 4 years of study in a college of medicine to earn the doctor of medicine (M.D.) degree, and then 3 or more years in hospital residency learning a specialty such as family medicine, pediatrics, surgery, obstetrics, or psychiatry. A degree of doctor of osteopathy (D.O.) is awarded to those students who complete 4 years in a college of osteopathic medicine before their residency. All medical schools recommend a broad preprofessional education that includes courses in biology, chemistry, physics, mathematics, English, the social sciences, arts and humanities. The degree of a premedical student can be from any college and in any curriculum or major offered by the university. The major should reflect the student's interests and provide appropriate preparation for an alternative career.

Law

An attorney offers assistance, often where a third-party neutral arbiter is required to resolve conflicts. Many attorneys work in private practice, but others secure positions in the public sector, e.g., federal or state governmental agencies. A minimum of three years from an American Bar Approved (ABA) law school is required to earn a Doctor of Jurisprudence (J.D) degree. A bachelor's degree is required for admission to all accredited law schools. A student planning to enter law school may pursue an undergraduate degree in any discipline. The choice of the bachelor's degree should reflect a student's passion and personal interests and not be perceived as being the best degree to help them be admitted into law school. Appropriate courses should be completed that will enhance a student's development of critical thinking skills, including analytical written and oral skills. An understanding of business, social sciences, and humanities is necessary to comprehend the pluralistic society within and outside of the United States. These courses should include accounting, management, political science, psychology, criminal justice, economics, philosophy, English literature, and history. The completion of these courses will provide students with a knowledge base and skill sets that will assist them with their preparation for law school. Courses in mathematics and statistics are also helpful in developing analytical skills. Advanced writing courses and speech communication courses will also serve students well.

Library and Information Science

Librarians and information science specialists select, organize, preserve and promote information resources as well as advocate and teach information literacy skills. Professional opportunities include work for libraries in academic institutions, public education, city and county municipalities, medical facilities, government agencies, and corporate settings. They also have work opportunities in the publishing and information technology professions. Master's degree programs in library and information science provide the professional preparation. Iowa State students may earn a bachelor's degree in any department before entering a professional master's degree program. They may choose majors that reflect their interests and provide a foundation for working in the library and information science field.

Occupational Therapy

Occupational therapists provide purposeful activities to help those who have been disabled by physical illness or injury, birth defects, emotional disorder, aging, drug abuse, or other problems to learn to cope with

everyday living. Therapists treat patients in hospitals, school systems, and rehabilitation centers. Students may complete a bachelor's degree in any major at Iowa State University, and then enter a master's or doctoral degree program at another university.

Optometry

Optometrists examine, diagnose, treat and manage diseases of the visual system, the eye and associated structures. Treatment may include corrective glasses or contacts, vision therapy and therapeutic drugs. Optometrists usually set up their own offices or work in group practice. Professional study requires 4 years in a school or college of optometry and leads to the doctor of optometry (O.D.) degree. All optometry schools require at least 90 semester credits of preprofessional courses, including biology, chemistry, physics, mathematics, and English. Certain optometry schools require a bachelor's degree. Students wishing to earn the bachelor's degree from Iowa State University may choose any major and take the courses required for graduation with that major as they take the courses required for admission to a professional optometry program.

Pharmacy

Pharmacists prepare and dispense therapeutic drugs; educate health care professionals, patients and the general public about the appropriate use of drugs; conduct pharmaceutical research and work in industrial settings which involve the manufacture, marketing and advertising of pharmaceutical. Students may complete prepharmacy courses at Iowa State University. Many schools do not require a bachelor's degree for admission, however most students complete at least 3 years of college before admission to pharmacy schools. Upon admission, the student will then transfer to a Pharm. D. program of study which will entail four years of study.

Physical Therapy

Physical therapists work with people who have been disabled by injury, illness, or birth defects. They assist in evaluating the physical problems and administer therapeutic agents such as massage and exercise, heat, baths, ultrasonics, and electricity; they work in hospitals, clinics, nursing homes, schools, rehabilitation centers, and private practice. Usually, students earn a bachelor's degree at ISU before entering professional school to earn a doctoral degree. The bachelor's degree from ISU may be earned in any department, provided that the physical therapy prerequisites are completed. Courses required for admission to a professional program include biology, chemistry, physics, psychology, mathematics, and statistics.

Physician Assistant

A physician assistant provides medical services under the supervision of a licensed physician. PAs conduct physical examinations, order and interpret laboratory tests, make diagnostic and treatment decisions, and are allowed to prescribe medication in most states. Certification as a physician assistant requires at least 2 years in a professional program at the master's degree level. Applicants must have had health-care experience with direct patient contact experience. Students must have earned a bachelor's degree before entering a PA program. The degree can be in any area but the student must complete the pre-requisite courses for the PA program. These usually include courses in biology, chemistry, psychology, and statistics.

Podiatry

Podiatrists diagnose, and treat diseases and disorders of the human foot and ankle. They treat patients in private and group practice, hospitals, and, increasingly, in industrial and sports-related positions. Professional training requires 4 years in a college of podiatric medicine and leads to the degree of doctor of podiatric medicine (D.P.M.). This is usually followed by 1 to 3 years in a hospital residency. All podiatric colleges require at least 3 years of preprofessional study, including courses in biology, general and organic chemistry, physics, and English. Most entrants have a bachelor's degree, which may be in any major. A few students may complete the admission requirements and most of the bachelor's degree requirements in 3 years. If so, a maximum of 32 semester credits may be transferred to Iowa State University from the first year in an accredited podiatric college in order to complete the requirements for the bachelor's degree.

Theology or Religious Studies

The professional education of a student of religion can follow one of two paths. The path to a profession as a pastor, priest, rabbi or other leadership position in a religious tradition usually requires 3 years in a program leading to the master of divinity (M.Div.) offered at a school of divinity or of theology. The path to a profession as a teacher of religious studies at the college level requires 4-7 years in a program leading to the Ph.D. at a graduate school of Religious Studies. Both seminaries and graduate schools require a bachelor's degree for admission.
The American Association of Theological Schools recommends the following areas of study as the best preparation for theological studies: English language and literature; history, including non-Western culture; philosophy; natural sciences, social sciences, especially psychology, sociology and anthropology; the fine arts; Biblical and modern languages; and religion, both Western and Eastern. Although students in a variety of major fields may qualify for admission to a theological school, interested persons are advised to review their proposed programs with a representative of the Religious Studies Program in the Department of Philosophy and Religious Studies.

Veterinary Medicine

About 75% of all veterinarians are engaged in private practice. In a mixed practice, they diagnose and treat health problems among a variety of animals. Others specialize in one species (e.g., feline, pet bird) and still others specialize in a specific discipline within veterinary medicine (e.g.,

cardiology, ophthalmology). Veterinarians may also choose public and corporate practice (e.g., public health, education, research, food safety, industry, laboratory animal medicine, aquatic animal medicine, poultry medicine, and military veterinary medicine).

The professional program requires four years at a college of veterinary medicine and leads to the doctor of veterinary medicine degree (D.V.M.). Admission to a veterinary college involves at least two years of preprofessional college education. Candidates must take courses in biology, chemistry, genetics, physics, English, humanities, social sciences, speech, anatomy and physiology, and biochemistry. (For Iowa State University see Veterinary Medicine, Admission Requirements; for most recent information, consult the College of Veterinary Medicine Web site: www.vetmed.iastate.edu (http://www.vetmed.iastate.edu).)

Students may pursue their preveterinary preparation in any college at Iowa State University. A major (preveterinary medicine is not a major) should be selected that is allied to each student's vocational interests in veterinary medicine or that otherwise offers vocational satisfaction in the event that plans for entry into the College of Veterinary Medicine change. Students are encouraged to pursue a bachelor's degree; the most effective progress toward a bachelor's degree is made when a major is selected upon entry and no change occurs before graduation. However, students who have not even considered a career other than veterinary medicine may need some time to explore possibilities before selection of a major.

To assist students who have indicated interest in the preveterinary program for the College of Veterinary Medicine and are undecided about a major, an advising category is available known as GENPV (General Undergraduate Studies Pre Vet). Orientation and advising services for these students are designed to help students fulfill preveterinary course requirements, to introduce available majors and careers allied to veterinary medicine, and to introduce career options in veterinary medicine. GENPV students must select a major by the end of their second semester. Some Iowa State University majors allow, by careful planning, the opportunity for a student to earn the bachelor's degree by combining credits from three years of preprofessional study and one year of professional study in the College of Veterinary Medicine.

College of Agriculture and Life Sciences

Wendy Wintersteen, Endowed Dean
Joe Colletti, Senior Associate Dean
David Acker, Associate Dean for Academic and Global Programs
John Lawrence, Associate Dean for Extension and Outreach
Theressa Cooper, Assistant Dean for Diversity
Ruth MacDonald, Assistant Dean of Graduate Programs
Howard Tyler, Assistant Dean for Student Services

www.cals.iastate.edu (http://www.cals.iastate.edu)

Students enrolled in the College of Agriculture and Life Sciences are provided a broad-based education that includes coursework in communications; biological, physical, and social sciences; humanities; and technical subject matter.

Upon graduation students find diverse career opportunities because of the well balanced education they have received as undergraduates. Opportunities for graduates of the College of Agriculture and Life Sciences include: agribusiness and industry, production agriculture, biological and environmental sciences, value-added processing, natural resource management, rural development, public agencies, education, animal and human health professions, and graduate studies.

High School Preparation

Requirements for students entering from high school or transferring with less than 24 college credits into the College of Agriculture and Life Sciences include four years of English; three years of mathematics which must include one year each of algebra, geometry, and advanced algebra; three years of science which must include one year each of Biology and chemistry, or Biology and physics, or chemistry and physics; and two years of social studies. No foreign language is required for admission to the College of Agriculture and Life Sciences.

Core Curriculum and Electives

All curricula in the College of Agriculture and Life Sciences lead to a bachelor of science degree. To graduate with a degree from the College of Agriculture and Life Sciences a student must complete while at Iowa State University a minimum of 18 credits from the College's departmental offerings, program offerings, and cross-listed program offerings. Twelve or more of those 18 credits must be 300-level or above. Some curricula within the College may have more restrictive requirements.

Each major has specific degree requirements for graduation based on department and college student learning outcomes. College of Agriculture and Life Sciences core curriculum requirements for the four areas listed below are established to provide the foundation for successful accomplishment of both departmental and college level learning outcomes.

Students pursuing a primary major in another college and taking a second major in the College of Agriculture and Life Sciences must fulfill the core curriculum requirements of the College of Agriculture and Life Sciences, and all the requirements of the second major. The College of Agriculture and Life Sciences core curriculum follows.

Interpersonal and public communication skills	10
6 credits of English composition with grades of C or better	

3 credits of speech fundamentals with grades of C or better	
1 credit of LIB 160 Information Literacy	
Total Credits	10
Mathematical, physical, and life sciences	17
3 credits of mathematics	
3 credits of statistics	
5 credits of physical science (e.g., chemistry, geological and atmospheric sciences, physics)	
6 credits of life sciences including BIOL 101 Introductory Biology, or BIOL 211 Principles of Biology I, or BIOL 212 Principles of Biology II and 3 credits of life sciences from a college-approved list: (http://www.ag.iastate.edu/student/student_services.php)	
Personal development	15
3 credits of ethics from a college-approved list	
3 credits of humanities from a college-approved list	
3 credits of social sciences from a college-approved list	
3 credits of U.S. diversity from an approved list	
3 credits of international perspectives from an approved list	

All students graduating with majors within the College of Agriculture and Life Sciences are expected to be proficient in the following college-level outcomes:

Professional, Interpersonal and Cross-cultural Communications

- Speak and write clearly and persuasively.
- Prepare effective visual, oral, written and electronic presentations.
- Effectively read, listen, observe and reflect.

Problem-Solving/Critical Thinking

- Apply a holistic approach to solving complex issue-laden problems.
- Apply a rational and objective process to:
  - Distinguish verifiable facts from value claims,
  - Determine the accuracy of statements,
  - Identify assumptions and detect bias,
  - Distinguish relevant from irrelevant information,
  - Prioritize needs.
- Summarize, analyze, and interpret simple research data and policy issues.

Leadership

- Organize, facilitate, and participate effectively in a group, team, or organization.
- Define a problem or opportunity, implement an action planning process, work towards a goal and justify actions taken.

Entrepreneurship

- Demonstrate innovativeness and creativity regardless of context.
- Identify and pursue opportunities that produce value.
- Be persistent in shepherding necessary resources and managing associated risk to facilitate change.

Life-long learning

- Articulate how continued learning after graduation will enrich their lives.
- Identify and participate in new areas for learning beyond the classroom and after graduation.

Ethics

- Define and assess their ethical perspective, moral responsibility, and values.
- Identify and critically evaluate contemporary ethical and moral issues in professional and private life.

Environmental Awareness

- Explain the physical and Biological interactions within ecosystems
- Explain how human activities impact the environment and how societies are affected by environmental change.

International/Multi-Cultural Awareness

- U.S. Diversity – Students should achieve two of the following outcomes. They should be able to:
  - Articulate how their personal life experiences and choices fit within the context of the larger mosaic of U.S. society, indicating how they have confronted and critically analyzed their perceptions and assumptions about diversity-related issues,
  - Analyze and evaluate the contributions of various underrepresented social groups in shaping the history and culture of the U.S.,
  - Analyze individual and institutional forms of discrimination based on factors such as race, ethnicity, gender, religion, sexual orientation, class, etc.,
  - Analyze the perspectives of groups and individuals affected by discrimination,
  - Analyze how cultural diversity and cooperation among social groups affect U.S. society.
- International Perspectives – Students should achieve two of the following outcomes. They should be able to:
  - Analyze the accuracy and relevancy of their own worldviews and anticipate how people from other nations may perceive that worldview,
  - Describe and analyze how cultures and societies around the world are formed, are sustained, and evolve,
  - Analyze and evaluate the influence of global issues in their own lives,

- Describe the values and perspectives of cultures other than their own and discuss how they influence individuals' perceptions of global issues and/or events,
- Communicate competently in a second language.

In addition to the College level learning outcomes, each department within the college has additional discipline-specific outcomes that apply to graduates of that department.

Electives

Students use electives to broaden their education or to strengthen an area of specialization. Electives may be used to meet the requirements for a double major (see statement on double majors in this catalog). Those who wish to change their major, or who decide to graduate with a double major, must be enrolled for the last two semesters in the curriculum in which they expect to graduate. Students in ROTC may apply ROTC credits toward elective requirements. No more than 9 credits of 490 coursework from any Iowa State University curriculum may be applied toward graduation, although some individual curricula may establish a more restrictive use of 490 credits toward fulfillment of graduation requirements.

Advising

Each student in the College of Agriculture and Life Sciences works closely with an academic adviser who is associated with the major in which the student is enrolled.

All entering students are strongly encouraged to participate in the summer orientation program in which they will have the opportunity to meet and work with academic advisers in planning their first semester schedule of classes.

The advisers also assist students in making personal adjustments to university life, offer suggestions on academic and co-curricular choices, and provide information on career choices. Advisers make a special effort to adjust course schedules in accordance with students' interests and capabilities.

A student may wish to prepare for admission to a professional program such as law, medicine, or veterinary medicine while pursuing a bachelor of science degree in the College of Agriculture and Life Sciences. This may be accomplished through several majors; however, it is recommended that the student work closely with an academic adviser.

Each department prepares a guide to help students chart their long-term programs and to specify the exact requirements for graduation. Visit the college web site www.ag.iastate.edu (http://www.ag.iastate.edu).

Graduate Study

Graduate study in agriculture is conducted through the Graduate College. Details are found in the Graduate College section of this catalog.

Various departments in the College of Agriculture and Life Sciences also participate in the following graduate-level interdepartmental offerings:

Biorenewable Resources and Technology
Ecology and Evolutionary Biology
Environmental Science
Genetics and Genomics
Immunobiology
Microbiology
Molecular, Cellular, and Developmental Biology
Neuroscience
Nutritional Sciences
Plant Biology
Seed Technology and Business
Sustainable Agriculture
Technology and Social Change (interdepartmental minor)
Toxicology

For details, consult the Graduate College section of this catalog.

Departments of the College

- Agricultural and Biosystems Engineering
- Agricultural Education and Studies
- Agronomy
- Animal Science
- Roy J. Carver Department of Biochemistry, Biophysics, and Molecular Biology
- Ecology, Evolution, and Organismal Biology
- Economics
- Entomology
- Food Science and Human Nutrition
- Genetics, Development and Cell Biology
- Horticulture
- Natural Resource Ecology and Management
- Plant Pathology and Microbiology
- Sociology
- Statistics

Majors in the College of Agriculture and Life Sciences

A student has many majors from which to choose. Each major is unique although many courses are common. This is helpful to students in that they may transfer from one major to another before the second year with

little loss of credits. Options and areas of specialization further define the majors and required coursework within some majors. In all cases, majors are designed to help students succeed in their chosen professions. Majors in agriculture and life sciences are:

Primary Majors

Agricultural Biochemistry
Agricultural Business
Agricultural and Life Sciences Education
Agricultural Studies
Agricultural Systems Technology
Agriculture and Society
Agronomy
Animal Ecology
Animal Science
Biology
Culinary Food Science
Dairy Science
Dietetics
Diet and Exercise
Environmental Science
Food Science
Forestry
Genetics
Global Resource Systems
Horticulture
Industrial Technology
Microbiology
Nutritional Science

Secondary Majors*

Environmental Studies
International Agriculture
Seed Science

*A secondary major must be taken in conjunction with a primary major.

Minors

Agricultural Biochemistry
Agricultural Business
Agricultural Education and Studies
Agricultural Systems Technology
Agronomy
Animal Ecology
Animal Science
Biology
Culinary Food Science
Emerging Global Diseases*
Entrepreneurial Studies*
Environmental Studies
Food and Society
Food Safety*
Food Science
Forestry
Genetics
Horticulture
Industrial Technology
Insect Science
International Agriculture
Learning and Leadership Sciences
Meat Science
Microbiology
Nutrition
Sustainability* (http://www.las.iastate.edu/sustainability)

*The College of Agriculture and Life Sciences participates in these interdepartmental minors.

Certificate

Occupational Safety

See statement on minors in the Colleges and Curricula section of this catalog.

Special Programs

Agriculture Exploration

Agriculture Exploration is a starting place for students who wish to pursue careers in the life sciences, food science, natural resources, production agriculture, business, or communications but who are unsure of which majors to choose. Students entering this program will be advised in the Student Services Office until they select their majors.

Preveterinary Medicine

Students in the College of Agriculture and Life Sciences may complete the requirements for admission to the College of Veterinary Medicine by enrolling in any major within the college. Because a solid foundation in the sciences is basic to the program in veterinary medicine, those majors that emphasize the sciences are usually more compatible with preveterinary medicine (see College of Veterinary Medicine section of this catalog for specific admissions requirements).

Students who are undecided about choice of major may enroll in general preveterinary studies (Gen PV). These students will also enroll in an orientation course, which describes the various college majors. A Gen PV student has up to 1.5 semesters to select a major.

Preveterinary medicine students also have an opportunity, with careful planning, to complete the requirements for a bachelor of science degree in an individual curriculum within the College of Agriculture and Life Sciences after admission to the College of Veterinary Medicine. This may be done by completing the prescribed course of study established by an individual major. Students also may meet degree requirements of

an individual major through the College of Agriculture and Life Sciences Honors Program. Further details are available from an academic adviser or from members of the College of Agriculture and Life Sciences Honors Committee.

Honors Program

The College of Agriculture and Life Sciences Honors Program provides an opportunity for students of high ability to maximize their educational experience by individualizing their program of study. (See statement on Honors Program in the Colleges and Curricula section of this catalog). For more information, contact the chair of the College of Agriculture and Life Sciences Honors Committee, or a department Honors contact person.

Off-Campus Programs

Coursework leading to a master of science degree in agricultural education, master of agriculture degree in professional agriculture and a master of science degree in agronomy are offered to students who choose to study off-campus; see Extended and Continuing Education for further information.

Study Abroad and International Travel Opportunities

Agriculture and life sciences are part of a highly interconnected global system; decisions made in one sector have profound impacts worldwide. It is important for students to develop an understanding and appreciation for the global system and the role that U.S. agriculture plays in providing a safe and predictable food supply for a growing world population. The College of Agriculture and Life Sciences provides study abroad and international internship opportunities in more than 25 countries around the world. For additional information, contact the Office of Global Agriculture Programs in the College of Agriculture and Life Sciences.

Internships and Cooperative Education Programs

Practical work experience can provide a unique learning opportunity that complements academic coursework. This experience is provided through internships or cooperative education programs. For additional information, contact a departmental adviser or internship coordinator.

Agricultural Biochemistry

The department of Biochemistry, Biophysics & Molecular Biology (http://www.bbmb.iastate.edu) offers majors in biochemistry or biophysics in the College of Liberal Arts and Sciences and a major in agricultural biochemistry in the College of Agriculture and Life Sciences.

Biochemists and biophysicists seek to understand life processes in terms of chemical and physical principles. They conduct research in the frontiers of biology such as metabolic networking; structure and function of enzymes, membranes, and hormones; computational approaches; genomic and proteomic technology; protein engineering; plant biotechnology; muscle structure and function; and the design and evaluation of drugs for the treatment of disease. Biochemistry, biophysics and molecular biology provide the basis for much of modern biotechnology. Graduates have opportunities in industry, especially the biotechnology sector, in universities, veterinary and medical schools, and government laboratories. Students who meet the necessary high scholastic standards have the opportunity to continue their education to pursue advanced degrees in graduate school, medicine, pharmacy or veterinary medicine.

Graduates of biochemistry, agricultural biochemistry and biophysics understand the chemical principles of biological systems including molecular biology. They have developed laboratory expertise in modern biochemical techniques, including the ability to analyze data and prepare scientific reports. Most have participated in undergraduate research and have developed the skills necessary for both written and oral presentations at a level that will serve the student both within the university and in postgraduate professional life. Graduates have the experience of interacting with persons of different disciplines and cultures. Students have the training in biological and physical science and mathematics to solve problems of broad scope in biological, biomedical and environmental sciences and to provide leadership in diverse scientific and technological arenas.

A program that combines a bachelor of science and masters of science in biochemistry or biophysics is offered.

Agricultural Biochemistry Major in the College of Agriculture and Life Sciences

For the undergraduate curriculum leading to the degree bachelor of science, see College of Agriculture, Curricula. Agricultural biochemistry is recommended to students interested in the areas of agriculture requiring strong preparation in biochemistry, chemistry, physics, and mathematics, or in preparation for the study of veterinary medicine. Employment opportunities exist in agrochemical industries, and animal and plant biotechnology.

Agricultural Biochemistry program of study

BBMB 101	Introduction to Biochemistry	1
BBMB 102	Introduction to Biochemistry Laboratory	1
BBMB 201	Chemical Principles in Biological Systems	2
BBMB 404	Biochemistry I	3
or (4 credits)		
BBMB 504	Amino Acids and Proteins	
BBMB 505	Bioenergetics and Metabolism	
BBMB 405	Biochemistry II	3
or (4 credits)		
BBMB 506	Membrane Biochemistry	
BBMB 507	Biochemistry of Nucleic Acids	
BBMB 411	Techniques in Biochemical Research	4

BBMB 490	Independent Study (Not required)	1-3
BBMB 499	Undergraduate Research (Not required but strongly encouraged)	1-5
Take one of the following:		
CHEM 201	Advanced General Chemistry	
CHEM 177 & CHEM 178	General Chemistry I and General Chemistry II	
Take one of the following:		
CHEM 201L	Laboratory in Advanced General Chemistry	
or CHEM 177N	Laboratory in General Chemistry I	
or CHEM 177L	Laboratory in General Chemistry I	
CHEM 211 & 211L	Quantitative and Environmental Analysis and Quantitative and Environmental Analysis Laboratory	4
Take one of the following:		
CHEM 322L	Laboratory in Physical Chemistry	
or BBMB 461 & BBMB 561	Molecular Biophysics and Laboratory in Molecular Biophysics	
CHEM 324	Introductory Quantum Mechanics	3
CHEM 325	Chemical Thermodynamics	3
CHEM 331 & CHEM 332	Organic Chemistry I and Organic Chemistry II	6
CHEM 333L	Laboratory in Organic Chemistry I (for Chemistry and Biochemistry Majors)	1-2
or CHEM 331L	Laboratory in Organic Chemistry I	
MATH 165	Calculus I	4
MATH 166	Calculus II	4
MATH 265	Calculus III	3-4
or MATH 266	Elementary Differential Equations	
or MATH 267	Elementary Differential Equations and Laplace Transforms	
PHYS 221 & PHYS 222	Introduction to Classical Physics I and Introduction to Classical Physics II	10
BIOL 211 & BIOL 212	Principles of Biology I and Principles of Biology II	6
BIOL 211L	Principles of Biology Laboratory I	1
or BIOL 212L	Principles of Biology Laboratory II	
or BIOL 313L	Genetics Laboratory	
BIOL 313	Principles of Genetics	3
BIOL 314	Principles of Molecular Cell Biology	3
Agricultural Sciences from approved list		9
Total Credits		76-84

The College of Agriculture and Life Sciences requires the following:

University Requirements: Select approved courses to meet U.S. Diversity 3 cr. and International Perspectives 3 cr. Credits can dual assign with Humanities and Social Science choices.

Communications Proficiency

ENGL 150	Critical Thinking and Communication (C or better)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (C or better)	3
SP CM 212	Fundamentals of Public Speaking	3
LIB 160	Information Literacy	1
Total Credits		10

Ethics

Courses from an approved list.	3

Humanities and Social Sciences: select from approved lists

Humanities course	3
Social Science course	3
Total Credits	6

Agricultural Sciences

Courses from an approved list	9

Agricultural Biochemistry, B.S. - option 1

Freshman

Fall	Credits	Spring	Credits
CHEM 177	4	CHEM 178	3
CHEM 177N	1	MATH 166	4
MATH 165	4	ENGL 250	3
ENGL 150	3	BBMB 102	1
BIOL 211	3	BIOL 212	3
BIOL 211L*	1	Student choice	3
BBMB 101	1		
LIB 160	1		
	18		17

Sophomore

Fall	Credits	Spring	Credits
PHYS 221	5	PHYS 222	5
CHEM 211	2	CHEM 332	3
CHEM 211L	2	BIOL 314	3
CHEM 331	3	BBMB 201	2
CHEM 331L	1	MATH 265 or 266	3-4
BIOL 313	3		
	16		16-17

Junior

Fall	Credits	Spring	Credits
BBMB 404	3	BBMB 405	3

SP CM 212	3 Student choice	3
Student choice	3 Student choice	3
Student choice	3 Student choice	3
Student choice	3 Student choice	3
	15	15

Senior

Fall	Credits	Spring	Credits
BBMB 411	4	CHEM 325	3
CHEM 324	3	BBMB 461	2
Student choice	3	and BBMB 561L	2
Student choice	3	or CHEM 322L	3
Student choice	3	Student choice	3
		Student choice	3
		Student choice	3
	16		19

* Students may elect to take either 211L, 212L or 313L.

'Student choice 'are for courses in Humanities, Ethnics, Social Sciences, Agriculture Sciences, and Electives.

Agricultural Biochemistry, B.S. - option 2

Freshman

Fall	Credits	Spring	Credits
CHEM 201	5	MATH 166	4
CHEM 201L	1	ENGL 250	3
MATH 165	4	BBMB 102	1
BIOL 211	3	BIOL 212	3
BIOL 211L*	1	LIB 160	1
BBMB 101	1	CHEM 211	2
		CHEM 211L	2
	15		16

Sophomore

Fall	Credits	Spring	Credits
PHYS 221	5	PHYS 222	5
CHEM 331	3	CHEM 332	3
CHEM 331L	1	BIOL 314	3
BIOL 313	3	BBMB 201	2
Student choice	3	MATH 265 or 266	3-4
Student choice	3		
	18		16-17

Junior

Fall	Credits	Spring	Credits
BBMB 404	3	BBMB 405	3
SP CM 212	3	Student choice	3
Student choice	3	Student choice	3
Student choice	3	Student choice	3
Student choice	3	Student choice	3
	15		15

Senior

Fall	Credits	Spring	Credits
BBMB 411	4	CHEM 325	3
CHEM 324	3	BBMB 461	2
Student choice	3	and	
Student choice	3	BBMB 561L	2
Student choice	3	OR CHEM 322L	3
		Student choice	3
		Student choice	3
		Student choice	3
	16		19

* Students may elect to take either 211L,212L or 313L.

'Student choice 'are for courses in Humanities, Ethnics, Social Sciences, Agriculture Sciences, and Electives.

Courses primarily for undergraduates:

BBMB 101: Introduction to Biochemistry

(1-0) Cr. 1. F.

Research activities, career opportunities in biochemistry and biophysics, and an introduction to the structure of biologically important compounds. For students majoring in biochemistry, agricultural biochemistry or biophysics or considering one of these majors.

BBMB 102: Introduction to Biochemistry Laboratory

(0-2) Cr. 1. S.

Prereq: Credit or enrollment in CHEM 177 and CHEM 177L or CHEM 201 and CHEM 201L

Topics in the scientific background of biochemistry, such as macromolecules, metabolism, and catalysis. Laboratory experimentation covers biochemical concepts and the study of bio-molecules including proteins, lipids and nucleic acids. A significant component is practice in scientific communication. For students majoring in biochemistry, agricultural biochemistry or biophysics or considering one of these majors.

BBMB 120: The Biochemistry of Beer

(Cross-listed with FS HN). (2-0) Cr. 2. F.

An introduction to the major classes of biomolecules, basic biochemical concepts, enzymology, metabolism and genetic engineering as they apply to the production and flavor of beer. All aspects of the biochemistry of beer will be covered, including the malting of barley, starch conversion, yeast fermentation and the chemical changes that occur during the aging of beer. Intended for non-majors. Natural science majors are limited to elective credit only.

BBMB 201: Chemical Principles in Biological Systems

(2-0) Cr. 2. S.

Prereq: Credit or enrollment in CHEM 332

Survey of chemical principles as they apply in biological systems including: water, organic chemistry of functional groups in biomolecules and biochemical cofactors, weak bonds and their contribution to biomolecular structure, oxidation-reduction reactions and redox potential, thermodynamic laws and bioenergetics, chemical equilibria and kinetics, inorganic chemistry in biological systems, data presentation. The subjects will be taught using molecules from biological systems as examples. Intended for majors in biochemistry, biophysics or agricultural biochemistry.

BBMB 221: Structure and Reactions in Biochemical Processes

(3-0) Cr. 3. F.S.

Prereq: CHEM 163, CHEM 167, or CHEM 177

Fundamentals necessary for an understanding of biochemical processes. Primarily for students in agriculture. Not acceptable for credit toward a major in biochemistry, biophysics, or agricultural biochemistry. Credit for both BBMB 221 and Chem 231 may not be applied toward graduation.

BBMB 301: Survey of Biochemistry

(3-0) Cr. 3. F.S.SS.

Prereq: CHEM 231 or CHEM 331

A survey of biochemistry: structure and function of amino acids, proteins, carbohydrates, lipids, and nucleic acids; enzymology; metabolism; biosynthesis; and selected topics. Not acceptable for credit toward a major in biochemistry, biophysics, or agricultural biochemistry.

BBMB 316: Principles of Biochemistry

(3-0) Cr. 3. F.

Prereq: CHEM 231 or CHEM 331; BIOL 212; BIOL 313 and BIOL 314 strongly recommended.

Understanding biological systems at the molecular level; chemistry of biological macromolecules, enzyme function and regulation, metabolic pathways; integration of metabolism in diverse living systems. For students in biology and related majors who do not require the more rigorous treatment of biochemistry found in BBMB 404/405. Not acceptable for credit toward a major in biochemistry, biophysics, or agricultural biochemistry.

BBMB 404: Biochemistry I

(3-0) Cr. 3. F.

Prereq: CHEM 332

A general overview for graduate and advanced undergraduate students in agricultural, biological, chemical and nutritional sciences. Chemistry of amino acids, proteins, carbohydrates, and lipids, vitamins; protein structure; enzymology; carbohydrate metabolism. Credit for both BBMB 420 and the BBMB 404 - 405 sequence may not be applied toward graduation.

BBMB 405: Biochemistry II

(3-0) Cr. 3. S.

Prereq: BBMB 404

A general overview for graduate and advanced undergraduate students in agricultural, biological, chemical, and nutritional sciences. Metabolism of carbohydrates, amino acids, nucleotides and lipids; formation, turnover, and molecular relationships among DNA, RNA, and proteins; genetic code; regulation of gene expression; selected topics in the molecular physiology of plants and animals. Credit for both BBMB 420 and the BBMB 404 - BBMB 405 sequence may not be applied toward graduation.

BBMB 411: Techniques in Biochemical Research

(2-8) Cr. 4. F.

Prereq: Credit or enrollment in BBMB 404 or BBMB 504 and BBMB 505; CHEM 211

Laboratory experimentation and techniques for studying biochemistry, including: chromatographic methods; electrophoresis; spectrophotometry; enzyme purification; enzyme kinetics; and characterization of carbohydrates, proteins, lipids, and nucleic acids. Scientific communication and technical writing are emphasized.

BBMB 420: Mammalian Biochemistry

(3-0) Cr. 3. F.

Prereq: CHEM 332, BIOL 314

Structure and function of proteins; enzymology; biological oxidation; chemistry and metabolism of carbohydrates, lipids, amino acids and nucleic acids; protein synthesis and the genetic code; relationship of biochemistry to selected animal diseases. Biochemistry of higher animals emphasized. Not acceptable for credit toward a major in agricultural biochemistry or biochemistry. Acceptable for credit toward a major in biophysics. Credit for both BBMB 420 and the BBMB 404 - 405 sequence may not be applied toward graduation.

BBMB 430: Procaryotic Diversity and Ecology

(Dual-listed with BBMB 530). (Cross-listed with MICRO). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: MICRO 302, MICRO 302L

Survey of the diverse groups of procaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

BBMB 440: Laboratory in Microbial Physiology, Diversity, and Genetics
(Cross-listed with MICRO). (2-6) Cr. 4. F.
Prereq: MICRO 302, MICRO 302L, CHEM 332, BIOL 313L
Fundamental techniques and theory for studying the cellular mechanisms, genetic processes and diversity of microbial life. Experimental techniques will include isolation and physiological characterization of bacteria that inhabit different environments as well as an emphasis on genetic and molecular techniques to understand antibiotic resistance processes and mechanisms. Also included are techniques for phylogenetic characterization, measuring gene expression, and genetic manipulation of bacteria. Essential components for the effective communication of scientific results are also emphasized.

BBMB 461: Molecular Biophysics
(Dual-listed with BBMB 561). (2-0) Cr. 2. S.
Prereq: Credit or enrollment in MATH 166 and CHEM 178 and PHYS 222 or PHYS 112.
Physical methods for the study of molecular structure and organization of biological materials. X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy. Registration for the graduate credit commits the student to graduate-level examinations, which differ from undergraduate-level examinations in the number and/or difficulty of questions.

BBMB 490: Independent Study
Cr. 1-3. Repeatable. F.S.SS.
Prereq: College of Agriculture: junior or senior classification and permission of instructor; College of Liberal Arts and Sciences: permission of instructor.
Independent study with a faculty mentor. No more than 9 credits of BBMB 490 may count toward graduation.

BBMB 490H: Independent Study, Honors
Cr. 1-3. Repeatable. F.S.SS.
Prereq: College of Agriculture: junior or senior classification and permission of instructor; College of Liberal Arts and Sciences: permission of instructor
Independent study with a faculty mentor. No more than 9 credits of BBMB 490 may count toward graduation.

BBMB 499: Undergraduate Research
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of faculty member with whom student proposes to work.
Independent research under faculty guidance.

Courses primarily for graduate students, open to qualified undergraduates:

BBMB 504: Amino Acids and Proteins
(2-0) Cr. 2. F.
Prereq: CHEM 332 or equivalent
Review of amino acids and proteins, including atomic interactions, thermodynamics, structure and properties of amino acids, post-translational modifications, protein expression, purification and analysis, protein secondary, tertiary and quaternary structure, protein folding, oxygen transport and hemoglobin, models for equilibrium binding, elementary reactions and enzyme kinetics, biosynthesis of amino acids: pathways and mechanisms.

BBMB 505: Bioenergetics and Metabolism
(2-0) Cr. 2. F.
Prereq: CHEM 211, CHEM 332; a previous course in biochemistry is strongly recommended
Examination of catabolic pathways involved in the oxidation of organic and inorganic molecules, and energy metabolism involving inputs from light or other non-light sources. Central metabolism and glycolysis, fermentation, aerobic and anaerobic respiration, photosynthesis.

BBMB 506: Membrane Biochemistry
(2-0) Cr. 2.
Prereq: CHEM 332 or equivalent
Analysis of the structure, function, and synthesis of membranes. Bacterial and eukaryotic membrane characteristics. Membrane transport and signaling mechanisms. Analysis of the structure and function of lipids and membrane proteins.

BBMB 507: Biochemistry of Nucleic Acids
(2-0) Cr. 2. S.
Prereq: CHEM 332 or equivalent
Analysis of the chemical structure, function, synthesis, and metabolism of nucleic acids. Chemical characterization of nucleotides, polynucleotides, DNA, and RNA. Analysis of transcription, translation, and the genetic code.

BBMB 510: Molecular Biology and Biochemistry of RNA
(2-0) Cr. 2. F.
Prereq: BIOL 313, BBMB 405, BBMB 502, BBMB 506 and 507 or Gen 409, or equivalent
Biochemical processes that define structure and function of nucleic acids. Emphasis on the molecular processes that take place during synthesis, processing, and function of different RNA species; review of recent advances in RNA research.

BBMB 530: Procaryotic Diversity and Ecology
(Dual-listed with BBMB 430). (Cross-listed with MICRO). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MICRO 302, MICRO 302L
Survey of the diverse groups of procaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

BBMB 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

BBMB 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

BBMB 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

BBMB 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

BBMB 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

BBMB 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

BBMB 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

BBMB 552: Biomolecular NMR Spectroscopy
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: CHEM 325 or permission of instructor
Advanced solution state Nuclear Magnetic Resonance spectroscopy as applied to biological systems. Topics include theoretical principles of NMR, practical aspects of experimental NMR, methodologies for protein structure determination, NMR relaxation, recent advances in NMR spectroscopy.

BBMB 561: Molecular Biophysics
(Dual-listed with BBMB 461). (2-0) Cr. 2. S.
Prereq: Credit or enrollment in MATH 166 and CHEM 178 and PHYS 222 or PHYS 112.
Physical methods for the study of molecular structure and organization of biological materials. X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy. Registration for the graduate credit commits the student to graduate-level examinations, which differ from undergraduate-level examinations in the number and/or difficulty of questions.

BBMB 561L: Laboratory in Molecular Biophysics
(1-3) Cr. 2. S.
Prereq: Credit or enrollment in BBMB 461/BBMB 561
Practice in methods of X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy as applied to macromolecules.

BBMB 569: Bioinformatics III (Structural Bioinformatics)
(Cross-listed with BCB, COM S, CPR E, GDCB). (3-0) Cr. 3. F.
Prereq: BCB 567, BBMB 316, GEN 409, STAT 430
Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution.

BBMB 590: Special Topics
Cr. arr.
By arrangement.

BBMB 593: Workshop in Biochemistry and Biophysics
Cr. 1. Repeatable. F.S.
Prereq: Permission and signature of course administrator required.
Workshops in selected topics in biochemistry and biophysics. Credit in this course does not meet the requirement for advanced graduate electives in Biochemistry. Spring only: BBMB Undergraduate Research Symposium participation. Scheduled class meetings are required in addition to attending the symposium.

Courses for graduate students:

BBMB 607: Plant Biochemistry
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Description of unique aspects of plant biochemistry including lipid metabolism, cell wall structure, secondary metabolism, phytoalexin biosynthesis, and plant defenses.

BBMB 615: Molecular Immunology
(Cross-listed with MICRO, V MPM). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function.

BBMB 622: Carbohydrate Chemistry
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: BBMB 404 or BBMB 504 and BBMB 505
Structure, occurrence, properties, function, and chemical and enzymatic modifications of monosaccharides, oligosaccharides, polysaccharides, and glycoproteins.

BBMB 632: Kinetics of Enzyme Action
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BBMB 504 and BBMB 505
Fundamental and advanced enzyme kinetics. Topics include integrated rate equations, methods for deriving initial-rate equations, inhibition, product effects, methods for verifying kinetic mechanisms, allostery, hysteresis, isotope effects, and complex kinetic mechanisms.

BBMB 642: Mechanisms of Enzymatic Catalysis
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: BBMB 404 or BBMB 420; or BBMB 504 and BBMB 505
The chemical basis of enzymatic catalysis with emphasis on mechanisms of substrate recognition, general acid-base catalysis and stereo-electronic factors.

BBMB 645: Molecular Signaling
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: BBMB 405 or BBMB 420; or BBMB 506 and BBMB 507
Molecular mechanisms of cellular signaling including receptor activation, desensitization and cross talk, signal transduction pathways, and nuclear receptors. Discussion includes a variety of cell surface receptors and their hormone; growth factor and extracellular matrix activators; protein kinases; caspase and transcription factor downstream signals; lipids, gases and cyclic nucleotides as regulators of cell signaling. Course content includes current literature, student and instructor presentations and research proposal writing.

BBMB 652: Protein Chemistry - Chemical Methods
(2-0) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: BBMB 404 or BBMB 504 and BBMB 505
First 8 weeks. Chemical reactions as a means of determining protein structure and biological function.

BBMB 653: Protein Chemistry - Physical Methods
(2-0) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: BBMB 404 or BBMB 504 and BBMB 505
Second 8 weeks. Protein structure determination as a means of understanding biological function.

BBMB 660: Membrane Biochemistry
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Protein and lipid constituents of biological membranes. Structure and topography of membrane proteins. Selected topics concerning the membrane proteins involved in diverse biochemical processes, such as energy transduction transport across membranes, neurotransmission and signal transduction.

BBMB 661: Current Topics in Neuroscience
(Cross-listed with GDCB, NEURO). (2-0) Cr. 2-3. Repeatable. Alt. S., offered even-numbered years.
Prereq: NEURO 556 (or comparable course) or permission of instructor
Topics may include molecular and cellular neuroscience, neurodevelopment, neuroplasticity, neurodegenerative diseases, cognitive neuroscience, sensory biology, neural integration, membrane biophysics, neuroethology, techniques in neurobiology and behavior.

BBMB 675: Nucleic Acid Structure and Function
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
In-depth discussion of nucleic acid properties, structures and structure/function relationships. Interactions between nucleic acids and proteins will be emphasized.

BBMB 676: Biochemistry of Gene Expression in Eucaryotes
(Cross-listed with MCDB). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: BBMB 404 and BBMB 504; and BBMB 506 and BBMB 507; or BBMB 405 or BBMB 505 and or GDCB 511
Analysis of the biochemical processes involved in expression of eucaryotic genes and the regulation thereof, including RNA polymerase, transcriptional regulatory proteins, enhancers and silencers, chromosome structure, termination, RNA processing, RNA transport, RNA turnover, small RNAs, translational regulation, protein turnover.

BBMB 681: Advanced Seminar
Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor
Student presentations.

BBMB 682: Departmental Seminar
Cr. R. F.S.
Prereq: Permission of instructor
Faculty, staff and invited guest research seminar.

BBMB 696: Research Seminar
(Cross-listed with AGRON, FOR, GDCB, HORT, PLBIO). Cr. 1. Repeatable.
Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

BBMB 698: Seminar in Molecular, Cellular, and Developmental Biology
(Cross-listed with GDCB, MCDB, MICRO, V MPM). (2-0) Cr. 1-2. Repeatable. F.S.
Student and faculty presentations.

BBMB 699: Research
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor

Agricultural Business

Administered by the Department of Economics. The major in agricultural business prepares students for advanced studies and for careers in agricultural finance, management in agricultural supply and marketing industries, commodity merchandising and research, business research and management, farm and ranch operations, commercial farm management and appraisal, agricultural sales and marketing, agricultural reporting and public relations, agricultural extension, international activities, and government service. A major in agricultural business with a minor in economics is not permitted; however, a double major in agricultural business and economics is permitted.

Students majoring in Agricultural Business often choose elective coursework leading to minors in the College of Business or in the College of Agriculture and Life Sciences, or emphasizing specific areas within agricultural business such as finance, management, commodity analysis, research, agricultural sales and marketing, environmental economics, farm and ranch operations, international economics, agricultural extension, or government service.

Minor - Agricultural Business

The Department of Economics offers a minor in Agricultural Business. Courses to be included in the minimum of 15 credits include the following:

ECON 101	Principles of Microeconomics	3
ECON 230	Farm Business Management	3
ECON 235	Introduction to Agricultural Markets	3
ECON 301	Intermediate Microeconomics	3-4
Three credits of ECON courses from: 230-289, 300-389, 400-489 courses.		3

Agricultural Business, B.S.

Freshman

Fall	Credits	Spring	Credits
ECON 110	1	ECON 102	3
ECON 101-101L	4	ECON 235	3
ENGL 150	3	BIOL 101 or 211	3
LIB 160	1	ECON 207 or MATH 166	3
MATH 160 or 165	4	Ag Science or Humanities	3
Ag Science or Humanities	3		
	16		15

Sophomore

Fall	Credits	Spring	Credits
ACCT 284	3	Business elective or FIN 301[a,b]	3

ECON 301	3-4	CHEM 163-163L or PHYS 111	4-5
ENGL 250	3	ECON 302 or 353	3
ECON 292	1	International or Diversity	3
Ag Science or Humanities	3	Life Sciences	3
	13-14		16-17

Junior

Fall	Credits	Spring	Credits
Business elective or FIN 301[a,b]	3	Business elective or FIN 301[a,b]	3
ECON 230-289, 300-389, or 400-489	3	ECON 230-289, 300-389, or 400-489	3
SP CM 212 (or AgEds 311)	3	STAT 326	3
STAT 226	3	International or Diversity	3
Ethics	3	Elective	3
	15		15

Senior

Fall	Credits	Spring	Credits
ECON 230-289, 300-389, or 400-489	3	ECON 230-289, 300-389, or 400-489	3
ENGL 302 or 309 or 314	3	ECON 492	0
Electives	9	Electives	12
	15		15

a. Select six credits from ACCT 285 or any 300-489 ACCT, FIN, MKT, MGMT, MIS, or SCM courses.

b. Students interested in taking additional FIN courses beyond FIN 301 should take STAT 226 during the first semester of their sophomore year, and FIN 301 instead of Business Elective in the second semester of their sophomore year.

Curriculum in Agricultural Business

The major in agricultural business requires a minimum of 120 credits and a 2.00 minimum GPA. Only 65 credits from a two-year institution may apply, which may include up to 16 technical credits. In addition, at most 9 P-NP credits of free electives can be applied toward the degree, and a minimum of 18 credits must be earned from courses taught by the Department of Economics at ISU.

International Perspective (http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current)**: 3 cr.**
3 cr. from approved list.

U.S. Diversity (http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses)**: 3 cr.**
3 cr. from approved list.

Communication/Library: 13 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
One of the following		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
One of the following		3
SP CM 212	Fundamentals of Public Speaking	
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
LIB 160	Information Literacy	1
Communication Proficiency Requirement: A grade of C or better in ENGL 250, a C or better in either ENGL 150 or (ENGL 302 or ENGL 309 or ENGL 314), and a C or better in the speech fundamentals course (SP CM 212 or AGEDS 311).		
Total Credits		13

Humanities and Social Sciences: 6 cr.

ECON 102	Principles of Macroeconomics	3
Three credits from approved course list.		3
Total Credits		6

Ethics: 3 cr.
3 cr. from approved list

Life Sciences: 6 cr.

One of the following:		3
BIOL 101	Introductory Biology	
BIOL 211	Principles of Biology I	
Three credits from approved course list.		3
Total Credits		6

Mathematics: 12-14 cr.

One of the following:		4
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
One of the following:		3-4
ECON 207	Applied Economic Optimization	
MATH 166	Calculus II	
STAT 226	Introduction to Business Statistics I	3
STAT 326	Introduction to Business Statistics II	3

Physical Sciences: 5 cr.

CHEM 163	College Chemistry	5
& 163L	and Laboratory in College Chemistry	

or PHYS 111	General Physics	
Total Credits		5

Agricultural, Food, or Natural Resources Sciences: 6 cr.
6 cr. from approved list (http://tinyurl.com/lcs25jb).

General Economics: 9-10 cr.

ECON 101	Principles of Microeconomics	3
ECON 301	Intermediate Microeconomics	3-4
One of the following:		3
ECON 302	Intermediate Macroeconomics	
ECON 353	Money, Banking, and Financial Institutions	
ECON 492	Graduating Senior Survey	R
Total Credits		9-10

Business and Agricultural Business: 29 cr.

ACCT 284	Financial Accounting	3
FIN 301	Principles of Finance	3
Six credits from ACCT 285 or any 300-489 ACCT, FIN, MKT, MGMT, MIS, or SCM courses.		6
ECON 110	Orientation in Agricultural Business	1
ECON 235	Introduction to Agricultural Markets	3
ECON 292	Career Seminar	1
Nine credits of ECON 230-289, 300-389, 400-489 courses.		9
Three credits of 400-489 level ECON courses.		3
Total Credits		29

Electives: 22-24 cr.
Agricultural business majors seeking a double major in economics must take a minimum of 42 credits in economics. These include all of the economics courses required for the economics major. To double major in economics, agricultural business majors must also earn an average grade of C or higher in ECON 101 Principles of Microeconomics, ECON 102 Principles of Macroeconomics, ECON 301 Intermediate Microeconomics, and ECON 302 Intermediate Macroeconomics, with no grade lower than a C#.

Agricultural and Life Sciences Education

For undergraduate curricula in agriculture and life sciences education, and agricultural studies, leading to the degree of bachelor of science, see College of Agriculture and Life Sciences, Curricula.

The department offers two curricula for students desiring to enter careers in agriculture and related fields. These curricula are agriculture and life sciences education and agricultural studies. The agricultural and life sciences education curriculum prepares persons for careers as agricultural education instructors, and educational specialists for industry, nonprofit organizations, and governmental agencies. The agriculture and life sciences education curriculum has two options, teacher certification and communications. The agricultural studies curriculum prepares persons for careers in production agriculture and agricultural industry. Graduates of both curricula accept positions in agricultural business, industry, agencies, and production agriculture.

Graduates will have a broad base of agricultural knowledge, and will be skilled in decision-making, planning, organizing, presenting, and evaluating information. Through the successful completion of the required coursework, active participation in clubs and organizations, and the acquisition of technical skills and experiences associated with work experiences, internships, and international travel, graduates of our baccalaureate programs meet the university, college, and departmental outcomes in the following nine areas:

1. professional, interpersonal, and cross-cultural communications
2. problem solving and critical thinking
3. leadership
4. entrepreneurship
5. life-long learning
6. ethics
7. environmental awareness
8. U.S. diversity
9. international perspectives.

More information regarding the departmental learning outcomes can be found at www.ageds.iastate.edu/. (http://www.ageds.iastate.edu)

Curriculum in Agricultural and Life Sciences Education

Administered by the Department of Agricultural Education and Studies. Students majoring in Agricultural Education choose between two options: Teacher Certification or Communications.

Teacher Certification Option

Total Degree Requirement: 128 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA. Teacher certification requires 2.5 GPA at particular points in the program of study, and a minimum grade of C- in selected courses.

International Perspective: 3 cr. from approved list
U.S. Diversity: 3 cr. from approved list
Communications Proficiency:
6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

Interpersonal and Public Communication 10 cr.:

ENGL 150	Critical Thinking and Communication	3

ENGL 250	Written, Oral, Visual, and Electronic Composition	3
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	3
LIB 160	Information Literacy	1
Total Credits		10

Humanities and Social Sciences: 6 cr.

PSYCH 230	Developmental Psychology	3
3 credits from approved American history list		3

Ethics: 3 cr. from approved list
Math, Physical and Life Sciences: 19 cr.

CHEM 163	College Chemistry	4
or CHEM 177	General Chemistry I	
CHEM 163L	Laboratory in College Chemistry	1
or CHEM 177L	Laboratory in General Chemistry I	
MATH 104	Introduction to Probability	3
or MATH 150	Discrete Mathematics for Business and Social Sciences	
BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
STAT 104	Introduction to Statistics	3
Total Credits		19

Agricultural Sciences and Economics: 31 cr.
All courses minimum grade C- is required.

ACCT 284	Financial Accounting	3
AGEDS 315	Personal, Professional, and Entrepreneurial Leadership in Agriculture	3
AGEDS 488	Methods of Teaching Agricultural Mechanics	3
AN S 101	Working with Animals	2
AGRON 181	Introduction to Crop Science	3
AGRON 182	Introduction to Soil Science	3
AN S 114	Survey of the Animal Industry	2
ECON 101	Principles of Microeconomics	3
ECON 230	Farm Business Management	3
HORT 221	Principles of Horticulture Science	3
NREM 120	Introduction to Renewable Resources	3
Total Credits		31

Professional Credits -Teacher Certification option: 41 cr.
All courses minimum grade C is required.

AGEDS 110A	Agriculture and Life Sciences Education (Fall only)	1
AGEDS 211A	High School Agriculture Programs	1
AGEDS 310	Foundations of Agricultural Education Programs	3
AGEDS 401	Planning Agriculture and Life Sciences Education Programs	3
AGEDS 402	Methods of Teaching in Agriculture and Life Sciences	3
AGEDS 416	Pre-Student Teaching Experience in Agricultural Education	1
AGEDS 417	Supervised Teaching in Agriculture and Life Sciences	1-16
C I 202	Learning Technologies in the 7-12 Classroom	3
C I 204	Social Foundations of Education in the United States	3
C I 333	Educational Psychology	3
C I 406	Social Justice Education and Teaching: Secondary	3
SP ED 401	Teaching Secondary Students with Exceptionalities in General Education	3
Total Credits		28-43

Electives: Select courses to get to 128 credits.

Communications Option: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr. from approved list
U.S. Diversity: 3 cr. from approved list
Communications Proficiency:
6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

Interpersonal and Public Communication 13 cr.:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	3
LIB 160	Information Literacy	1
One of the following:		
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
AGEDS 327	Advanced Communications for Agriculture and Life Sciences	
3 credits from approved list		3
Total Credits		13

Humanities and Social Sciences: 9 cr.

ECON 101	Principles of Microeconomics	3
or ECON 102	Principles of Macroeconomics	
Psychology elective		3
Approved humanities elective		3
Total Credits		9

Ethics: 3 cr. from approved list

Math, Physical and Life Sciences: 20 cr.

CHEM 163	College Chemistry	4
or CHEM 177	General Chemistry I	
CHEM 163L	Laboratory in College Chemistry	1
or CHEM 177L	Laboratory in General Chemistry I	
MATH 104	Introduction to Probability	3
or MATH 150	Discrete Mathematics for Business and Social Sciences	
BIOL 211	Principles of Biology I	3
BIOL 212	Principles of Biology II	3
STAT 101	Principles of Statistics	3-4
or STAT 104	Introduction to Statistics	
Life science elective		3
Total Credits		20-21

Agricultural Sciences and Economics: 32 cr.

10 credits in a selected area of agricultural sciences and economics including 6 credits at the 300-400 level; 6 credits each in two additional areas of agricultural sciences and economics; 10 credits agricultural sciences and economics electives.

Professional Communications: 33 cr.

AGEDS 110A	Agriculture and Life Sciences Education (Fall only)	1
AGEDS 211	Early Field Based Experience	1
AGEDS 215	Career Seminar	1
AGEDS 315	Personal, Professional, and Entrepreneurial Leadership in Agriculture	3
AGEDS 412	Internship in Agricultural Education and Studies	2-6
21 credits from approved electives		21
Total Credits		29-33

Electives: 12-13 cr.

Minor - Agriculture and Life Sciences Education

The department offers a minor in agriculture and life sciences education which may be earned by completion of a minimum of 15 credits in agricultural education and studies courses, with a minimum of two courses at the 400 level. A minor will not meet state licensure requirements for teaching high school agriculture. Courses that can be taken for a minor are:

AGEDS 211	Early Field Based Experience	1
AGEDS 310	Foundations of Agricultural Education Programs	3
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	3
AGEDS 312	Science With Practice	3
AGEDS 315	Personal, Professional, and Entrepreneurial Leadership in Agriculture	3
AGEDS 412	Internship in Agricultural Education and Studies	2-6
AGEDS 388	Agricultural Mechanics Applications	3
AGEDS 414	Developing Agricultural Education Programs in Non-Formal Settings	2
AGEDS 450	Farm Management and Operation	3
AGEDS 451	Agricultural Law	4
AGEDS 461	Technology Transfer and the Role of Agricultural and Extension Education	3
AGEDS 488	Methods of Teaching Agricultural Mechanics	3
AGEDS 490	Independent Study in Agricultural Education and Studies	1-3
AGEDS 496	Agricultural Travel Course	1-3
AGEDS 499	Undergraduate Research	arr †
AGEDS 327	Advanced Communications for Agriculture and Life Sciences	3
AGEDS 402	Methods of Teaching in Agriculture and Life Sciences	3
Total Credits		41-49 †

† Arranged with instructor.

Visit the departmental website at www.AgEds.iastate.edu/. (http://www.AgEds.iastate.edu/.html)

Graduate Study

The department offers the degrees of master of science and doctor of philosophy, with a major in agricultural education; a specialization in agricultural extension education; opportunities for emphasis in international agricultural education; and a minor for students majoring in other curricula. Graduate students who have earned a bachelor's degree in an agricultural discipline may plan a course of study that leads to teacher certification. Candidates pursuing the master of science degree may do so by completing either a thesis or nonthesis program of study.

Students have an opportunity to develop competence in disciplinary foundations and ethics, program planning, learning theory, instructional methods, program leadership and administration, program evaluation,

research methodologies, data analysis and interpretation, writing for publication, and grant proposal writing.

The department also cooperates in the international development studies option of the General Graduate Studies Program. Courses and workshops are offered, both on and off campus, for extension educators, teachers, and industry and government personnel.

Agricultural and Life Sciences Education, B.S - communications option

First Year

Fall	Credits	Spring	Credits
AGEDS 110	1	BIOL 212	3
Ag elective	3	ENGL 250	3
BIOL 211	3	Psych elective	3
ENGL 150	3	Life Science Elective	3
LIB 160	1	Ag Elective	3
MATH 104 or 150	3		
ECON 101 or 102	3		
	17		15

Second Year

Fall	Credits	Spring	Credits
CHEM 163 and Lab	5	Prof Comm Elective	3
Prof Comm Elective	3	Ag Elective	6
Ag Elective	3	Intl Perspectives Elective	3
Ethics Elective	3	AGEDS 215	1
STAT 104	3	AGEDS 211	1
		ENGL 302	3
		OR Engl 309, 314, AgEdS 327	
	17		17

Third Year

Fall	Credits	Spring	Credits
AGEDS 315	3	Prof Comm Elective	6
Prof Comm Elective	3	Ag Elective	6
U.S. Diversity Elective	3	AGEDS 311	3
Ag Elective	3	Humanities Elective	3
Elective	3		
	15		18

Fourth Year

Fall	Credits	Spring	Credits
AGEDS 412	2-6	Prof Comm Elective	3
Ag Elective	5	Elective	6-7
Prof Comm Elective	3	Ag Elective	3
Elective	3		
	13-17		12-13

* Communications Option: In addition, students would have to meet requirements in the following areas.
Select one technical agricultural area in which you will complete at least 10 credits (6 of these must be 300-400 level courses)
Select two other technical agricultural areas in which you will complete at least 6 credits (2 courses) in each area.
A 2.0 grade point average is required.

Agricultural and Life Sciences Education, B.S - teacher certification option

Freshman

Fall	Credits	Spring	Credits
AGEDS 110A	1	C I 202	3
AN S 114	2	ENGL 250	3
AN S 101	2	ECON 101	3
BIOL 211 & 211L	4	AGRON 181	3
ENGL 150	3	BIOL 212 & 212L	4
LIB 160	1		
MATH 140 or 150	3		
	16		16

Sophomore

Fall	Credits	Spring	Credits
CHEM 163 & 163L	5	PSYCH 230	3
C I 204	3	Ethics Elective	3
NREM 120	3	STAT 104	3
ACCT 284	3	American History Elective	3
AGEDS 310	3	AGEDS 211	1
		HORT 221	3
	17		16

Junior

Fall	Credits	Spring	Credits
ECON 230	3	Intl Perspectives Elective	3
C I 333	3	AGEDS 311	3
AGEDS 315	3	Elective	6
AGEDS 488	3	AGRON 182	3
Elective	3		
	15		15

Senior

Fall	Credits	Spring	Credits
AGEDS 401	3	AGEDS 416	1
AGEDS 402	3	AGEDS 417	1-16

Elective	6	
C I 406	3	
SP ED 401	3	
	18	2-17

Courses primarily for undergraduates:

AGEDS 110: Orientation
(1-0) Cr. 1. F.S.
Orientation to the department. Careers in agriculture.

AGEDS 110A: Agriculture and Life Sciences Education (Fall only)
(1-0) Cr. 1. F.S.
Orientation to the department. Careers in agriculture.

AGEDS 110B: Agricultural Studies (Fall only)
(1-0) Cr. 1. F.S.
Orientation to the department. Careers in agriculture.

AGEDS 110C: Agricultural and Life Sciences exploration
(1-0) Cr. 1. F.S.
Orientation to the department. Careers in agriculture.

AGEDS 111: Dean s Leadership Seminar
(1-0) Cr. 1. F.
Prereq: Permission of the Associate Dean for Academic Programs, College of Agriculture and Life Sciences
Introduction to leadership in agriculture and the life sciences, problem solving applied to current case studies, global perspective required by leaders, and designing programs to respond to societal needs in the agricultural and life sciences.

AGEDS 112: Agriculture Biotechnology Colloquium
(1-0) Cr. 1. S.
Prereq: Enrollment as an agricultural excellence scholar
The scientific basis of biological and social sciences in agriculture.

AGEDS 113: Access to Success Seminar I
(1-0) Cr. 1. Repeatable. F.S.
Course provides career skills, learning strategies and social and academic integration techniques to student members of Step Forward Learning Community. Utilization of campus resources, encouragement of self-exploration, and development of academic skills. Offered on a satisfactory-fail basis only.

AGEDS 116: Initial Field Experience in Agricultural Education
(1-2) Cr. 1. F.
Prereq: AGEDS majors only.
Field experience in a formal education setting designed to explore teaching as a career through guided observation and interviews, reflection, and on-campus dialogue.

AGEDS 211: Early Field Based Experience
(1-0) Cr. 1. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: AGEDS 110
Forty hours on-site in an agricultural setting. Students will have an opportunity outside the classroom for career guidance, role modeling, and reflection on their observations that they can apply to their courses and other educational experiences.

AGEDS 211A: High School Agriculture Programs
(1-0) Cr. 1. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: AGEDS 110
Forty hours on-site in an agricultural setting. Students will have an opportunity outside the classroom for career guidance, role modeling, and reflection on their observations that they can apply to their courses and other educational experiences.

AGEDS 211C: Agricultural Industries and Agencies
(1-0) Cr. 1. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: AGEDS 110
Forty hours on-site in an agricultural setting. Students will have an opportunity outside the classroom for career guidance, role modeling, and reflection on their observations that they can apply to their courses and other educational experiences.

AGEDS 215: Career Seminar
(1-0) Cr. 1. F.S.
Prereq: Sophomore classification
Overview of career opportunities. Evaluation of interests and accomplishments and setting career goals. Development of job search and interviewing skills. Establishing networks of job contacts.

AGEDS 310: Foundations of Agricultural Education Programs
(3-0) Cr. 3. F.S.
Historical development of agricultural education programs. Philosophic premises, program goals and objectives. Educational and social issues impacting the implementation of agricultural education programs.

AGEDS 311: Presentation and Sales Strategies for Agricultural Audiences
(3-0) Cr. 3. F.S.
Utilizing instructional methods, techniques, and problem solving, presentation and sales strategies with agricultural audiences.

AGEDS 312: Science With Practice
(1-6) Cr. 3. Repeatable. F.S.
Prereq: College of Agriculture and Life Sciences majors only
A planned learning experience wherein each student and faculty mentor develops a learning agreement that encompasses specific activities and expectations. Students are engaged in reflective activities that include journals, micro-reflections, formal presentations, and a comprehensive portfolio.

AGEDS 315: Personal, Professional, and Entrepreneurial Leadership in Agriculture
(3-0) Cr. 3. F.S.
Leadership principles and strategies to influence and motivate team members to achieve personal, professional, and entrepreneurial goals in production agriculture, agricultural education, and agricultural organizations.

AGEDS 327: Advanced Communications for Agriculture and Life Sciences
(2-2) Cr. 3. F.S.
Prereq: ENGL 250 or equivalent.
Development of written, oral, visual and electronic communications relevant to agriculture and life sciences. Students develop skills and perspectives consistent ethical and democratic principles applicable to agriculture, natural resource, and life science issues. Provide explanations of scientific and technical concepts to rural, industry, and urban audiences. Field trips.

AGEDS 388: Agricultural Mechanics Applications
(2-3) Cr. 3. Repeatable, maximum of 2 times. F.S.SS.
Introduction to SMAW (Arc), GMAW (Mig), GTAW (Tig), Oxy-Fuel welding, Oxy-Fuel cutting, and Plasma cutting theories and applications. Emphasis will be on theoretical foundation of welding, safety, welding skill development, and management of equipment, and materials. Introduction to small engines and applications. Emphasis will be on theory of operating systems, maintenance, troubleshooting, failure analysis, and safety.

AGEDS 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

AGEDS 401: Planning Agriculture and Life Sciences Education Programs
(Dual-listed with AGEDS 501). (3-0) Cr. 3. F.
Prereq: AGEDS 310
Responsibilities of an agricultural education teacher, curriculum development, experiential learning opportunities including FFA and SAE, and assessment and maintenance of program quality.

AGEDS 402: Methods of Teaching in Agriculture and Life Sciences
(Dual-listed with AGEDS 502). (3-0) Cr. 3. F.
Prereq: Concurrent enrollment in AGEDS 401
Topics include: principles of teaching and learning, individualized and group methods, application of learning, instructional management, special populations, and evaluation.

AGEDS 412: Internship in Agricultural Education and Studies
Cr. 2-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior classification in AGEDS and permission of instructor
A supervised two to twelve week learning experience in an approved learning setting with application to educational, agricultural, communications and/or environmental practices and principles.

AGEDS 414: Developing Agricultural Education Programs in Non-Formal Settings
(2-0) Cr. 2. S.
Basic concepts in planning, conducting, and evaluating educational programs in non-formal settings. Includes programming for youth and adults in Extension, agricultural industry, and related agencies.

AGEDS 416: Pre-Student Teaching Experience in Agricultural Education
Cr. 1. F.S.
Prereq: AGEDS 211, AGEDS 402 and admission to teacher education program
A forty hour field-based experience in an approved secondary agricultural education program. Concurrent enrollment in 417 is required.

AGEDS 417: Supervised Teaching in Agriculture and Life Sciences
Cr. 1-16. Repeatable. F.S.
Prereq: AGEDS 211, AGEDS 402 and admission to teacher education program
Supervised teaching in public schools.

AGEDS 450: Farm Management and Operation
(2-4) Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Econ 235, Econ 230, junior classification
Participation in the management and operation of a diversified Iowa farm. The class is responsible for the plans, records, and decisions for buying and selling the farm's livestock, crops, and equipment. Special speakers on current topics. May be taken for credit 3 times at different times of the year with permission of the instructor.

AGEDS 451: Agricultural Law
(3-2) Cr. 4. S.
Prereq: Senior classification
The legal framework impinging upon decision-making by firms, families, and individuals, real and personal property, contracts, secured transactions, negotiable instruments, debtor-creditor relations, bankruptcy, farm income tax organization of firms, intergenerational property transfers, trusts and farm estate planning, civil and criminal liabilities, environmental law, federal and state regulatory powers.

AGEDS 461: Technology Transfer and the Role of Agricultural and Extension Education
(Dual-listed with AGEDS 561). (3-0) Cr. 3. S.
Impact of agricultural and extension education processes on development and their role in the transfer of agricultural technology. Utilizing situational analysis techniques to analyze and solve problems in international agricultural education programs.
Meets International Perspectives Requirement.

AGEDS 475: Agri-Marketing and Communications Competition
(2-0) Cr. 1-2. Repeatable, maximum of 6 credits. F.S.
Prereq: Admission by invitation.
Specialized training in communication and agricultural marketing knowledge and skills in preparation for intercollegiate competition. Maximum of 6 credits can be applied toward graduation.

AGEDS 488: Methods of Teaching Agricultural Mechanics
(2-3) Cr. 3. F.S.
Methods and management techniques in agricultural mechanics laboratories. Emphasis will be on safety, mechanical skills development and management of students, facilities, equipment, and materials.

AGEDS 490: Independent Study in Agricultural Education and Studies
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490A: Philosophy, Curriculum, and Methods
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490B: Leadership, Evaluation, and Administration
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490C: Business, Industry, and Production Agriculture
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490D: Extension and International Agriculture
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490E: Instructional Technology
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490F: Environmental Issues
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490G: Entrepreneurship
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490H: Independent Study in Agricultural Education and Studies, Honors
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 490I: Communications
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, permission of instructor

AGEDS 496: Agricultural Travel Course
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study agriculture and education related topics. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

AGEDS 496A: International
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study agriculture and education related topics. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.
Meets International Perspectives Requirement.

AGEDS 496B: Domestic
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study agriculture and education related topics. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

AGEDS 499: Undergraduate Research
Cr. arr. F.S.SS.
Prereq: Permission of instructor, adviser, and departmental chair
Research experience in agricultural education and studies with application to selected problems.

Courses primarily for graduate students, open to qualified undergraduates:

AGEDS 501: Planning Agriculture and Life Sciences Education Programs
(Dual-listed with AGEDS 401). (3-0) Cr. 3. F.
Prereq: AGEDS 310
Responsibilities of an agricultural education teacher, curriculum development, experiential learning opportunities including FFA and SAE, and assessment and maintenance of program quality.

AGEDS 502: Methods of Teaching in Agriculture and Life Sciences
(Dual-listed with AGEDS 402). (3-0) Cr. 3. F.
Prereq: Concurrent enrollment in AGEDS 401
Topics include: principles of teaching and learning, individualized and group methods, application of learning, instructional management, special populations, and evaluation.

AGEDS 510: Introduction to Research in Agricultural Education
(3-0) Cr. 3. S.
Prereq: Graduate classification
Determining your research focus; developing research problems and objectives; reviewing the literature and establishing a theoretical framework; establishing procedures for data collection and analysis; ethical issues.

AGEDS 511: Professional Agricultural Presentation Practices
(3-0) Cr. 3. F.SS.
Prereq: Graduate Classification
The identification and use of key planning, delivery and evaluation of presentations using audience engagement techniques focused on research-based principles and field-based practices of professional presenters in agriculture and the life sciences.

AGEDS 520: Instructional Methods for Adult and Higher Education in Agriculture and Natural Resources
(3-0) Cr. 3. S.
Prereq: Graduate classification
Theory and practice of adult education. Teaching and learning in formal and non-formal instructional programs for adult learners.

AGEDS 524: Program Development and Evaluation in Agricultural and Extension Education
(3-0) Cr. 3. F.
Prereq: Graduate classification
Theories and practice of program planning for nonformal education. Addresses use of program logic modeling and considers critical theories of planning to address power and interests in program development, needs assessment, and evaluation.

AGEDS 533: Introduction to Learning Theory in Agricultural Education
(3-0) Cr. 3. S.
Prereq: Graduate classification
Introduction to a variety of theoretical perspectives of learning and how they may be used within the context of agricultural education. Emphasis will be on the major domains of learning, developmental considerations, basic assumptions, concepts, and principles of various learning theories; understanding how each theoretical perspective may be used in both formal and non-formal educational settings.

AGEDS 550: Foundations of Agricultural Education
(3-0) Cr. 3. F.
Prereq: Graduate classification
Philosophical premises, ethical principles, historical development, contextual applications, and knowledge bases for agricultural education.

AGEDS 561: Technology Transfer and the Role of Agricultural and Extension Education
(Dual-listed with AGEDS 461). (3-0) Cr. 3. S.
Impact of agricultural and extension education processes on development and their role in the transfer of agricultural technology. Utilizing situational analysis techniques to analyze and solve problems in international agricultural education programs.
Meets International Perspectives Requirement.

AGEDS 590: Special Topics in Agricultural Education
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590A: Curriculum
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590B: Methods
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590C: Philosophy
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590D: Evaluation
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590E: Administration
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590F: Leadership
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590G: Guidance
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590I: Instructional Technology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590J: Extension
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590K: International Agriculture
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 590L: Program Planning
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593: Workshop in Agricultural Education
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593A: Curriculum
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593B: Methods
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593C: Evaluation
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593D: Administration
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593E: Leadership
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593F: Extension
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593G: Program Planning
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593H: Instructional Technology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 593M: Biotechnology Workshop
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 12 credits in agricultural education

AGEDS 599: Creative Component
Cr. arr. Repeatable. F.S.SS.
For nonthesis masters degree programs.

Courses for graduate students:

AGEDS 615: Seminar in Agricultural Education
(1-0) Cr. 1. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

AGEDS 615A: Writing for publication
(1-0) Cr. 1. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

AGEDS 615B: Ethics
(1-0) Cr. 1. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

AGEDS 615C: Grant writing
(1-0) Cr. 1. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

AGEDS 615D: Career planning
(1-0) Cr. 1. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

AGEDS 615E: Contemporary issues
(1-0) Cr. 1. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

AGEDS 617: Professional Internship for Agricultural Educators
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Analysis of the roles and activities of professionals in agricultural education. Supervised professional field-based experience in public and private settings. Offered on a satisfactory-fail basis only.

AGEDS 625: Leadership, Administration, Supervision and Management of Agricultural Education Programs
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Graduate classification
Principles and best practices for leading, administering, supervising, and managing agricultural education programs. Analyzing selected case studies that apply theory to practice in agricultural situations.

AGEDS 699: Research
Cr. arr. Repeatable.

Agricultural Studies

Undergraduate Study

For undergraduate curricula in agriculture and life sciences education, and agricultural studies, leading to the degree of bachelor of science, see College of Agriculture and Life Sciences, Curricula.

The department offers two curricula for students desiring to enter careers in agriculture and related fields. These curricula are agriculture and life sciences education and agricultural studies. The agricultural and life sciences education curriculum prepares persons for careers as agricultural education instructors, and educational specialists for industry, nonprofit organizations, and governmental agencies. The agriculture and life sciences education curriculum has two options, teacher certification and communications. The agricultural studies curriculum prepares persons for careers in production agriculture and agricultural industry. Graduates of both curricula accept positions in agricultural business, industry, agencies, and production agriculture.

Graduates will have a broad base of agricultural knowledge, and will be skilled in decision making, planning, organizing, presenting, and evaluating information. Through the successful completion of the required coursework, active participation in clubs and organizations, and the acquisition of technical skills and experiences associated with work experiences, internships, and international travel, graduates of our baccalaureate programs meet the university, college, and departmental outcomes in the following nine areas:

1. professional, interpersonal, and cross-cultural communications
2. problem solving and critical thinking
3. leadership
4. entrepreneurship
5. life-long learning
6. ethics
7. environmental awareness
8. U.S. diversity
9. international perspectives.

More information regarding the departmental learning outcomes can be found at www.ageds.iastate.edu/. (http://www.ageds.iastate.edu)

Curriculum in Agricultural Studies

Administered by the Department of Agricultural Education and Studies. Students are encouraged to develop one or more areas of concentration in agricultural sciences and economics.

Total Degree Requirement: 120 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective:
3 cr. from approved list.

U.S. Diversity:
3 cr. from approved list.

Communications Proficiency:
6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

Communication/Library 13 cr.:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	3
AGEDS 327	Advanced Communications for Agriculture and Life Sciences	3
LIB 160	Information Literacy	1
Total Credits		13

Humanities and Social Sciences: 6 cr.

ECON 101	Principles of Microeconomics	3
Plus 3 credit hours from approved humanities list		3
Total Credits		6

Ethics: 3 cr.
3 cr. from approved list.

Math Physical and Life Sciences: 17 crs.

BIOL 101	Introductory Biology	3
or BIOL 211	Principles of Biology I	
Life Science Elective from College Approved List		3
CHEM 163	College Chemistry	4
or CHEM 177	General Chemistry I	
CHEM 163L	Laboratory in College Chemistry	1
or CHEM 177L	Laboratory in General Chemistry I	
MATH 104	Introduction to Probability	3
or MATH 150	Discrete Mathematics for Business and Social Sciences	
STAT 104	Introduction to Statistics	3
Total Credits		17

Agricultural Sciences and Economics: 43 cr.

AGEDS 110B	Agricultural Studies (Fall only)	1
AGEDS 215	Career Seminar	1
AGEDS 315	Personal, Professional, and Entrepreneurial Leadership in Agriculture	3
AGEDS 450	Farm Management and Operation	3
AGEDS 451	Agricultural Law	4
AGRON 181	Introduction to Crop Science	3

AGRON 182	Introduction to Soil Science	3
AGRON 280	Crop Development, Production and Management	3
AN S 101	Working with Animals	2
AN S 114	Survey of the Animal Industry	2
ECON 230	Farm Business Management	3
ECON 235	Introduction to Agricultural Markets	3
Econ 300 Level from Department Approved List		3
NREM 120	Introduction to Renewable Resources	3
or NREM 130	Natural Resources and Agriculture	
And 6 credit hours from AN S, any level.		6
Total Credits		43

Other Required Course:
Electives: Select courses to get to 120 credits.
No more than 4 cr. of or 397 may count toward graduation.

No more than 6 cr. of 490 may count toward graduation.

Preveterinary Studies

Preparation for admission to veterinary medicine may be accomplished through the agricultural studies curriculum.

Agricultural Studies, B.S.

Freshman

Fall	Credits	Spring	Credits
AGEDS 110B	1	AN S 114	2
ECON 101	3	AGRON 182	3
MATH 104 or 150	3	AN S 101	2
NREM 120/130	3	STAT 104	3
ENGL 150	3	ENGL 250	3
LIB 160	1	Humanities Elective	3
AGRON 181	3		
	17		16

Sophomore

Fall	Credits	Spring	Credits
AGEDS 215	1	ACCT 284	3
BIOL 101	3	Life Science Elective	3
AGRON 280	3	U.S. Diversity Elective	3
Intl Perspective Elective	3	AN S Elective	3
ECON 235	3	Elective	3
	13		15

Junior

Fall	Credits	Spring	Credits
AN S Elective	3	AGEDS 311	3
AGEDS 315	3	ECON 230	3
CHEM 163 & 163L	5	Ethics Elective	3
Elective	6	Elective	7
	17		16

Senior

Fall	Credits	Spring	Credits
AGEDS 450	3	AGEDS 451	4
ECON 334	3	Elective	10
AGEDS 327	3		
Elective	3		
	12		14

* A 2.00 grade point average is required.

Agriculture and Society

College of Agriculture— Agriculture & Society

This undergraduate degree emphasizes the application of social science knowledge to issues related to agriculture and society. The interdisciplinary major draws largely on courses from sociology, political science and economics. Its goal is to prepare students to become leaders in addressing complex issues related to the social and human dimensions of agriculture at both the local and global level. Students will learn social science concepts and skills to understand, analyze and communicate complex ideas, information and data related to agricultural systems.

Internships are an important part of the Agriculture & Society major. The curriculum offers the flexibility needed to accommodate the special interests and needs of each student.

The curriculum is designed to provide students with the following skills and competencies:

1. Recognize, analyze and evaluate the critical human and social factors (e.g. practices, policies, laws, institutions) impacting agriculture.
2. Understand the social dimensions of agriculture and its connections with food and environmental systems.
3. Develop problem solving, critical thinking, and leadership skills to positively influence human impacts on agriculture.
4. Understand the perspectives of diverse stakeholders and develop strategies to communicate clearly and effectively to a range of audiences.

Students will develop the necessary skills to become effective leaders with companies, local, national and international non-governmental organizations (NGOs), and government agencies that work on agricultural, food and environmental related issues. Graduates can work as public policy analysts, government relations, public relations, program

analyst, program specialists, marketing, sales, agriculture, educators, and executive directors.

Curriculum in Agriculture & Society

Administered by the Department of Sociology

Total Degree Requirement: 128 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communications Proficiency (C or better):

6 credits of English Composition		6
Three credits of Speech Fundamentals		3

Communication/Library:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
SP CM 212	Fundamentals of Public Speaking	3
P R 305	Publicity Methods	3
LIB 160	Information Literacy	1

Humanities and Social Sciences: 6 cr.

3 credits from approved humanities list		3
3 credits from approved social science list		

Ethics: 3 cr.
3 cr. from approved list.

Life Sciences: 6 cr.

BIOL 101	Introductory Biology	3
or BIOL 211	Principles of Biology I	
Three credits from approved life sciences list		3
Total Credits		6

Mathematical and Physical Sciences: 12 cr.

MATH 150	Discrete Mathematics for Business and Social Sciences	3
or MATH 140	College Algebra	
STAT 101	Principles of Statistics	4
or STAT 104	Introduction to Statistics	
Five credit hours from:		5
MTEOR 206	Introduction to Weather and Climate	
AGRON 206	Introduction to Weather and Climate	
or ASTRO, CHEM, GEOL, PHYS		
Total Credits		12

Sociology 15 cr.

SOC 110	Orientation to Public Service and Administration in Agriculture	R
SOC 230	Rural Society in Transition	3
SOC 325	Transition in Agriculture	3
SOC 382	Environmental Sociology	3
SOC 415	Dynamics of Social Change	3
Sociology elective 300 level or above		3
Total Credits		15

Economics and Agricultural Education and Studies: 16 cr.

ECON 101	Principles of Microeconomics	3
ECON 102	Principles of Macroeconomics	3
ECON 235	Introduction to Agricultural Markets	3
or ECON 380	Energy, Environmental and Resource Economics	
AGEDS 451	Agricultural Law	4
ECON 362	Applied Ethics in Agriculture	3
or ECON 385	Economic Development	
or ACCT 284	Financial Accounting	
Total Credits		16

Political Sciences: 15 cr.

POL S 215	Introduction to American Government	3
POL S 310	State and Local Government	3
Political Science elective-choose from		9
POL S 235	Introduction to Ethics and Politics	
POL S 319	Law and Politics	
POL S 334	Politics and Society	
POL S 335	Science, Technology, and Public Policy	
Total Credits		15

Agricultural Sciences: 9 cr.
Complete 9 cr. from MTEOR 206 Introduction to Weather and Climate or AGRON, AN S, AST, ENT, FS HN, HORT, or NREM.

Minor or Area of Concentration: 15 cr.
Complete 15 cr. from approved specialization area.

Agriculture and Society, B.S.

Freshman

Fall	Credits	Spring	Credits
SOC 110		R ENGL 250	3
ENGL 150	3	MATH 150	3
LIB 160	1	ECON 102	3
BIOL 101 or 211	3	SOC 325	3
ECON 101	3	Agriculture Science Elective	3
POL S 215	3		
Agricultural Science Elective	3		
	16		15

Sophomore

Fall	Credits	Spring	Credits
POL S 310	3	P R 305	3
STAT 101	4	SP CM 212	3
Physical Science Elective	3	Ethics Elective	3
SOC 415	3	Physical Science Elective	3
Area of Concentration	3	Area of Concentration	3
	16		15

Junior

Fall	Credits	Spring	Credits
SOC elective	3	POL S elective	3
POL S elective	3	POL S elective	3
US Diversity Elective	3	International Perspective Elective	3
Area of Concentration	3	Area of Concentration	3
Free Electives	2	ECON 235 or 380	3
	14		15

Senior

Fall	Credits	Spring	Credits
ECON 235 or 380	3	ECON 362 or ECON 385 or ACCT 284	3
SOC 464	3	AGEDS 451	4
Agricultural Science Elective	3	Humanities Elective	4
Area of Concentration undefined	3	Free Elective	6
Free electives	3		
	15		17

Graduate Study

The department offers work for the degrees master of science and doctor of philosophy with majors in sociology and rural sociology and minor work for students majoring in other departments. For M.S. and Ph.D. departmental requirements, see Program of Graduate Study for Degrees in Sociology and Rural Sociology, available from the department office. The department offers concentrations in a number of areas, e.g., community studies and development; sociology of families, inequality, food systems, agriculture and environment; methodology; social change and development; criminology; the economy, organizations and work; and social psychology. The Department of Sociology does not offer a nonthesis master's program.

Graduates have a broad understanding of sociology, address complex societal problems, and communicate effectively with scientific colleagues and the general public in both formal and informal settings. They understand sociological theory, conduct research, and are prepared to educate college students and contribute to public policy. Although the department stipulates no language requirement for either the degree master of science or the degree doctor of philosophy, specifying competence in one or more languages may be desirable in some instances.

The department also participates in the interdepartmental program in interdepartmental majors in sustainable agriculture, transportation and water resources, and interdepartmental minors in gerontology (see Index).

Agricultural Systems Technology

The Department of Agricultural and Biosystems Engineering offers a bachelor of science degree in agricultural systems technology (AST).

AST graduates have the ability to apply science and technology to problems related to agriculture; they manage complex agricultural systems for sustainability. They find careers within a variety of agriculturally-related industries, businesses, and organizations, including: agricultural machinery, environment, government, farm builders, grain, feed, seed, fertilizer, chemical, food, biorenewable resources, and production agriculture.

Students majoring in AST B.S. degree choose between two options: Agricultural and Biosystems Management; or Machine Systems. Required AST courses are taught under the course designator TSM (Technology Systems Management).

For more information about the AST degree: http://www.abe.iastate.edu/undergraduate-students/agricultural-systems-technology/

Total Degree Requirement: 120 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

Communications Proficiency:
6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

Communication/Library: 13 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
One of the following:		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
AGEDS 327	Advanced Communications for Agriculture and Life Sciences	
One of the following:		3
SP CM 212	Fundamentals of Public Speaking	

COMST 214	Professional Communication	
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
LIB 160	Information Literacy	1
Total Credits		13

Mathematical, Physical, and Life Sciences: 25 cr.

MATH 151	Calculus for Business and Social Sciences	3
MATH 145	Applied Trigonometry	3
STAT 104	Introduction to Statistics	3
PHYS 111	General Physics	5
CHEM 163	College Chemistry	4
CHEM 163L	Laboratory in College Chemistry	1
BIOL 101	Introductory Biology	3
or BIOL 211	Principles of Biology I	
Plus 3 life sciences credits from approved College of Agriculture and Life Sciences list		3
Total Credits		25

Business, Humanities, Ethics, and Social Sciences: 18 cr.

ACCT 284	Financial Accounting	3
ECON 101	Principles of Microeconomics	3
Ethics Course		3
TSM 370	Occupational Safety	
Humanities course from College of Agriculture and Life Sciences list		3
International Perspectives course from University list		3
U.S. Diversity course from University list		3
Total Credits		18

Technical Core: 30 cr.

TSM 110	Introduction to Technology	1
TSM 111	Experiencing Technology	1
TSM 115	Solving Technology Problems	3
TSM 116	Introduction to Design in Technology	3
TSM 201	Preparing for Workplace Seminar	1
TSM 210	Fundamentals of Technology	3
TSM 214	Managing Technology Projects	1
TSM 270	Principles of Injury Prevention	3
TSM 310	Total Quality Improvement	3
TSM 363	Electric Power and Electronics for Agriculture and Industry	4
TSM 397	Internship in Technology	R
TSM 399	Work Experience in Technology	2
TSM 415	Applied Project Management in Technology	2
TSM 416	Technology Capstone	3
Total Credits		30

No more than 4 cr. of TSM 397 may count toward graduation.

Agricultural and Biosystems Management Option: 34 cr.

TSM 322	Preservation of Grain Quality	2
TSM 322L	Preservation of Grain Quality Laboratory	1
TSM 324	Soil and Water Conservation Management	3
TSM 325	Biorenewable Systems	3
TSM 327	Animal Production Systems	3
TSM 330	Agricultural Machinery and Power Management	3
TSM 433	Precision Agriculture	3
ECON 230	Farm Business Management	3
13 credits of free electives		13
Total Credits		34

Machine Systems option: 34 cr.

TSM 216	Advanced Technical Graphics, Interpretation, and CAD	2
A B E 271, A B E 272, or A B E 273		1
TSM 240	Introduction to Manufacturing Processes	3
TSM 330	Agricultural Machinery and Power Management	3
TSM 335	Tractor Power	4
TSM 337	Fluid Power Systems Technology	3
TSM 433	Precision Agriculture	3
TSM 443	Statics and Strength of Materials for Technology	3
TSM 465	Automation Systems	3
9 credits of free electives		9
Total Credits		34

Agricultural Systems Technology, B.S. - Machine Systems

First Year

Fall	Credits	Spring	Credits
TSM 110	1	TSM 111	1
TSM 116	3	TSM 115	3
ENGL 150	3	MATH 151	3
LIB 160	1	PHYS 111	5
MATH 145	3	US Diversity - see list*	3
CHEM 163	4		
CHEM 163L	1		
	16		15

Second Year

Fall	Credits	Spring	Credits
TSM 201	1	TSM 216	2
TSM 210	3	A B E 271, A B E 272, or A B E 273	1
TSM 214	1	TSM 240	3
TSM 270	3	STAT 104	3
ACCT 284	3	BIOL 101 or BIOL 211	3
ECON 101	3	SP CM 212, COMST 214, or AGEDS 311	3
ENGL 250	3		
	17		15

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
TSM 335	4	TSM 310	3	TSM 397	0
TSM 363	4	TSM 330	3		
TSM 433	3	TSM 337	3		
ENGL 302, ENGL 309, ENGL 314, or AGEDS 327	3	Humanities - See list*	3		
		Life Science - See list*	3		
	14		15		0

Fourth Year

Fall	Credits	Spring	Credits
TSM 399	2	TSM 370	3
TSM 415	2	TSM 416	3
Elective	9	TSM 443	3
International Perspective - see list*	3	TSM 465	3
	16		12

* See list - Speak with an academic adviser for options for each list.

Agricultural Systems Technology, B.S. - Agricultural & Biosystems Management

First Year

Fall	Credits	Spring	Credits
TSM 110	1	TSM 111	1
TSM 116	3	TSM 115	3
ENGL 150	3	MATH 151	3
LIB 160	1	PHYS 111	5
MATH 145	3	ECON 101	3
CHEM 163	4		
CHEM 163L	1		
	16		15

Second Year

Fall	Credits	Spring	Credits
TSM 201	1	TSM 322	2
TSM 210	3	TSM 322L	1
TSM 214	1	BIOL 101 or 211	3
TSM 270	3	ECON 230	3
ACCT 284	3	STAT 104	3
ENGL 250	3	SP CM 212, COMST 214, or AGEDS 311	3
	14		15

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
TSM 325	3	TSM 310	3	TSM 397	0
TSM 327	3	TSM 324	3		
TSM 363	4	TSM 330	3		
ENGL 302, ENGL 309, ENGL 314, or AGEDS 327	3	TSM 370	3		
US Diversity - see list*	3	Life Science - see list*	3		
	16		15		0

Fourth Year

Fall	Credits	Spring	Credits
TSM 399	2	TSM 416	3
TSM 415	2	International Perspective - see list*	3
TSM 433	3	Elective	10

Humanities - see list*	3	
Elective	3	
	13	16

* See list - Speak with an academic adviser for options for each list.

Minor in agricultural systems technology

The Department of Agricultural and Biosystems Engineering offers a minor in agricultural systems technology which may be earned by completing a minimum of 15 credits of technology systems management courses, which includes:

TSM 115	Solving Technology Problems	3
TSM 210	Fundamentals of Technology	3
9 credits from:		9
TSM 310	Total Quality Improvement	
TSM 322	Preservation of Grain Quality	
TSM 322L	Preservation of Grain Quality Laboratory	
TSM 324	Soil and Water Conservation Management	
TSM 325	Biorenewable Systems	
TSM 327	Animal Production Systems	
TSM 330	Agricultural Machinery and Power Management	
TSM 335	Tractor Power	
TSM 337	Fluid Power Systems Technology	
TSM 363	Electric Power and Electronics for Agriculture and Industry	
TSM 393E	Topics in Technology: Chemical Application Systems	
TSM 393F	Topics in Technology: Agricultural Safety and Health	
TSM 433	Precision Agriculture	
• At least six (6) credits of 300-level or higher TSM classes (from the classes listed above)		
• At least nine (9) credits that are not used to meet any other department, college, or university requirement.		
Total Credits		15

Courses primarily for undergraduates:

TSM 110: Introduction to Technology

(1-0) Cr. 1. F.

Prereq: AST or I Tec majors only or permission of instructor

Team-oriented introduction to agricultural systems technology and industrial technology. Internships, careers, competencies, academic success strategies, transition to academic life.

TSM 111: Experiencing Technology

(0-2) Cr. 1. S.

Prereq: AST or I Tec majors only or permission of instructor

Laboratory-based, team-oriented experiences in a spectrum of topics common to the practice of technology. Internships, competencies, industry visits.

TSM 115: Solving Technology Problems

(2-2) Cr. 3. F.S.

Prereq: Credit or enrollment for credit in MATH 140 or higher

Solving technology problems and presenting solutions through data analysis and technical report writing. Problem solving cycle, unit conversion, unit factor method, SI units, significant digits, graphing, curve fitting and computer programming. Use of modern hardware and software tools for applied data-driven problem solving.

TSM 116: Introduction to Design in Technology

(2-2) Cr. 3. F.S.

Use of parametric solid modeling software to create three dimensional solid models and document parts and assemblies. Includes national and international standards for documentation, design projects, and teamwork. Rapid prototyping design creation, 3D printing, assemblies, rendering, and detailing technical drawings.

TSM 201: Preparing for Workplace Seminar

(Cross-listed with A B E). (1-0) Cr. 1. F.S.

Prereq: Prereq: Sophomore classification in AE, AST, BSE, or I TEC

8 week course. Professionalism in the context of the engineering/technical workplace. Development and demonstration of key workplace competencies: teamwork, initiative, communication, and engineering/technical knowledge. Resumes; Cover Letters; Behavioral Based Interviewing; Industry Speakers; Preparation for internships experiences.

TSM 210: Fundamentals of Technology

(3-0) Cr. 3. F.S.

Prereq: TSM 115 or equivalent; and MATH 140 or higher

Introduction to problem solving related to fundamental agricultural and/or industrial technology systems and mathematical tools needed for data analysis. Basic laws of energy, force, and mass applied to technology systems such as: mechanical power transmission; heating, ventilation and air conditioning; electrical circuits. Introduction to engineering economics: using the time value of money to make economic decisions.

TSM 214: Managing Technology Projects

(2-0) Cr. 1. F.S.

Prereq: TSM 201 or A B E 201; and sophomore classification in A E, AST, BSE, or ITEC.

8 week course. Introduction to project management principles. Use of project management in technology-based projects for academic, industry, and personal use.

TSM 216: Advanced Technical Graphics, Interpretation, and CAD
(1-2) Cr. 2. F.S.
Prereq: TSM 116
Advanced computer-aided-design topics incorporating 3D design and documentation used in manufacturing settings. Topics include: geometric dimensioning and tolerancing, weldments, sheet metal parts, advanced visualization, feature based design of parts and assemblies.

TSM 240: Introduction to Manufacturing Processes
(1-4) Cr. 3. F.S.
A study of selected materials and related processes used in manufacturing. Lecture and laboratory activities focus on materials, properties, and processes. This includes plastics and metals.

TSM 270: Principles of Injury Prevention
(3-0) Cr. 3. F.
Basic foundations of injury causation and prevention in home, motor vehicle, public, and work environments. Offered online only.

TSM 310: Total Quality Improvement
(3-0) Cr. 3. S.
Prereq: STAT 101 or STAT 104, junior classification
Introduction to the fundamental concepts of TQM - Deming style of management, statistical studies to understand the behavior of products, processes, or services, and how to define and document processes and customer focus. Introduction to continuous improvement tools and methods - emphasis on team work and problem solving skills.

TSM 322: Preservation of Grain Quality
(2-0) Cr. 2. S.
Prereq: MATH 140 or higher
Principles and management for grain quality preservation. Quality measurement. Drying and storage. Fans and airflow through grain. Handling methods.

TSM 322L: Preservation of Grain Quality Laboratory
(0-3) Cr. 1. S.
Prereq: Credit or enrollment for credit in TSM 322
Hands-on experiences in the principles and management for grain quality preservation. Quality measurement. Drying and storage. Fans and airflow through grain. Handling methods. System planning. Industry tour.

TSM 324: Soil and Water Conservation Management
(2-2) Cr. 3. S.
Prereq: MATH 140 or MATH 151
Introduction to engineering and conservation principles applied to the planning of erosion control systems, water control structures, water quality management, and drainage and irrigation systems.

TSM 325: Biorenewable Systems
(Cross-listed with A B E). (3-0) Cr. 3. F.
Prereq: ECON 101; CHEM 163 or higher; and MATH 140 or higher
Converting biorenewable resources into bioenergy and biobased products. Biorenewable concepts as they relate to drivers of change, feedstock production, processes, products, co-products, economics, and transportation/logistics.

TSM 327: Animal Production Systems
(3-0) Cr. 3. F.
Prereq: TSM 210
Confined animal feeding operations. Environmental controls for animal production. Response of animals to the environment. Heat and moisture balance in animal housing. Ventilation, water, feed handling, air pollution, odor and waste management systems.

TSM 330: Agricultural Machinery and Power Management
(2-3) Cr. 3. S.
Prereq: MATH 145 or MATH 151; and TSM 210
Selection, sizing, and operational principles of tractors and machinery systems. Cost analysis and computer techniques applied to planning and management of agricultural machine systems. Principles, operation, and application of agricultural machinery.

TSM 335: Tractor Power
(3-3) Cr. 4. F.
Prereq: TSM 210, MATH 145
Theory and construction of tractor engines, mechanical power trains and hydraulic systems. Introduction to traction, chassis mechanics, and hydraulic power.

TSM 337: Fluid Power Systems Technology
(2-2) Cr. 3. S.
Prereq: TSM 210
Fundamental fluid power principles. Fluid properties. Function and performance of components such as pumps, valves, actuators, hydrostatic transmission. Analysis of fluid power circuits and systems. Introduction to electrohydraulics. Course includes lab using fluid power trainers.

TSM 340: Advanced Automated Manufacturing Processes
(2-2) Cr. 3. F.
Prereq: TSM 216, TSM 240, MATH 151
NC programming operations for CNC mills and lathes. Transfer of parts descriptions into detailed process plans, tool selection, and NC codes. Computer assisted CAD/CAM NC programming for 2D/3D machining and machining of student programmed NC code in lab.

TSM 363: Electric Power and Electronics for Agriculture and Industry
(3-3) Cr. 4. F.
Prereq: TSM 210
Basic electricity. Electrical safety, wiring, 3-phase service, controls, and motors for agricultural and industrial applications. Planning building lighting and electrical systems. Electronics to sense, monitor, and control mechanical processes.

TSM 370: Occupational Safety
(3-0) Cr. 3. S.
Prereq: TSM 270, junior standing
Identifies safety and health risks in industrial work environments. Focus on how managers and supervisors meet their responsibilities for providing a safe workplace for their employees. Includes the identification and remediation of workplace hazards.

TSM 371: Occupational Safety Management
(2-0) Cr. 2. S.
Introduction to occupational safety and health administration and management. Focus on development and management of safety programs and obtaining employee involvement in occupational safety programs.

TSM 372: Legal Aspects of Occupational Safety and Health
(2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: TSM 371
A review of the common legal issues facing safety practitioners in the workplace. Includes OSHA, EPA and DOT regulations; workers' compensation, as well as common liability issues.

TSM 376: Fire Protection and Prevention
(3-0) Cr. 3. Alt. F., offered even-numbered years.
An overview of the current problems and technology in the fields of fire protection and fire prevention, with emphasis on industrial needs, focusing on the individual with industrial safety responsibilities.

TSM 393: Topics in Technology
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393A: Topics in Technology: Agriculture and Biosystems Management
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393B: Topics in Technology: Machine Systems
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393C: Topics in Technology: Manufacturing
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393D: Topics in Technology: Occupational Safety
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393E: Topics in Technology: Chemical Application Systems
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393F: Topics in Technology: Agricultural Safety and Health
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393G: Topics in Technology: Electronic Integration for Agriculture and Production Systems
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393I: Topics in Technology: Irrigation Systems Management
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393J: Topics in Technology: Machinery Management Using Precision Agriculture Technology
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 397: Internship in Technology
Cr. R. Repeatable. F.S.SS.
Prereq: At least 45 credits of coursework, AST or I Tec major, and approval of internship coordinator
A supervised work experience in an approved learning setting with application to technology practices and principles. Reporting during work experience and self and employer evaluation required. Minimum GPA requirement.

TSM 399: Work Experience in Technology
Cr. 2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: TSM 397 in the preceding semester and approval of internship coordinator
Written reports and reflection on work experience. A maximum of 4 credits of TSM 399 maybe be used toward the total credits required for graduation.

TSM 408: Interdisciplinary Problem Solving
(3-0) Cr. 3.
Prereq: Junior or senior classification
Use of the Theory of Constraints as a way of approaching problem solving, win-win negotiation, project planning and effective delegation in the context of engineering/business systems. Team projects aimed at improving design outcomes.

TSM 409: Interdisciplinary Systems Effectiveness
(3-0) Cr. 3.
Prereq: Junior or senior classification
Focus on functions that determine the effectiveness of an entire organization. Generic Theory of Constraints solutions to production, distribution, and project management are compared to traditional solutions. Strategy for improvements discovered using simulations.

TSM 415: Applied Project Management in Technology
(2-0) Cr. 2. F.S.
Prereq: Senior classification with less than 32 credits remaining; TSM 214; and credit or enrollment for credit in TSM 310.
Implementation of project management principles using case studies and teamwork; problem definition in a technology context; development of charter for technology capstone project.

TSM 416: Technology Capstone
(1-4) Cr. 3. F.S.
Prereq: TSM 415 in previous semester
Application of project management tools to a technology capstone project; development and evaluation of potential project solutions using tools from the technology curriculum; problem resolution emphasizing communication, critical analysis, and planning techniques; presentation of project through oral presentation and written reports with input from client, faculty, and other stakeholders.

TSM 433: Precision Agriculture
(Dual-listed with TSM 533). (2-2) Cr. 3. F.
Prereq: MATH 140 or higher
Geographic information systems (GIS) and global positioning systems (GPS). Hardware systems for precision farming emphasized. Autosteering and automatic implement control systems. Collection and management of yield data. Sampling strategies for precision farming. Introduction to building fertilizer prescriptions and recommendations. Economic benefits of precision farming systems.

TSM 440: Cellular Lean Manufacturing Systems
(2-2) Cr. 3. F.
Prereq: TSM 310
Introduction to lean tools and techniques that reduce costs and improve business performance: JIT, VSM, SMED, Kaizen, Standard Work, Cycle Time Reduction, Takt Time, A3, etc. Emphasis on lean thinking and competency development through application: simulations, case studies, industry guests and mentors, teamwork and industry-related lean projects.

TSM 443: Statics and Strength of Materials for Technology
(2-2) Cr. 3. S.
Prereq: PHYS 111; and MATH 145 or MATH 151
Application of standard analytic and computer based techniques of solving problems related to force and moments. The properties of materials and how to select appropriate materials for a particular design is reviewed.

TSM 444: Facility Planning
(3-0) Cr. 3. F.
Prereq: TSM 216; TSM 240; and STAT 101 or STAT 104
Fundamental principles and practices in designing, evaluating, and organizing new or existing facilities. Emphasis on CAD-based facility design, production flow analysis, activity relationship analysis, materials handling, office layout, supporting services design, and facility cost analysis.

TSM 465: Automation Systems
(2-2) Cr. 3. S.
Prereq: TSM 363
Theory and applications of automation systems. Emphasizes features, capabilities, design and programming skills of Programmable Logic Controller (PLC) based industrial control systems. Introduction to industrial robots and sensors.

TSM 470: Industrial Hygiene: Physical, Chemical, and Biological Hazards
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 151 or higher
A qualitative and quantitative introduction to health effects of chemical, biological, and physical hazards in a workplace.

TSM 471: Safety Laboratory
(0-2) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: Credit or enrollment for credit in TSM 470
Introduction to equipment, methods, and strategies to measure, evaluate, control, and research hazards and risk in the workplaces.

TSM 477: Risk Analysis and Management
(Dual-listed with TSM 577). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 151; and STAT 101 or STAT 104
Risk analysis and management focuses on developing a risk oriented pattern of thinking that is appropriate for today's complex world. The tools that will be gained in this course will be helpful in recognizing, understanding, and analyzing hazards and risks in modern complex systems.

TSM 490: Independent Study
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490H: Independent Study: Honors
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490I: Independent Study: Manufacturing
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490J: Independent Study: Agriculture and Biosystems Management
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490M: Independent Study: Machine Systems
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490O: Independent Study: Occupational Safety
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 493: Workshop in Technology
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 493A: Workshop in Technology: Agriculture and Biosystems Management
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 493B: Workshop in Technology: Machine Systems
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 493C: Workshop in Technology: Manufacturing
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 493D: Workshop in Technology: Occupational Safety
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 495: Agricultural and Biosystems Engineering Department Study Abroad Preparation or Follow-up
(Cross-listed with A B E). Cr. 1-2. Repeatable. F.S.SS.
Prereq: Permission of instructor
Preparation for, or follow-up of, study abroad experience (496). For preparation, course focuses on understanding the tour destination through readings, discussions, and research on topics such as the regional industries, climate, crops, culture, economics, food, geography, government, history, natural resources, and public policies. For follow-up, course focuses on presentations by students, report writing, and reflection. Students enrolled in this course intend to register for 496 the following term or have had taken 496 the previous term.
Meets International Perspectives Requirement.

TSM 496: Agricultural and Biosystems Engineering Department Study Abroad
(Cross-listed with A B E). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
Tour and study at international sites relevant to disciplines of industrial technology, biological systems engineering, agricultural systems technology, and agricultural engineering. Location and duration of tours will vary. Trip expenses paid by students. Pre-trip preparation and/or post-trip reflection and reports arranged through 495.
Meets International Perspectives Requirement.

Courses primarily for graduate students, open to qualified undergraduates:

TSM 533: Precision Agriculture
(Dual-listed with TSM 433). (2-2) Cr. 3. F.
Prereq: MATH 140 or higher
Geographic information systems (GIS) and global positioning systems (GPS). Hardware systems for precision farming emphasized. Autosteering and automatic implement control systems. Collection and management of yield data. Sampling strategies for precision farming. Introduction to building fertilizer prescriptions and recommendations. Economic benefits of precision farming systems.

TSM 540: Advanced Design and Manufacturing
(3-0) Cr. 3. S.
Prereq: Permission of instructor
Application of six sigma philosophy to advance product design and process control. Application of value steam mapping to the existing manufacturing system to develop future continuous improvement plans. Application of Taguchi Parameter design methodologies for optimizing the performance of manufacturing processes. Application of Taguchi Tolerance Design methodologies for product design.

TSM 575: Safety and Public Health Issues in Modern Society
(2-0) Cr. 2. Repeatable, maximum of 2 times.
Exploration and analysis of current safety and public health issues impacting society. The focus will be on topics that impact individuals in work, public, and home environments.

TSM 577: Risk Analysis and Management
(Dual-listed with TSM 477). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 151; and STAT 101 or STAT 104
Risk analysis and management focuses on developing a risk oriented pattern of thinking that is appropriate for today's complex world. The tools that will be gained in this course will be helpful in recognizing, understanding, and analyzing hazards and risks in modern complex systems.

TSM 590: Special Topics in Technology
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 590A: Special Topics in Technology: Agriculture and Biosystems Management
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 590B: Special Topics in Technology: Machine Systems
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 590C: Special Topics in Technology: Manufacturing
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 590D: Special Topics in Technology: Occupational Safety
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 593: Workshop in Technology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

TSM 598: Technical Communications for a Master's Degree
(Cross-listed with A B E). Cr. 1. F.S.SS.
A technical paper draft based on the M.S. thesis or creative component is required of all master's students. This paper must be in a form that satisfies the requirements of some specific journal and be ready for submission. A technical presentation based on M.S. thesis or creative component is required of all master's students. This presentation must be in a form that satisfies the normal presentation requirements of a professional society. The presentation itself (oral or poster) may be made at a professional society meeting or at any international, regional, state, or university conference/event as long as the presentation content and form conforms to normal expectations. Offered on a satisfactory-fail basis only.

TSM 599: Creative Component
Cr. 1-3. Repeatable, maximum of 6 credits.
A discipline-related problem to be identified and completed under the direction of the program adviser. Three credits required for all nonthesis master's degree students.

Courses for graduate students:

TSM 601: Graduate Seminar
(Cross-listed with A B E). (1-0) Cr. 1. F.
Keys to starting a good MS thesis or PhD dissertation project. Learning how to begin formulating research questions. Review of literature, research hypotheses, objectives, methods, making figures and tables, and discussing results. Discussion of appropriate outlets including peer-reviewed journals, patents and intellectual property rights, responsible conduct, plagiarism, authorship, and reproducible research. Using peer review, conducting a peer review, and responding to feedback. Other topics may include on-campus library resources, data management, and time management.

TSM 652: Program and Learner Evaluation
(3-0) Cr. 3.
Prereq: STAT 401 or equivalent
Techniques for evaluating learners, facilities, programs, and staff utilizing theories for developing measurement instruments. Outcomes assessment is emphasized.

TSM 655: Academic Leadership in Technology and Engineering
(3-0) Cr. 3.
Prereq: Permission of instructor
A definition of the faculty role in technology and engineering disciplines, including strategies for dealing with programs, personnel, and constituencies are presented. Leadership skills involving team formation, team operation, and conflict resolution are addressed.

TSM 657: Curriculum Development in Technology and Engineering
(3-0) Cr. 3.
Prereq: Permission of instructor
Basic concepts, trends, practices, and factors influencing curriculum development, techniques, organization and procedures. Emphasis will be given to course development using the backward design process.

TSM 694: Teaching Practicum
(Cross-listed with A B E). Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and permission of instructor
Graduate student experience in the agricultural and biosystems engineering departmental teaching program.

TSM 697: Internship in Technology
Cr. R.
Prereq: permission of major professor and approval by department chair, graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

TSM 698: Technical Communications for a Doctoral Degree
(Cross-listed with A B E). Cr. 1. F.S.SS.
A technical paper draft based on the dissertation is required of all Ph.D. students. This paper must be in a form that satisfies the requirements of some specific journal and be ready for submission. A technical presentation based on the dissertation is required of all Ph.D. students. This presentation must be in a form that satisfies the normal presentation requirements of a professional society. The presentation itself (oral or poster) may be made at a professional society meeting or at any international, regional, state, or university conference/event as long as the presentation content and form conforms to normal expectations. Offered on a satisfactory-fail basis only.

TSM 699: Research
Cr. arr.

Agronomy

Undergraduate Study

The Department of Agronomy offers a major leading to a degree of Bachelor of Science (B.S.) in agronomy. The curriculum is designed to provide a strong foundation in crop science, soil science, agricultural meteorology, and plant breeding.

Graduates have the theoretical and practical knowledge needed for efficient and sustainable production of food, feed, fuel, and fiber. Graduates are skilled in critical thinking, problem solving, and communicating and working effectively with others. They understand the ethical, cultural, and environmental dimensions of issues facing professionals in agriculture and natural resources. There are many opportunities for undergraduate students to be involved in research and international agriculture.

An agronomy major prepares students for employment in agricultural business and industry, agricultural service organizations, crop production and soil management, environmental and natural resource management, and farm management. Graduates pursue careers in the seed, fertilizer, and agricultural chemical industries as field agronomists, crop and soil management specialists, research technicians, sales and marketing specialists, and production managers. State and federal agencies employ agronomists as extension specialists, county extension directors, environmental and natural resource specialists, research associates, soil surveyors, soil conservationists, regulatory agencies as plant, food,

and grain inspectors, science-based professional positions, graduate study, or research careers. Additional areas of work open to agronomists include integrated pest management, land appraisal, agricultural finance, turfgrass management, and the home lawn care industry.

The department offers an international scholar program leading to a credentialed title of "Agronomy International Scholar" for agronomy majors who have distinguished themselves in global understanding and international experience. Contact the department for requirements.

Department of Agronomy website - http://www.agron.iastate.edu/.

Curriculum in Agronomy

Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA. A minimum of 15 credits of agronomy courses must be earned at Iowa State and not transferred from other institutions.

International Perspective: 3 cr.

3 cr. from approved International Perspective list: http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current

U.S. Diversity: 3 cr.

3 cr. from approved U.S. Diversity list: http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses

Communication/Library: 13 cr.

6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
SP CM 212	Fundamentals of Public Speaking	3
or AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
LIB 160	Information Literacy	1
One of the following:		3
ENGL 302	Business Communication	3
ENGL 309	Proposal and Report Writing	3
ENGL 314	Technical Communication	3

Humanities: 3 cr.

3 cr. from approved humanities list: http://www.cals.iastate.edu/student-services/humanities

Social Sciences: 3 cr.

3 cr. from approved social sciences list: http://www.cals.iastate.edu/student-services/social-sciences

Ethics: 3 cr.

3 cr. from approved ethics list: http://www.cals.iastate.edu/student-services/ethics

Mathematical Sciences: 6 cr.

MATH 140	College Algebra	3
STAT 104	Introduction to Statistics	3

Physical Sciences: 8 cr.

CHEM 163	College Chemistry	5
& 163L	and Laboratory in College Chemistry	
or CHEM 177	General Chemistry I	
& 177L	and Laboratory in General Chemistry I	
One of the following:		
AGRON 259	Organic Compounds in Plants and Soils	3
BBMB 221	Structure and Reactions in Biochemical Processes	3
CHEM 231	Elementary Organic Chemistry	4
& 231L	and Laboratory in Elementary Organic Chemistry	

Life and Biological Sciences: 7 cr.

BIOL 212	Principles of Biology II	4
& 212L	and Principles of Biology Laboratory II	
AGRON 320	Genetics, Agriculture and Biotechnology	3
or BIOL 313	Principles of Genetics	

Supporting Sciences (all 300-400 level): 15 cr.

This requirement can be met in one of three ways:

a. Complete at least 3 credits in basic or mathematics-intensive discipline (ACCT, BBMB, BIOL, CHEM, COM S, ECON, All Engineering, GEOL, GEN, MATH, MTEOR, PHYS, STAT) as well as at least 6 additional credits in BIOL, BBMB, ENSCI, ENT, GEOL, HORT, GEN, MICRO, NREM, PL P, TSM. The other 6 credits can be a combination of the above department's courses and/or AGRON.

b. Complete the courses needed to fulfill a second major or a minor that complements the student's academic and professional goals.

c. Petition the Agronomy Curriculum Committee with a specific set of coures designed around "keeper of the land", "builder of genetic diversity", "explorer of plant life", "developer of bio-energy", "confronter of world hunger", "designer of sustainable systems".

Agronomy Core: 47 cr.

AGRON 105	Leadership Experience	R
AGRON 110	Professional Development in Agronomy: Orientation	1
AGRON 180	Global Agriculture in a Changing World	3
AGRON 181	Introduction to Crop Science	3
AGRON 182	Introduction to Soil Science	3
AGRON 183	Basic Skills for Agronomists	1

AGRON 206	Introduction to Weather and Climate	3
AGRON 210	Professional Development in Agronomy: Career Planning	1
AGRON 279	Field Exploration of Agronomy	3
AGRON 280	Crop Development, Production and Management	3
AGRON 281	Crop Physiology	3
AGRON 282	Soil Conservation and Land Use	3
AGRON 310	Professional Development in Agronomy: Work Experience	R
or AGRON 311	Professional Internship in Agronomy	
AGRON 316	Crop Structure-Function Relationships	3
AGRON 342	World Food Issues: Past and Present	3
or AGRON 450	Issues in Sustainable Agriculture	
AGRON 354 & 354L	Soils and Plant Growth and Soils and Plant Growth Laboratory	4
AGRON 360	Environmental Soil Science	3
or AGRON 392	Systems Analysis in Crop and Soil Management	
AGRON 410	Professional Development in Agronomy: Senior Forum	1
Additional AGRON credits at the 300-400 level		6

Electives: 17 cr.

Additional free electives	17

Minor - Agronomy

The department offers a minor in Agronomy that may be earned by taking 18 credits, 9 credits of which must be from these agronomy courses: AGRON 180, AGRON 181, AGRON 182, AGRON 280, AGRON 281, or AGRON 282. An additional 9 credits must be taken from approved agronomy courses, with a minimum of 6 of the credits from courses at the 300 level or higher. At least 9 credits must be taken at Iowa State University with 6 credits numbered 300 or above. At least 9 credits must be unique to the requirements for the minor and not used to fulfill specified requirements from the student's major.

Foundational Courses (9 required credits):

AGRON 180	Global Agriculture in a Changing World	3
AGRON 181	Introduction to Crop Science	3
AGRON 182	Introduction to Soil Science	3
AGRON 280	Crop Development, Production and Management	3
AGRON 281	Crop Physiology	3
AGRON 282	Soil Conservation and Land Use	3
Approved Elective Courses for Minor Credit (9 credits minimum, 6 credits at 300+ level)		
CROP SCIENCE		
AGRON 217	Weed Identification	1
AGRON 316	Crop Structure-Function Relationships	3
AGRON 317	Principles of Weed Science	3
AGRON 320	Genetics, Agriculture and Biotechnology	3
AGRON 330	Crop and Seed Identification Laboratory	2
AGRON 334	Forage Crop Management	3
AGRON 338	Seed Science and Technology	3
AGRON 351	Turfgrass Establishment and Management	3
AGRON 421	Introduction to Plant Breeding	3
SOIL SCIENCE		
AGRON 259	Organic Compounds in Plants and Soils	3
AGRON 354	Soils and Plant Growth	3
AGRON 354L	Soils and Plant Growth Laboratory	1
AGRON 360	Environmental Soil Science	3
AGRON 452	GIS for Geoscientists	3
AGRON 459	Environmental Soil and Water Chemistry	4
AGRON 463	Soil Formation and Landscape Relationships	3
AGRON 477	Soil Physics	3
AGRON 485	Soil and Environmental Microbiology	3
ENSCI 402	Watershed Hydrology	3
AGRICULTURAL METEOROLOGY		
AGRON 206	Introduction to Weather and Climate	3
AGRON 404	Global Change	3
AGRON 405	Environmental Biophysics	3
AGRON 406	World Climates	3
AGRON 407	Mesoscale Meteorology	3
GENERAL AGRONOMY COURSES		
AGRON 342	World Food Issues: Past and Present	3
AGRON 392	Systems Analysis in Crop and Soil Management	3
AGRON 450	Issues in Sustainable Agriculture	3
AGRON 446	International Issues and Challenges in Sustainable Development	3
AGRON 497	Agroecology Field Course	3
Students minoring in agronomy can take the following courses: AGRON 331, AGRON 370, AGRON 490, and AGRON 496; but only one (1) credit from these courses can be used in the minor program		

Agronomy, B.S.

Freshman

Fall	Credits	Spring	Credits
AGRON 110	1	AGRON 181	3
AGRON 180	3	AGRON 182	3
AGRON 183	1	BIOL 212	3

CHEM 163 & Lab or CHEM 177 & Lab	5	BIOL 212L	1
ENGL 150	3	ENGL 250	3
LIB 160	1	Math or Social Sciences	3
Math or Social Sciences	3		
	17		16

Sophomore

Fall	Credits	Spring	Credits
AGRON 206	3	AGRON 281	3
AGRON 210	1	AGRON 282	3
AGRON 279	3	AGEDS 311 or SP CM 212	3
AGRON 280	3	Organic Chemistry: AGRON 259, BBMB 221, OR CHEM 231 & L	3-4
STAT 104	3	Elective	3
Humanities	3		
	16		15-16

Junior

Fall	Credits	Spring	Credits
AGRON 354	3	AGRON 316	3
AGRON 354L	1	AGRON 320 or BIOL 313	3-4
AGRON 342 or AGRON 450	3	ENGL 302, 309, or 314	3
Elective	3	International Perspectives	3
Supporting Sciences	6	Supporting Sciences	3
	16		15-16

Senior

Fall	Credits	Spring	Credits
Agronomy Electives	6	AGRON 360 OR AGRON 392	3
Elective	6	AGRON 410	1
Ethics	3	Elective	5
U.S. Diversity	3	Supporting Sciences	6
	18		15

Graduate Study

Introduction

Agronomy is the science and technology of producing plants that serve humans, using practices essential for maintaining and improving life. The Department of Agronomy at the Iowa State University of Science and Technology (ISU) administers Master of Science (MS) and Doctor of Philosophy (PhD) degree programs in four different graduate majors that emphasize different disciplines of agronomy. These majors are: Agricultural Meteorology; Crop Production and Physiology; Plant Breeding; and Soil Science. A fifth graduate major, Agronomy, offers both an MS and a Graduate Certificate through distance education suitable for professionals working in industry or government, as well as a graduate minor for on–campus students.

Admission

To be fully admitted, prospective graduate students must have an undergraduate GPA of at least a 3.00 GPA (4.00 scale) or rank in the upper one–half of their undergraduate class. Provisional and restricted admission demand that students fulfill certain requirements. Non–native English speakers must take the Test of English as a Foreign Language (TOEFL). Students applying to the Agricultural Meteorology and Plant Breeding graduate majors must take the Graduate Record Examination (GRE). For all of the majors except Agronomy, a faculty member of the graduate major must agree to be the major professor before the student is admitted.

Program of Study

The academic courses used to satisfy requirements for a graduate degree compose a student's Program of Study (POS). The POS must be approved by the student's POS Committee. For the MS in Agronomy, the POS Committee must be composed of at least two faculty who are both members of the Graduate Major in Agronomy. For the other four majors at the MS degree level, at least three faculty must serve on a POS Committee. Two of the three must be members of the major, and at least one must be a member of a different graduate major. At the PhD level the POS Committee must have at least five members, of which at least three must be faculty in the major, and at least one a member of a different graduate major. If the student is pursuing a graduate minor, either as part of an MS or PhD, a graduate faculty member representing the minor must serve on the POS Committee.

Agronomy

The POS for the MS in Agronomy is fixed and consists of the following:

AGRON 501	Crop Growth and Development	3
AGRON 502	Chemistry, Physics, and Biology of Soils	3
AGRON 503	Climate and Crop Growth	3
AGRON 511	Crop Improvement	3
AGRON 512	Soil-Plant Environment	3
AGRON 513	Quantitative Methods for Agronomy	3
AGRON 514	Integrated Pest Management	3
AGRON 531	Crop Ecology and Management	3
AGRON 532	Soil Management	3
AGRON 533	Crop Protection	3
AGRON 591	Agronomic Systems Analysis	3
AGRON 592	Current Issues in Agronomy	3
AGRON 594	Agronomy MS Practicum	1

AGRON 599M	Agronomy	arr †

† Arranged with instructor.

All Other Degrees

The courses in each student's POS will vary depending on the major and the student's interests. Every on–campus student must include AGRON 601 in their POS. Note that only a maximum of three 400–level courses or up to one 300–level and two 400–level courses may be included on the POS. If a 300–level course is listed on the POS it cannot be an AGRON course.

Agricultural Meteorology

Students with a major in Agricultural Meteorology must include AGRON 698 in their POS. Students are encouraged to include the following courses: AGRON 505; AGRON 577; MTEOR 605; a modeling course such as AGRON 508, AGRON 518, AGRON 525, AGRON 677, GEOL 516, or MTEOR 552; and a course in statistics.

Crop Production and Physiology

The Graduate Major in Crop Production and Physiology has defined five Core Areas.

Core Area 1 (molecular biology / biochemistry): BBMB 404, BBMB 405, BBMB 542A–G, BBMB 607, and PLBIO 545.

Core Area 2 (growth and development): AGRON525, AGRON551, BIOL 454, BIOL 428, and GDCB 528.

Core Area 3 (plant physiology and metabolism): AGRON508, AGRON516, AGRON519, AGRON 525, AGRON 538, AGRON 553, AGRON 556, BBMB 645, and PLBIO 513.

Core Area 4 (crop ecology and management): AGRON 509, AGRON 515, AGRON 530, AGRON 553, AGRON 556, BIOL 472, BIOL 474, EEOB 570, EEOB 582, EEOB 584, EEOB 589, HORT 524, PL P 577, and PL P 594.

Core Area 5 (statistics / quantitative methods): AGRON 526, STAT 401, STAT 402, STAT 407, STAT 505, STAT 512, CRP 551, and NREM 546.

To major in Crop Production and Physiology, at least one course from three of the Core Areas must be included in the POS for the MS. For the PhD, at least one course from each of the Core Areas must be included. A single course cannot be used for more than one Core Area. Students are also encouraged to consider AGRON 698.

Plant Breeding

The Graduate Major in Plant Breeding has both a resident and distance–education MS program. The following courses are recommended for students with a major in Plant Breeding: AGRON 521, AGRON 522, AGRON 523, AGRON 524, AGRON 528, AGRON 561, AGRON 600A, AGRON 698, GEN 510, STAT 401, and STAT 402. For the distance program, the following courses are recommended: AGRON 501, AGRON 506, AGRON 513, AGRON 520, AGRON 521, AGRON 523, AGRON 524, AGRON 528, AGRON 544, and AGRON 599. Resident students pursuing the PhD also often include AGRON 621 and AGRON 625 in their POS.

Soil Science

Students pursuing a major in Soil Science may specialize in one of six areas: soil chemistry; soil fertility; soil management; soil microbiology and biochemistry; soil morphology and genesis; or soil physics. If a specialization is chosen, the major professor must be in the designated specialty area. For the PhD, the POS must include one credit of AGRON 600B. Students are also encouraged to consider including AGRON 698 in their POS.

Master of Science

The general requirements for an MS degree include:

- a minimum of 30 credits from academic courses and research activities;
- at least 22 credits earned at ISU;
- two–thirds or more of earned credits related to the major; and
- completion of a final oral examination.

Both non–thesis and thesis options for an MS degree in Agricultural Meteorology, Crop Production and Physiology, Plant Breeding, and Soil Science are available. Students in the Agronomy major must choose the non–thesis option.

Students in Agricultural Meteorology working towards the MS must meet with their POS Committee at least twice. Besides the final oral examination, an additional meeting must be held near the beginning of the graduate program. At this meeting the student will introduce the area of research to be pursued, potential research questions and methods, and a proposed POS. The student must also present a short written report on how the proposed research will help them master established Enduring Understandings in Agricultural Meteorology.

Creative Component

If the non–thesis MS degree is chosen, then the student must:

1. register for at least two credits of AGRON 599 that will be used to complete a "creative component;" and
2. pass a comprehensive final oral examination.

The creative component is work that presents "substantial evidence of individual accomplishment." The POS Committee and the student will specify the creative component, how it will be documented, and how it will be evaluated. The POS Committee also has flexibility in determining the format of the final oral examination. For Agricultural Meteorology, the final oral exam must include an evaluation of the student's mastery of the Enduring Understandings in Agricultural Meteorology.

Thesis

In the thesis option the student must:

1. pursue a research project culminating in a written thesis; and
2. pass a comprehensive final oral examination.

A minimum of three research credits of AGRON 699 must be listed on the POS to account for work on an MS thesis. The thesis is submitted to the POS Committee prior to the final oral examination. During the final oral examination, the student will present and defend the thesis in the presence of the POS Committee. Students in Agricultural Meteorology must also demonstrate mastery of the Enduring Understandings in Agricultural Meteorology. The presentation (also called the "exit seminar") is open to the general public. Only POS Committee members may attend the examination that follows the presentation.

Doctor of Philosophy

The general requirements for a PhD degree include:

- a minimum of 72 credits from academic courses and research activities;
- at least 36 of these credits earned at ISU;
- completion of a preliminary oral examination;
- a written PhD dissertation; and
- completion of a comprehensive final oral examination.

Note that the 72 credits can include the credits earned in pursuit of an MS degree. If an MS was earned at another institution, those courses earned at the other institution can be listed along with the ISU courses, but only if the POS Committee determines that the courses are appropriate. Students in Agricultural Meteorology working towards the PhD must meet with their POS Committee at least three times. Besides the final oral examination and another for the preliminary exam, an additional meeting must be held near the beginning of the graduate program. At this meeting the student will introduce the area of research to be pursued, potential research questions and methods, and a proposed POS. If a student will pursue a PhD without first completing an MS, then during the first meeting of the POS Committee the student must also present a short written report that illustrates connections between the Enduring Understandings in Agricultural Meteorology and their planned research.

Qualification Exam

Agricultural Meteorology

Students in Agricultural Meteorology must take and pass a qualification exam once they have decided to pursue a PhD. The qualification exam must be passed before taking the preliminary exam. The format of the qualification exam is as follows. The student will produce a written report that demonstrates their knowledge of the Enduring Understandings in Agricultural Meteorology. If the student has come from another university the report must present research completed at ISU and not at the previous institution (such as a thesis). This report will be submitted to all of the faculty in the major. The student will then make an oral presentation to faculty and other students in the major that summarizes and defends the written report. After the oral presentation, the faculty will meet to determine whether or not the student passed the exam, and whether the student can re–take the exam if the student failed. The faculty will provide written feedback to the student, suggesting areas where improvement is needed and a course of action. The qualification exam can be taken only two times during a student's graduate career at ISU. If a student who had entered the PhD program without an MS degree takes the qualification exam and fails the exam, the student can: take the qualification exam again, if so allowed by the faculty; or continue their graduate career in pursuit of an MS degree. In the latter case, the student could take the qualification exam one more time after an MS degree has been completed.

All Other Majors

A qualification exam is not required for students in the Crop Production and Physiology, Plant Breeding, or Soil Science majors.

Preliminary Exam

All students pursuing a PhD must take and pass a preliminary oral examination.

Agricultural Meteorology

For students in Agricultural Meteorology the preliminary exam consists of a defense of the student's proposed dissertation research to the POS Committee. Besides an oral defense, the student must also submit a written report on their proposed research. If the student fails the preliminary exam, the POS Committee must also decide if the student can re–take the exam. The preliminary exam can only be taken twice.

Crop Production and Physiology

Students in Crop Production and Physiology may be asked to take a written preliminary examination. If a student fails the written preliminary examination, the POS Committee may require the student to retake the exam, to answer additional written questions, or proceed with the oral examination. The nature of the preliminary oral exam is determined by the student's POS Committee.

Plant Breeding

Students in Plant Breeding must pass a uniform written preliminary examination that consists of five questions, each from one of five topical areas. Faculty members in Plant Breeding evaluate each answer. Evaluators assign a pass or fail grade to the answer. If an evaluator assigns a failing grade to a question, the evaluator shall clearly indicate the strengths and weaknesses of the answer and provide written information (e.g., references, rationale) to the student which clearly outlines an acceptable response to the question. Failure to provide such written information may invalidate that grade and be considered sufficient cause to exclude the grade in the overall evaluation of the student's answer. Students who receive two pass grades for a question will have successfully completed that topic, and students

must pass each topic to pass the exam. If two valid grades are not in agreement (e.g., one passing grade and one failing grade), additional faculty members will evaluate the answer until there are two valid assessments that are in agreement. Students who do not pass a topic have the opportunity to repeat that topic on the next regularly scheduled exam date. The number of attempts for each topic has not been specified. The examination is offered the last Thursday and Friday of each January and September when one or more students have signed up to take the exam. Students may choose to attempt questions for all five topics, or for subsets of the topics. If a student decides to attempt questions for only certain topics, the student must specify which topics in writing at least one month prior to the scheduled exam date. The nature of the preliminary oral exam is determined by the student's POS Committee.

Soil Science

Students in Soil Science must pass a written preliminary examination. Exam questions are authored by members of the POS Committee. The format of each question is left open and they may be formulated as open– or closed–book problems. A reasonable period for completion may be set by the author of the question. The student's responses are formally scored or ranked only by the POS Committee member who authored the question. A copy of the student's responses to all questions is submitted to all POS Committee members at least one week before the student's preliminary oral examination. When the student submits a request to schedule the preliminary oral examination, the student's major professor certifies by signing the form that the student has satisfactorily completed a written preliminary exam. The nature of the preliminary oral exam is determined by the student's POS Committee.

Doctoral Dissertation and Final Oral Examination

All students must include at least three AGRON 699 credits in their POS for work on their PhD dissertation. During the required final oral examination, a student presents and defends the dissertation. This presentation (also called the "exit seminar") is open to the general public. Only POS Committee members may attend the examination that follows the presentation.

Graduate Certificate in Agronomy for distance students

The Graduate Certificate in Agronomy is for distance students and is comprised of the first six courses in the Master of Science in Agronomy Distance Curriculum. All six courses are required for certificate completion.

AGRON 501	Crop Growth and Development	3
AGRON 502	Chemistry, Physics, and Biology of Soils	3
AGRON 503	Climate and Crop Growth	3
AGRON 511	Crop Improvement	3
AGRON 512	Soil-Plant Environment	3
AGRON 514	Integrated Pest Management	3

Total Certificate Credits 18

Graduate Minor

Students who wish to minor in Agronomy must include a core course from each of the other four graduate majors in their POS. These courses are:

AGRON 505	Environmental Biophysics	3
AGRON 516	Crop Physiology	3
AGRON 521	Principles of Cultivar Development	3
AGRON 553	Soil-Plant Relationships	3

However, one substitution is allowed with the approval of the faculty member serving as the minor representative on the POS Committee.

Courses primarily for undergraduates:

AGRON 105: Leadership Experience

Cr. R. F.S.SS.

A participatory experience in activities or completion of a course that enhances the development of leadership and group-dynamic skills. See adviser for departmental requirements.

AGRON 110: Professional Development in Agronomy: Orientation

Cr. 1. F.

Orientation to college life, the profession of agronomy, and the agronomy curriculum.

AGRON 120: Introduction to Renewable Resources

(Cross-listed with ENV S, NREM). (3-0) Cr. 3. F.S.

Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management.

AGRON 160: Water Resources of the World

(Cross-listed with ENV S, GEOL, MTEOR). (3-0) Cr. 3. S.

Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement.

AGRON 180: Global Agriculture in a Changing World
(3-0) Cr. 3. F.
The global distribution of climate and soils and the physical processes that connect natural resources to agriculture and the environment. How agricultural production is distributed among food, feed, fiber, and energy. The impact of global change on the increasing demand for agricultural production. Meets International Perspectives requirement.
Meets International Perspectives Requirement.

AGRON 181: Introduction to Crop Science
(3-0) Cr. 3. F.S.
Basic structure and function of plants, origin and classification, growth and development. Fundamentals of photosynthesis, plant water use, plant nutrition and genetics that regulate plant growth, development and responses to the environment.

AGRON 182: Introduction to Soil Science
(3-0) Cr. 3. F.S.
Prereq: Chem 163
Introduction to physical, chemical, and biological properties of soils; soil formation, classification and global distribution; soil health, soils and humanity and sustainable land management.

AGRON 183: Basic Skills for Agronomists
(0-3) Cr. 1. F.
Developing the skills that agronomists employ in their work with crops, soil, and the environment through activities involving tools and methodologies used by agronomists. Enrollment is restricted to first-year students majoring in agronomy.

AGRON 206: Introduction to Weather and Climate
(Cross-listed with MTEOR). (3-0) Cr. 3. F.S.
Basic concepts in weather and climate, including atmospheric measurements, radiation, stability, precipitation, winds, fronts, forecasting, and severe weather. Applied topics include global warming, ozone depletion, world climates and weather safety.

AGRON 210: Professional Development in Agronomy: Career Planning
(1-0) Cr. 1. F.
Prereq: Sophomore classification
Career planning, résumé and cover letter preparation, and interviewing techniques. Career orientation through invited speakers.

AGRON 217: Weed Identification
(1-2) Cr. 1. F.S.
Prereq: BIOL 101 or equivalent
Half-semester course. Identification of important weeds of agricultural, horticultural and native ecosystems. Principles of plant taxonomy and classification. Field trips.

AGRON 259: Organic Compounds in Plants and Soils
(3-0) Cr. 3. S.
Prereq: CHEM 163, BIOL 212, MATH 140; AGRON 182 (or equivalent) or AGRON 282 or equivalent
Structure, function, and transformations of organic compounds significant in plant and soil environments.

AGRON 279: Field Exploration of Agronomy
(2-3) Cr. 3. F.
Prereq: AGRON 181 or equivalent and AGRON 182 or equivalent
Field-based investigation of Iowa's agronomic systems. Application of principles learned in introductory soils, crops and agronomy courses. For students majoring in Agronomy.

AGRON 280: Crop Development, Production and Management
(3-0) Cr. 3. F.S.
Prereq: AGRON 181 or equivalent and AGRON 182 or equivalent
Overview of crops and cropping systems in the context of global and US agriculture. Focus on agronomic principles, constraints and opportunities as they apply to various locations in Iowa, the USA and the world.

AGRON 281: Crop Physiology
(3-0) Cr. 3. S.
Prereq: Agron 181 or equivalent
Science governing plant growth and development in the context of cropping and genetic improvements.

AGRON 282: Soil Conservation and Land Use
(3-0) Cr. 3. F.S.
Prereq: Agron 182 or equivalent
Principles of soil conservation and land use with emphasis on best management practices and use of soil maps and databases such as Web Soil Survey. Only Agron 260 or Agron 282 can be used to meet graduation requirements.

AGRON 283: Pesticide Application Certification
(Cross-listed with ENT, FOR, HORT). (2-0) Cr. 2. S.
Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized.

AGRON 298: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department cooperative education coordinator, sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

AGRON 310: Professional Development in Agronomy: Work Experience
Cr. R. F.S.SS.
Professional work experience in agronomy. See adviser for departmental requirements. Offered on a satisfactory-fail basis only.

AGRON 311: Professional Internship in Agronomy
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor before internship begins
A supervised learning experience in a professional setting related to crop production, plant breeding, soil science or environmental science. For students majoring in Agronomy.

AGRON 316: Crop Structure-Function Relationships
(3-0) Cr. 3. F.S.
Prereq: BIOL 212 recommended
Basic principles concerning the growth, development, and production of crop communities in relation to their environment.

AGRON 317: Principles of Weed Science
(3-0) Cr. 3. F.
Biology and ecology of weeds. Interactions between weeds and crops. Principles and practices of integrated weed management systems. Herbicide mechanisms, classification, and fate in plants and soils.

AGRON 320: Genetics, Agriculture and Biotechnology
(Cross-listed with GEN). (3-0) Cr. 3. F.S.
Prereq: BIOL 212
Transmission genetics with an emphasis on applications in agriculture, the structure and expression of the gene, how genes behave in populations and how recombinant DNA technology can be used to improve agriculture. Credit for graduation will not be allowed for more than one of the following: Gen 260, 313, 320 and Biol 313 and 313L.

AGRON 330: Crop and Seed Identification Laboratory
(0-4) Cr. 2. S.
Prereq: AGRON 181 or equivalent.
Identification, agronomic and binomial classification of crops, weeds, and diseases. Analysis of crop seed samples for contaminants of weed and other crop seeds.

AGRON 331: Intercollegiate Crops Team
(0-6) Cr. 2. Repeatable. F.S.
Prereq: Permission of instructor. AGRON 330 recommended
Intensive training in preparation for intercollegiate competition in national crops contests.

AGRON 334: Forage Crop Management
(3-0) Cr. 3. S.
Prereq: AGRON 181 or equivalent
Production and management of forage crops; concepts applied to yield, quality, and stand persistence; systems of forage utilization including grazing, hay, and silage. Students enrolling for graduate credit will be expected to complete an additional class project.

AGRON 338: Seed Science and Technology
(Cross-listed with HORT). (2-3) Cr. 3. F.
Prereq: AGRON 181 (or equivalent) or HORT 221; BIOL 212
Seed production, maturation, dormancy, vigor, deterioration, and related aspects of enhancement, conditioning, storage, and quality evaluation. Aspects of the seed industry and regulation of seed marketing.

AGRON 342: World Food Issues: Past and Present
(Cross-listed with ENV S, FS HN, T SC). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

AGRON 342H: World Food Issues: Past and Present, Honors
(Cross-listed with ENV S, T SC). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

AGRON 351: Turfgrass Establishment and Management
(Cross-listed with HORT). (3-0) Cr. 3. F.
Prereq: HORT 221 or AGRON 181 (or equivalent) or BIOL 211
Principles and practices of turfgrass propagation, establishment, and management. Specialized practices relative to professional lawn care, golf courses, athletic fields, highway roadsides, and seed and sod production. The biology and control of turfgrass pests.

AGRON 351L: Turfgrass Establishment and Management Laboratory
(Cross-listed with HORT). (0-3) Cr. 1. F.
Prereq: Credit or enrollment in HORT 351
Those enrolled in the horticulture curriculum are required to take 351L in conjunction with 351 except by permission of the instructor.

AGRON 354: Soils and Plant Growth
(Cross-listed with HORT). (3-0) Cr. 3. F.S.
Prereq: AGRON 182 or equivalent and BIOL 101
Effects of chemical, physical, and biological properties of soils on plant growth, with emphasis on nutritive elements, pH, organic matter maintenance, and rooting development.

AGRON 354L: Soils and Plant Growth Laboratory
(Cross-listed with HORT). (0-3) Cr. 1. F.S.
Prereq: Agron or Hort major with credit or enrollment in AGRON 354
Laboratory exercises in soil testing that assess a soil's ability to support nutritive requirements for plant growth.

AGRON 360: Environmental Soil Science
(Cross-listed with ENSCI). (2-2) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or ENSCI 250 or GEOL 201
Application of soil science to contemporary environmental problems; comparison of the impacts that different management strategies have on short- and long-term environmental quality and land development. Emphasis on participatory learning activities.

AGRON 370: Field Experience in Soil Description and Interpretation
(0-3) Cr. 1. Repeatable, maximum of 4 times. F.S.
Prereq: AGRON 182 or equivalent and permission of instructor
Description and interpretation of soils in the field and laboratory, emphasizing hands-on experience. Evaluation of soil information for land use. Students may participate in intercollegiate judging contests.

AGRON 388: Agronomic Sciences in Theory and Practice
(1-0) Cr. 1. F.
Prereq: Junior or senior classification
How science works: Hypotheses, data integrity, classification, interpretations, ethics, and communications.

AGRON 392: Systems Analysis in Crop and Soil Management
(2-3) Cr. 3. F.S.
Prereq: AGRON 316 and AGRON 354
Management strategies at the level of the farm field. Emphasis will be on participatory learning activities.

AGRON 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

AGRON 402I: Watershed Hydrology and Surficial Processes
(Cross-listed with ENSCI, IA LL). Cr. 4. SS.
Prereq: Four courses in physical or biological sciences or engineering
Effects of geomorphology, soils, and land use on transport of water and materials (nutrients, contaminates) in watersheds. Fieldwork will emphasize investigations of the Iowa Great Lakes watershed.

AGRON 404: Global Change
(Dual-listed with AGRON 504). (Cross-listed with ENSCI, ENV S, MTEOR). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

AGRON 405: Environmental Biophysics
(Dual-listed with AGRON 505). (Cross-listed with ENSCI, MTEOR). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)
Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

AGRON 406: World Climates
(Cross-listed with ENSCI, MTEOR). (3-0) Cr. 3. S.
Prereq: AGRON 206/MTEOR 206
Distribution and causes of different climates around the world. Effects of climate and climate variations on human activities including society, economy and agriculture. Current issues such as climate change and international efforts to assess and mitigate the consequences of a changing climate. Semester project and in-class presentation required. Meets International Perspectives Requirement.

AGRON 407: Mesoscale Meteorology
(Dual-listed with AGRON 507). (Cross-listed with MTEOR). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Math 166 and Mteor 443
Arritt, Gallus. Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure.

AGRON 410: Professional Development in Agronomy: Senior Forum
(1-0) Cr. 1. F.S.
Prereq: Senior classification
Development of an appropriate content for professionalism. Topics include professional certification, ethics, and maintaining an active network of information sources and professional contacts in support of lifelong learning. Student interpretation, writings, presentations, and discussions.

AGRON 421: Introduction to Plant Breeding
(Cross-listed with HORT). (3-0) Cr. 3. F.
Prereq: GEN 320 or BIOL 313
Breeding methods used in the genetic improvement of self-pollinated, cross-pollinated and asexually reproducing agronomic and horticultural crops. Applications of biotechnology techniques in the development of improved cultivars.

AGRON 446: International Issues and Challenges in Sustainable Development
(Cross-listed with GLOBE, INTST). Cr. 3. F.S.
Prereq: 3-credit biology course, Sophomore or higher classification, permission of Instructor
Interdisciplinary study and analysis of agricultural systems, sustainable management, and impact on plants and animal biodiversity. International field experience in evaluating different agricultural systems and impact on biodiversity may be required. A program fee is charged to students for international study abroad.
Meets International Perspectives Requirement.

AGRON 450: Issues in Sustainable Agriculture
(Cross-listed with ENV S). (3-0) Cr. 3. F.
Agricultural science as a human activity; contemporary agricultural issues from agroecological perspective. Comparative analysis of intended and actual consequences of development of industrial agricultural practices.

AGRON 452: GIS for Geoscientists
(Dual-listed with AGRON 552). (Cross-listed with ENSCI, GEOL). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

AGRON 459: Environmental Soil and Water Chemistry
(Dual-listed with AGRON 559). (Cross-listed with ENSCI). (3-3) Cr. 4. F.
Prereq: Two semesters of college-level chemistry, MATH 140, AGRON 182 (or equivalent) or AGRON 360; GEOL 100 and AGRON 354 recommended
An introduction to the chemical properties of soils, chemical reactions and transformations in soils and surface waters, and their impact on the environment. Topics include solution chemistry in soils and surface waters, solid-phase composition of soils, reactions at the solid-solution interface, and applications to contemporary environmental issues.

AGRON 463: Soil Formation and Landscape Relationships
(Dual-listed with AGRON 563). (Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. Credit for one of AGRON 463 or AGRON 463I may be applied for graduation.

AGRON 463I: Soil Formation and Landscape Relationships
(Dual-listed with AGRON 563I). (Cross-listed with ENSCI, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

AGRON 463L: Soil Formation and Landscape Relationships Laboratory
(0-3) Cr. 1. S.
Prereq: Credit or enrollment in Agron 463
Laboratory exercise in soil formation with landscape relationships including pedon description with soil mapping.

AGRON 477: Soil Physics
(Dual-listed with AGRON 577). (Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: AGRON 182 or equivalent and MATH 166 recommended
The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

AGRON 484: Organic Agricultural Theory and Practice
(Dual-listed with AGRON 584). (Cross-listed with HORT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 9 cr. in biological or physical sciences
Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives.

AGRON 485: Soil and Environmental Microbiology
(Dual-listed with AGRON 585). (Cross-listed with ENSCI, MICRO). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

AGRON 488: GIS for Geoscientists II
(Dual-listed with AGRON 588). (Cross-listed with ENSCI, GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

AGRON 490: Independent Study
Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation
Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 490E: Independent Study: Entrepreneurship
Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation
Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 490G: Independent Study: General
Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation
Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 490H: Independent Study: Honors
Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation
Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 490Z: Independent Study: Service Learning
Cr. 1-3. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Junior or senior classification with at least 8 credits in agronomy; permission of instructor in specialty area after consultation
Selected studies in crops, soils, or agricultural meteorology according to the needs and interests of the student.

AGRON 491: Seed Science Internship Experience
(Cross-listed with HORT). Cr. 1-2. Repeatable, maximum of 1 times. F.S.SS.
Prereq: Agron 338, advanced approval and participation of employer and instructor
A professional work experience and creative project for seed science secondary majors. The project requires the prior approval and participation of the employer and instructor. The student must submit a written report.

AGRON 493: Workshop in Agronomy
Cr. arr. Repeatable, maximum of 4 times.
Prereq: Permission of instructor
Workshop experience in crops, soils, or agricultural meteorology.

AGRON 496: Agricultural Travel Course
Cr. arr. Repeatable.
Prereq: Permission of instructor
Limited enrollment. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on crop and livestock production. Location and duration of tours will vary. Tour expenses paid by students. Check with department for current offerings.

AGRON 496A: International Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Limited enrollment. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on crop and livestock production. Location and duration of tours will vary. Tour expenses paid by students. Check with department for current offerings. Meets International Perspectives Requirement.

AGRON 496B: Domestic Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Limited enrollment. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on crop and livestock production. Location and duration of tours will vary. Tour expenses paid by students. Check with department for current offerings.

AGRON 497: Agroecology Field Course
(3-0) Cr. 3. F.
Prereq: Jr. or Sr. classification with at least 8 credits in Agronomy
A one-week intensive class, offered off-campus. Student will visit farms within the Midwest and analyze the sustainability of each farm.

AGRON 498: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

AGRON 500: Orientation Seminar
(2-0) Cr. 1. F.
Prereq: International agronomy graduate students only
An introduction to Iowa and U.S. agriculture for international scholars in agronomic majors. Field trips when possible. Departmental role in the functioning of research, teaching, and extension in fulfilling the charge given the land-grant university.

AGRON 501: Crop Growth and Development
(3-0) Cr. 3. F.S.
Prereq: AGRON 181 or equivalent, MATH 140, CHEM 163, BIOL 101
Physiological processes in crop growth, development and yield: photosynthesis, respiration, water relations, mineral nutrition, assimilate partitioning, seedling vigor, light interception and canopy growth, root growth, reproduction and yield. Required course for the Master of Science in Agronomy degree program and Agronomy Graduate Certificate program.

AGRON 502: Chemistry, Physics, and Biology of Soils
(3-0) Cr. 3. F.
Prereq: AGRON 181 or equivalent, AGRON 182 or equivalent, BIOL 101, CHEM 163, MATH 140
Soil chemical, physical, and biological properties that control processes within the soil, their influence on plant/soil interactions, and soil classification. Basic concepts in soil science and their applications. Required course for the Master of Science in Agronomy degree program and Agronomy Graduate Certificate program.

AGRON 503: Climate and Crop Growth
(3-0) Cr. 3. F.S.SS.
Prereq: AGRON 181 or equivalent and MATH 140
Applied concepts in climate and agricultural meteorology with emphasis on the climate-agriculture relationship and the microclimate-agriculture interaction and crop risk management. Basic meteorological principles are also presented to support these applied concepts. Required course for the Master of Science in Agronomy degree program and Agronomy Graduate Certificate program.

AGRON 504: Global Change
(Dual-listed with AGRON 404). (Cross-listed with ENSCI, MTEOR). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

AGRON 505: Environmental Biophysics
(Dual-listed with AGRON 405). (Cross-listed with ENSCI, MTEOR). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)
Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

AGRON 506: Crop Genetics
(Cross-listed with HORT). Cr. 3. F.
Introduction to genetics of reproductive systems, recombination, segregation and linkage analysis, inbreeding, quantitative inheritance, fertility regulation, and polyploidy to prepare students for subsequent courses in crop improvement. Enrollment is restricted to off-campus MS in Plant Breeding students.

AGRON 507: Mesoscale Meteorology
(Dual-listed with AGRON 407). (Cross-listed with MTEOR). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Math 166 and Mteor 454
The physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Semester project and in-class presentation required.

AGRON 508: Biophysical Crop Ecology
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: AGRON 505
Physical modeling of bio-response and crop adaptation to climate. Principles of resource capture (light and water) applied to growth and development. Ecological implications of radiation, temperature, moisture, and the biological properties of size, shape, resistance to water vapor loss, and absorptivity to solar and thermal radiation. Physiological stress in the soil, plant, atmosphere continuum.

AGRON 509: Agroecosystems Analysis
(Cross-listed with SOC, SUSAG). (3-4) Cr. 4. F.
Prereq: Senior or above classification
Experiential, interdisciplinary examination of Midwestern agricultural and food systems, emphasizing field visits, with some classroom activities. Focus on understanding multiple elements, perspectives (agronomic, economic, ecological, social, etc), and scales of operation.

AGRON 510: Crop Improvement
(Cross-listed with STB). (3-0) Cr. 3. F.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
A study of the basic principles and methods in the genetic improvement of crop plants. Methods used in manipulating genomes through the use of biotechnology. Methods of cultivar development. Quantitative procedures for describing response to selection. Analysis of the relationship of reproductive characters and growth characteristics to response to selection.

AGRON 511: Crop Improvement
(3-0) Cr. 3. S.
Prereq: AGRON 181 or equivalent, MATH 140, CHEM 163, BIOL 101
Basic principles in the genetic improvement of crop plants. Methods of cultivar development in self-pollinated and cross-pollinated crop species. Required course for the Master of Science in agronomy degree program and agronomy graduate certificate program.

AGRON 512: Soil-Plant Environment
(3-0) Cr. 3. S.
Prereq: AGRON 502. Recommended AGRON 501
Soil properties and their impact on soil/plant relationships. Soil structure, aeration, moisture, and nutrients will be discussed in the context of soil fertility and environmental quality management. Required course for the Master of Science in agronomy degree program and agronomy graduate certificate program.

AGRON 513: Quantitative Methods for Agronomy
(3-0) Cr. 3. F.S.
Prereq: AGRON 181 or equivalent, MATH 140, STAT 104
Quantitative methods for analyzing and interpreting agronomic information. Principles of experimental design, hypothesis testing, analysis of variance, regression, correlation, and graphical representation of data. Use of SAS and Excel for organization, analyzing, and presenting data. Required course for the Master of Science in Agronomy degree program.

AGRON 514: Integrated Pest Management
(3-0) Cr. 3. SS.
Prereq: AGRON 181 or equivalent, AGRON 501, MATH 140, CHEM 163, BIOL 101; AGRON 502 and AGRON 503 recommended
Principles and practices of weed science, entomology, and plant pathology applied to crop production systems. Biology, ecology and principles of integrated crop pest management. Required course for the Master of Science in Agronomy degree program and Agronomy Graduate Certificate program.

AGRON 515: Integrated Crop and Livestock Production Systems
(Cross-listed with A B E, AN S, SUSAG). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: SUSAG 509
Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms.

AGRON 516: Crop Physiology
(3-0) Cr. 3. S.
Investigation of Molecular, whole plant, and plant community processes essential to biomass production and seed formation, and analysis of molecular approaches to overcome the limitations imposed on these processes by the environment.

AGRON 518: Microwave Remote Sensing
(Cross-listed with E E, MTEOR). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Math 265 or equivalent
Microwave remote sensing of Earth's surface and atmosphere using satellite-based or ground-based instruments. Specific examples include remote sensing of atmospheric temperature and water vapor, precipitation, ocean salinity, and soil moisture.

AGRON 519: Herbicide Physiology and Biochemistry
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: AGRON 316 (or equivalent) and AGRON 317
Herbicide mechanisms of action, selectivity, uptake, and translocation. Specific sites of herbicide action as they affect plant physiology. Herbicide resistance in weeds and crops. Implications of herbicides on weed management.

AGRON 520: Plant Breeding Methods
Cr. 3. S.
Prereq: AGRON 506
Breeding methods used in the genetic improvement of self-pollinated, cross-pollinated and asexually reproducing agronomic and horticultural crops. Application of biotechnology techniques in the development of improved cultivars.

AGRON 521: Principles of Cultivar Development
(3-0) Cr. 3. F.
Prereq: AGRON 421 and STAT 401
Theoretical and practical exploration of breeding methods to develop clonal, pureline, inbred and hybrid cultivars. Principles and strategies to set breeding objectives, parental selection and germplasm management, population development, generation advancements, multiple trait selection, experimental designs in breeding programs; seed production and certification. Introduce tools available to a breeder.

AGRON 522: Field Methods in Plant Breeding
(0-6) Cr. 1-2. Alt. SS., offered odd-numbered years.
Prereq: AGRON 521
Field experience in planning and conducting plant breeding research for germplasm and cultivar development. Offered on a satisfactory-fail basis only.

AGRON 523: Molecular Plant Breeding
(2-2) Cr. 3. S.
Prereq: AGRON 421 or AGRON 521, GDCB 542A
Plant breeding in the era of sequenced genomes and transformation. High throughout genomic technologies will be presented in relation to various applications in plant breeding.

AGRON 524: Applied Plant Molecular Genetics & Biotechnology
Cr. 3. F.
Prereq: AGRON 506
Basic principles and applied techniques used in the genetic improvement of crop plants. Discussion of structure and function of genes that control traits of value. Types of molecular markers, analysis of quantitatively inherited traits, genome mapping, analyses of databases.

AGRON 525: Crop and Soil Modeling
(3-0) Cr. 3. F.
Prereq: MATH 165 or Math 181 or equivalent; AGRON 316 or Agron 354 or equivalent.
Understanding basic crop physiology and soil processes through the use of mathematical and statistical approaches. Structure of crop models, dynamics and relationship among components such as leaf-level photosynthesis, canopy architecture, root dynamics and soil carbon and nitrogen pools.

AGRON 526: Field Plot Technique
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 401
Planning experiments for agricultural research, analysis of data, and concepts in data interpretation.

AGRON 528: Quantitative Genetics for Plant Breeding
(3-0) Cr. 3. S.
Prereq: AGRON 506 or AGRON 513
An introduction to the application of quantitative genetics to plant breeding programs.

AGRON 530: Ecologically Based Pest Management Strategies
(Cross-listed with ENT, PL P, SUSAG). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes.

AGRON 531: Crop Ecology and Management
(3-0) Cr. 3. F.
Prereq: AGRON 501, AGRON 502, AGRON 503; AGRON 512 and AGRON 514 recommended
Ecological principles underlying crop production systems. Crop production in the context of management approaches, system resources and constraints, and interactions. Emphasis on the ecology of row and forage crops common to the Midwest. Required course for the Master of Science in Agronomy degree program.

AGRON 532: Soil Management
(3-0) Cr. 3. F.
Prereq: AGRON 501, AGRON 503, AGRON 512. Recommended AGRON 513
Evaluates the impact of various soil management practices on soil and water resources. Combines and applies basic information gained in Agron 502 and Agron 512. Emphasizes the agronomic, economic, and environmental effects of soil management strategies. Required course for the Master of Science in Agronomy degree program.

AGRON 533: Crop Protection
(3-0) Cr. 3. F.
Prereq: AGRON 514
Integrated management systems for important crop pests. Cultural, biological and chemical management strategies applicable to major crops grown in the Midwest. Required course for the Master of Science in Agronomy degree program.

AGRON 534: Seed and Variety, Testing and Technology
(Cross-listed with STB). (2-0) Cr. 2.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
The components of seed quality and how they are assessed in the laboratory, including traits derived from modern biotechnology. The impact of new technologies on seed quality testing. Variety maintenance procedures and breeder seed. Variety identification: phenotype and grow-out trials, isozyme testing, and DNA marker testing. Procedures for evaluating varieties. The variance tests appropriate for fixed effects analysis of variance. Statistical inference and stratification for yield trials. Use of strip plot testing.

AGRON 535: Introduction to the Seed Industry
(Cross-listed with STB). Cr. 1.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
An analysis of the defining characteristics of the seed industry and introduction to the Master in Seed Technology and Business curriculum. The tasks of crop improvement and seed production will be analytically related to basic management functions and classifications of management activities that are used in the study of business administration. Management tasks and roles will be analyzed in related to the public policy issues that shape the seed industry, including ethical and economical approaches to biotechnology, intellectual property, and corporate responsibility.

AGRON 536: Quantitative Methods for Seed
(Cross-listed with STB). (2-0) Cr. 2. F.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
Quantitative Methods for analyzing and interpreting agronomic and business information for the seed industry. Principles of experimental design and hypothesis testing, regression, correlation, analysis of variance, and graphical representation of data. Use of spreadsheets and statistical software for manipulating, analyzing and presenting data.

AGRON 538: Seed Physiology and the Environment
(Cross-listed with HORT). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: AGRON 316; CHEM 231 or CHEM 331
Physiological aspects of seed development, maturation, longevity, dormancy, and germination of agronomic and horticultural crops and their interactions with field and storage environments. Emphasis on current literature and advanced methodology.

AGRON 539: Seed Conditioning and Storage
(Cross-listed with STB). (2-0) Cr. 2. F.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
The technical operations which may be carried out on a seed lot from harvest until it is ready for marketing and use. The opportunities for quality improvement and the risks of deterioration which are present during that time. Analysis of the costs of and benefits of operations. Evaluation of equipment based on benefits to the customer and producer. Interpretation of the role of the conditioning plant and store as focal points within the overall operations of a seed company.

AGRON 541: Applied Agricultural Meteorology
Cr. 2-3. F.S.SS.
Prereq: AGRON 206 or upper division Biological Science
Applied concepts in agricultural meteorology. Basic concepts of weather and of crop/climate relationships influencing production, protection, yield and associated production risk factors. Self study sections are available to resident and to distant education students all semesters. Credit for only one of Agron 503 or 541 may be applied toward graduation.

AGRON 544: Host-Pest Interactions
Cr. 3. F.
Prereq: AGRON 501
Incorporation of the principles of integrated pest management and crop protection. Management systems (biological, cultural, chemical) and strategies which practice principles of weed science, plant pathology, and entomology. Enrollment is restricted to off-campus students in Agronomy MS in Plant Breeding.

AGRON 546: Strategies for Diversified Farming Systems
(Cross-listed with HORT, SUSAG). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: SUSAG 509
Project-focused engagement in food and farming systems using tools and perspectives drawn from multiple disciplines. Includes a field component.

AGRON 547: Seed Production
(Cross-listed with STB). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of instructor
Survey of crop production; including management of soil fertility, planting dates, populations, weed control, and insect control. Analysis of the principles of seed multiplication and the key practices which are used to ensure high quality in the products. Field inspection procedures and production aspects that differ from other crop production. Foundation seed production. Analysis of the typical organization of field production tasks. Resources and capabilities required. Survey of differences in seed production strategies between crops and impact of differences on management of seed production.

AGRON 551: Growth and Development of Perennial Grasses
(Cross-listed with HORT). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: Junior or senior or graduate classification or permission of instructor
Selected topics on anatomy, morphology, and physiology relative to growth and development of perennial grasses. Emphasis on growth and development characteristics peculiar to grasses and variations of such characteristics under natural and managed conditions.

AGRON 552: GIS for Geoscientists
(Dual-listed with AGRON 452). (Cross-listed with ENSCI, GEOL). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

AGRON 553: Soil-Plant Relationships
(Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: AGRON 354
Composition and properties of soils in relation to the nutrition and growth of plants.

AGRON 554: Advanced Soil Management
(2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: AGRON 354; MATH 165
Implications of soil management on the soil environment and root activity. Effect of soil physical properties on soil erosion.

AGRON 555: Environmental Soil Mineralogy
(Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: AGRON 473, CHEM 178. Recommend: GEOL 311
Structure and behavior of clay minerals, humic substances and biochar in soil environments, with emphasis on reactions and environmental implications.

AGRON 556: Agroecosystem Nutrient Cycles
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 3 credits in chemistry and 6 credits in biology; Recommended: ENSCI 382, ENSCI 553, or upper-level coursework in nutrient cycles
Major, biologically important agroecosystem nutrient cycles as linked to energy (carbon) and water. Effects of agricultural production and management on cycling within systems and transfer among system at local, regional and global scales will be emphasized.

AGRON 558: Laboratory Methods in Soil Chemistry
(Cross-listed with ENSCI). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: AGRON 354 and CHEM 211
Experimental and descriptive inorganic and organic analyses. Operational theory and principles of applicable instruments, including spectrophotometry, atomic and molecular absorption and emission spectroscopy, mass spectrometry, X-ray diffraction and fluorescence, gas and ion chromatography, and ion-selective electrodes.

AGRON 559: Environmental Soil and Water Chemistry
(Dual-listed with AGRON 459). (Cross-listed with ENSCI). (3-3) Cr. 4. F.
Prereq: Two semesters of college-level chemistry, MATH 140, AGRON 182 (or equivalent) or AGRON 360; GEOL 100 and AGRON 354 recommended
An introduction to the chemical properties of soils, chemical reactions and transformations in soils and surface waters, and their impact on the environment. Topics include solution chemistry in soils and surface waters, solid-phase composition of soils, reactions at the solid-solution interface, and applications to contemporary environmental issues.

AGRON 561: Population and Quantitative Genetics for Breeding
(Cross-listed with AN S). (4-0) Cr. 4. F.
Prereq: STAT 401
Population and quantitative genetics for plant and animal genetics. Study of the genetic basis and analysis of variation in quantitative traits in domestic or experimental populations using phenotypic and molecular marker data, including estimation of heritability and other genetic parameters, linkage analysis and mapping of quantitative trait loci, and the impact of inbreeding, heterosis, and genotype-by-environment interaction.

AGRON 563: Soil Formation and Landscape Relationships
(Dual-listed with AGRON 463). (Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. Credit for one of AGRON 463 or AGRON 463I may be applied for graduation.

AGRON 563I: Soil Formation and Landscape Relationships
(Dual-listed with AGRON 463I). (Cross-listed with ENSCI, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

AGRON 570: Risk Assessment for Food, Agriculture and Veterinary Medicine
(Cross-listed with TOX, VDPAM). (3-0) Cr. 3. F.
Prereq: Statistics 300-level or higher.
Risk assessment principles as applied to biological systems. Exposure and effects characterization in human and animal health and ecological risk assessment. Risk analysis frameworks and regulatory decision-making. Introduction to quantitative methods for risk assessment using epidemiological and distributional analysis. Uncertainty analysis. This course is available only by distance.

AGRON 575: Soil Formation and Transformation
(Cross-listed with ENSCI). (3-0) Cr. 3. F.
Prereq: AGRON 463 or equivalent
Advanced study of soil formation, emphasizing relationships among soils, landscapes, environment, humans, and land use.

AGRON 577: Soil Physics
(Dual-listed with AGRON 477). (Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: AGRON 182 or equivalent and MATH 166 recommended
The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

AGRON 578: Laboratory Methods in Soil Physics
(Cross-listed with ENSCI). (0-3) Cr. 1. S.
Prereq: concurrent enrollment in AGRON 477 or AGRON 577
Methods of measuring soil physical properties such as texture, density, and water content, and transport of heat, water, and gases.

AGRON 584: Organic Agricultural Theory and Practice
(Dual-listed with AGRON 484). (Cross-listed with HORT, SUSAG). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 9 cr. in biological or physical sciences
Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives.

AGRON 585: Soil and Environmental Microbiology
(Dual-listed with AGRON 485). (Cross-listed with ENSCI, MICRO). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

AGRON 588: GIS for Geoscientists II
(Dual-listed with AGRON 488). (Cross-listed with ENSCI, GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

AGRON 590: Special Topics
Cr. arr. Repeatable.
Prereq: 15 credits in agronomy
Literature reviews and conferences on selected topics in crops, soils, or agricultural meteorology according to needs and interest of student.

AGRON 591: Agronomic Systems Analysis
(3-0) Cr. 3. S.
Prereq: AGRON 511, AGRON 513, AGRON 531, AGRON 532, AGRON 533
Analysis of cropping systems from a problem-solving perspective. Case studies will be used to develop the students' ability to solve agronomic problems. Required course for the Master of Science in Agronomy degree program.

AGRON 592: Current Issues in Agronomy
(3-0) Cr. 3. S.
Prereq: AGRON 501, AGRON 503, AGRON 511, AGRON 512, AGRON 513, AGRON 514
Critical analysis and discussion of agricultural practices, programs, and policies of current interest to the field of agronomy. Leadership skill development through consideration of technical, social, and ethical components underlying controversial topics. Enhancement of communication proficiency through debate and writing in order to define problems, articulate possible solutions, and propose appropriate courses of action. Required course for the Master of Science in agronomy degree program.

AGRON 593: Workshop in Agronomy
Cr. arr. Repeatable.
Prereq: Graduate classification

AGRON 594: Agronomy MS Practicum
(1-0) Cr. 1. SS.
Prereq: AGRON 501, AGRON 502, AGRON 503, AGRON 514 (or current enrollment. Recommended: AGRON 511, AGRON 512, AGRON 513
Practical field and laboratory experiences integrating coursework in climatology, crops, and soils. Includes lectures, labs and local agri-business tours.

AGRON 595: Seed Quality, Production, and Research Management
(Cross-listed with STB). (3-0) Cr. 3.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
Advanced survey of the organization, staff capabilities and management characteristics typical in seed production and crop improvement in seed enterprises. Analysis of the use of quality information in the management of seed operations and sales. Process management applications for seed. Production planning for existing capacity. Analysis of the manager's tasks in the annual cycle and how the tasks of these managers relate to the general categories of business management roles. Difference in management strategies used with different situations and groups of employees.

AGRON 599: Creative Component
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599A: Agricultural Meteorology
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599B: Crop Production and Physiology
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599C: Plant Breeding
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599D: Soil Chemistry
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599E: Soil Fertility
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599F: Soil Management
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599G: Soil Microbiology and Biochemistry
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599H: Soil Morphology and Genesis
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599I: Soil Physics
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599K: Seed Science
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599L: Weed Science
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AGRON 599M: Agronomy
Cr. arr.
Prereq: Nonthesis M.S. option only
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

Courses for graduate students:

AGRON 600: Seminar
(1-0) Cr. 1. Repeatable, maximum of 6 times. F.S.
Reports and discussion of recent literature and research.

AGRON 600A: Seminar: Plant Breeding
(1-0) Cr. 1. Repeatable, maximum of 6 times. F.S.
Instruction and practice in giving scientific presentations related to the fields of plant breeding, genetics, or genomics, with an emphasis on effective communication and presentation techniques. An oral seminar and a poster presentation are required, along with analyses of other seminars, and participation in planning and hosting invited speakers.

AGRON 600B: Seminar: Soils
(1-0) Cr. 1. Repeatable, maximum of 6 times. S.
Reports and discussion of recent literature and research.

AGRON 600C: Seminar: Crop Production and Physiology
(1-0) Cr. 1. Repeatable, maximum of 6 times. F.S.
Reports and discussion of recent literature and research.

AGRON 601: Agronomic Science Presentations
(3-0) Cr. 2. S.
Prereq: graduate status in agronomic science, permission of instructor.
Experience in critical communications in exchange of ideas through oral and poster presentations and scientific questioning/evaluation.

AGRON 605: Boundary-Layer Meteorology
(Cross-listed with MTEOR). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MTEOR 443 or equivalent-level course in engineering fluids
Atmospheric boundary-layer structure and dynamics. Diurnal and seasonal variations, turbulent fluxes and turbulence kinetic energy. Measurements and empirical relations for wind and temperature near the ground. Numerical simulation and applications to wind energy.

AGRON 610: Foundations of Sustainable Agriculture
(Cross-listed with A B E, ANTHR, SOC, SUSAG). (3-0) Cr. 3. F.
Prereq: Graduate classification, permission of instructor
Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts.

AGRON 621: Advanced Plant Breeding
(3-0) Cr. 3. S.
Prereq: AGRON 521, AGRON 526, AGRON 561, GEN 410
Estimation and interpretation of genetic effects and variances of plant breeding populations, analysis of mating designs, estimation of combining ability and heritability, best linear unbiased prediction, selection indices with and without molecular information, inbreeding and heterosis.

AGRON 625: Genetic Strategies in Plant Breeding
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: AGRON 521 and GDCB 510
Evaluation of genetic, molecular, and cellular approaches to crop improvement; gene transfer methods. Application and role of basic plant biology in breeding programs and processes; genome structure and function, gene isolation, expression, regulation, and modification. Integration of molecular and cellular methods in breeding strategies; analysis of alternative breeding methods, regulatory and ethical issues.

AGRON 655: Advanced Soil Fertility
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: AGRON 553
Evaluation of soil fertility and fertilizers; theory and applications.

AGRON 677: Advanced Soil Physics
(2-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: AGRON 577 and MATH 266; COM S 207 recommended
The flow and distribution of water, chemicals, and heat in soils. Physical principles and applications.

AGRON 685: Advanced Soil Biochemistry
(Cross-listed with ENSCI, MICRO). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: AGRON 585
Chemistry of soil organic matter and biochemical transformations brought about by microorganisms and enzymes in soils.

AGRON 696: Research Seminar
(Cross-listed with BBMB, FOR, GDCB, HORT, PLBIO). Cr. 1. Repeatable.
Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

AGRON 698: Agronomy Teaching Practicum
Cr. 1-2. Repeatable. F.S.SS.
Prereq: Graduate classification in agronomy and permission of instructor
Graduate student experience in the agronomy teaching program. Offered on a satisfactory-fail basis only.

AGRON 699: Research
Cr. arr. Repeatable.

AGRON 699A: Agricultural Meteorology
Cr. arr. Repeatable.

AGRON 699B: Crop Production and Physiology
Cr. arr. Repeatable.

AGRON 699C: Plant Breeding
Cr. arr. Repeatable.

AGRON 699D: Soil Chemistry
Cr. arr. Repeatable.

AGRON 699E: Soil Fertility
Cr. arr. Repeatable.

AGRON 699F: Soil Management
Cr. arr. Repeatable.

AGRON 699G: Soil Microbiology and Biochemistry
Cr. arr. Repeatable.

AGRON 699H: Soil Morphology and Genesis
Cr. arr. Repeatable.

AGRON 699I: Soil Physics
Cr. arr. Repeatable.

AGRON 699J: Plant Physiology
Cr. arr. Repeatable.

AGRON 699K: Seed Science
Cr. arr. Repeatable.

AGRON 699L: Weed Science
Cr. arr. Repeatable.

Animal Ecology

The animal ecology curriculum provides its majors with an understanding of ecological principles and processes and their applications to natural resource management. It is oriented toward students desiring a general and flexible program in environmental biology and for those planning graduate study. Students may select from four options: Fisheries and Aquatic Sciences, Interpretation of Natural Resources, Preveterinary and Wildlife Care, or Wildlife. Graduates find employment as aquaculturists, aquatic ecologists, wildlife biologists, fisheries biologists, resource managers, and ecologists for industry, environmental consulting firms, natural resource and environmental agencies and organizations, zoos, and as educators.

Graduates of the Animal Ecology major understand the basic principles of animal biology, ecology and management, and relevant aspects of scientific communication, basic mathematics and sciences, computing applications, and personal and professional development. Four specific options prepare students for careers in interpretation of natural resources, fisheries and aquatic sciences, pre-veterinary and wildlife care, and wildlife. Each option has specific outcomes expectations that include (1) the scope of the specialization and its relationships to broader aspects of animal ecology, biotic resource management, and other allied scientific disciplines and professions, (2) career opportunities and requirements, and (3) knowledge and skills appropriate for employment at technical and practitioner levels in each discipline. Graduates are able to communicate and work effectively in the multidisciplinary arena of ecology and natural resource management.

All options require three months (400 hours) of relevant work experience or study at a biological station prior to graduation. The latter may be accomplished at the university's affiliate field stations: Iowa Lakeside Laboratory at West Lake Okoboji, and Gulf Coast Research Laboratory at Ocean Springs, Mississippi. Information on these laboratories is available from the department's Student Services Center.

Preveterinary medicine preparation may be achieved while satisfying degree requirements in animal ecology.

Additional education and training can lead to other opportunities in such areas as research and management, natural resources planning and administration, teaching, and environmental consulting, among others. Graduate training is necessary for many specialized positions within the fields of animal ecology. Students preparing for graduate study should consult with their academic adviser concerning appropriate coursework.

Students wishing to be certified by the American Fisheries Society or The Wildlife Society need to consult with their advisors in selecting required courses in their respective programs. The formal application then needs to be completed and submitted for review by their professional societies. Certification in either society has many professional benefits and may be required or recommended for employment by federal and state agencies and private industry.

Students seeking certification to teach biology in secondary schools must meet requirements of the College of Human Sciences as well as those of the Animal Ecology curriculum. In addition, they must apply formally for admission to the teacher education program (see Teacher Education Program). Students with an interest in careers in outdoor writing are encouraged to obtain a minor or a second major in journalism (see Journalism and Communication, Courses and Programs). Students

who wish to pursue a job as a conservation officer may wish to minor in criminal justice (see Criminal Justice Studies).

Curriculum in Animal Ecology

Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communications Proficiency (with a C or better):

6 cr. of English composition		
3 cr. of speech fundamentals		

Communication/Library 16 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
SP CM 212	Fundamentals of Public Speaking	3
LIB 160	Information Literacy	1
Plus 6 credits from the following:		6
ENGL 207	Introduction to Creative Writing	
ENGL 275	Analysis of Popular Culture Texts	
ENGL 302	Business Communication	
ENGL 303	Free-Lance Writing for Popular Magazines	
ENGL 304	Creative Writing: Fiction	
ENGL 305	Creative Writing: Nonfiction	
ENGL 306	Creative Writing: Poetry	
ENGL 309	Proposal and Report Writing	
ENGL 310	Rhetorical Analysis	
ENGL 312	Biological Communication	
ENGL 314	Technical Communication	
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
JL MC 201	Reporting and Writing for the Mass Media	
P R 305	Publicity Methods	
NREM 330	Principles of Interpretation	
SP CM 312	Business and Professional Speaking	
SP CM 313	Communication in Classrooms and Workshops	

Humanities and Social Sciences: 6 cr.

Approved humanities course		3
Approved social science course		3
Total Credits		6

Ethics: 3 cr.

3 cr. from approved ethics list.

Mathematical Sciences: 6 cr.

MATH 140	College Algebra	3
MATH 145	Applied Trigonometry	3
STAT 101	Principles of Statistics	3-4
or STAT 104	Introduction to Statistics	
Total Credits		9-10

Physical Sciences: 13-14 cr.

CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	5
or CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
CHEM 231 & 231L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	4
or CHEM 331 & 331L	Organic Chemistry I and Laboratory in Organic Chemistry I	
PHYS 115 & 115L	Physics for the Life Sciences and Laboratory in Physics for the Life Sciences	5
or PHYS 111	General Physics	
Total Credits		14

Biological Sciences: 20 cr.

NREM 110	Orientation in Natural Resource Ecology and Management	1
NREM 120	Introduction to Renewable Resources	3
NREM 211	Careers in Natural Resources	1
A ECL 312	Ecology	4
A ECL 365	Vertebrate Biology	4
BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
Total Credits		21

Practical Experience:

Fisheries and Aquatic Sciences option

A ECL 321	Fish Biology	3
A ECL 486	Aquatic Ecology	3
A ECL 486L	Aquatic Ecology Laboratory	1
One of the following:		4
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Plus 20 credits from approved list		20
Total Credits		31

Interpretation of Natural Resources option

A ECL 366	Natural History of Iowa Vertebrates	3

BIOL 366	Plant Systematics	4
ENT 370	Insect Biology	3
NREM 303	Internship	1-3
NREM 330	Principles of Interpretation	3
BIOL 474	Plant Ecology	3-4
or FOR 356	Dendrology	
One of the following:		3
AGRON 182	Introduction to Soil Science	
AGRON 206	Introduction to Weather and Climate	
ASTRO 120	The Sky and the Solar System	
GEOL 100	The Earth	
GEOL 101	Environmental Geology: Earth in Crisis	
GEOL 108	Introduction to Oceanography	
Plus additional credits from approved list to total 33 credit hours.		10-13
Total credits = 33		

Preveterinary & Wildlife care option

AN S 214	Domestic Animal Physiology	3
or B M S 329	Anatomy and Physiology of Domestic Animals	
One of the following:		3
A ECL 551	Behavioral Ecology	
AN S 336	Domestic Animal Behavior and Well-Being	
BIOL 354	Animal Behavior	
ANTHR 438	Primate Evolutionary Ecology and Behavior	
Three credits from the following:		3
A ECL 321	Fish Biology	
A ECL 366	Natural History of Iowa Vertebrates	
A ECL 457	Herpetology	
A ECL 457L	Herpetology Laboratory	
A ECL 458	Ornithology	
A ECL 458L	Ornithology Laboratory	
A ECL 459	Mammalogy	
A ECL 459L	Mammalogy Laboratory	
One of the following:		3-5
AN S 214	Domestic Animal Physiology	
B M S 329	Anatomy and Physiology of Domestic Animals	
BIOL 335	Principles of Human and Other Animal Physiology	
BIOL 351	Comparative Chordate Anatomy	
BIOL 352	Vertebrate Histology	
BIOL 434	Endocrinology	
One of the following:		3
AN S 331	Domestic Animal Reproduction	
BIOL 313	Principles of Genetics	
BIOL 423	Developmental Biology	
GEN 320	Genetics, Agriculture and Biotechnology	
NREM 315	Genetics for Natural Resource Managers.	
At least three credits from the following list:		3-4
A ECL 401	Intro to Aquatic Animal Medicine	
A ECL 442	Aquaculture	
A ECL 454	Principles of Wildlife Disease	
AN S 319	Animal Nutrition	
AN S 493	Workshop in Animal Science	
BIOL 353	Introductory Parasitology	
MICRO 201	Introduction to Microbiology	
MICRO 201L	Introductory Microbiology Laboratory	
3 cr from course level 300-500 from A ECL or NREM		3
Plus additional credits from approved list to total 33 credit hours.		9-12
Total credits = 33		

Wildlife option

A ECL 371	Ecological Methods	3
A ECL 451	Wildlife Ecology and Management	3
BIOL 313	Principles of Genetics	3
or GEN 320	Genetics, Agriculture and Biotechnology	
or NREM 315	Genetics for Natural Resource Managers.	
BIOL 366	Plant Systematics	4
One of the following:		4
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Six credits from the following list:		6
A ECL 457	Herpetology	
A ECL 457L	Herpetology Laboratory	
A ECL 458	Ornithology	
A ECL 458L	Ornithology Laboratory	
A ECL 459	Mammalogy	
A ECL 459L	Mammalogy Laboratory	
Six credits from the following list:		6
A ECL 455	International Wildlife Issues	
ENV S 293	Environmental Planning	
ENV S 383	Environmental Politics and Policies	
NREM 270	Foundations in Natural Resource Policy and History	
NREM 385	Natural Resource Policy	
NREM 452	Ecosystem Management	

NREM 460	Controversies in Natural Resource Management	
At least three credits from the following list:		3-4
A ECL 415	Ecology of Freshwater Invertebrates, Plants, and Algae	
A ECL 454	Principles of Wildlife Disease	
A ECL 516	Avian Ecology	
A ECL 551	Behavioral Ecology	
ANTHR 438	Primate Evolutionary Ecology and Behavior	
BIOL 315	Biological Evolution	
BIOL 336	Ecological and Evolutionary Animal Physiology	
BIOL 354	Animal Behavior	
BIOL 354L	Laboratory in Animal Behavior	
BIOL 471	Introductory Conservation Biology	
EEOB 507	Advanced Animal Behavior	
ENT 370	Insect Biology	
At least five credits from the following list:		5
A ECL 415	Ecology of Freshwater Invertebrates, Plants, and Algae	
AGRON 317	Principles of Weed Science	
BIOL 355	Plants and People	
BIOL 454	Plant Anatomy	
BIOL 456	Principles of Mycology	
BIOL 474	Plant Ecology	
EEOB 564	Wetland Ecology	
FOR 356	Dendrology	
NREM 357	Midwestern Prairie Plants	
NREM 358	Forest Herbaceous Layer: Ecology and Identification.	
Plus additional credits from approved list to total 42 credit hours.		4-5

Total credits = 42

Minor - Animal Ecology

The department offers a minor in animal ecology that may be earned by taking 15 credits in the department including:

A ECL 312	Ecology	4
A ECL 365	Vertebrate Biology	4
NREM 120	Introduction to Renewable Resources	3

Plus four additional credits of Animal Ecology or NREM courses at the 300 level or above.

Animal Ecology, B.S. - fisheries and aquatic sciences

Freshman

Fall	Credits	Spring	Credits
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
NREM 110	1	NREM 120	3
MATH 140	3	ENGL 150	3
CHEM 163	4	LIB 160	1
CHEM 163L	1	MATH 145	3
Required Elective	3	STAT 101/104	3-4
	16		17-18

Sophomore

Fall	Credits	Spring	Credits
A ECL 365	4	CHEM 231	3
NREM 211	1	CHEM 231L	1
A ECL 312	4	SP CM 212	3
MATH Calculus Elective	4	Free Elective / Restricted Elective	6
ENGL 250	3	Required Elective	3
	16		16

Junior

Fall	Credits	Spring	Credits
PHYS 115 & 115L	5	A ECL 321	3
A ECL 486	3	Communications Elective	3
A ECL 486L	1	Restricted Elective	3
Restricted Elective	6	Required Elective	3
Required Elective	3	Free Elective	3
	18		15

Senior

Fall	Credits	Spring	Credits
Required Elective	3	Restricted Electives	7
Restricted Elective	6	Communications Elective	3
Free Electives	8	Free Electives	6
	17		16

* To complete degree program in 4 years students must maintain an average of 16 credits per semester.

** Initial math course is determined on the basis of high school math and placement test scores. A non-credit course (Math 10) maybe be required at additional costs.

*** In scheduling coursework, students should pay particular attention to courses with limited offerings (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course).

Animal Ecology, B.S. - interpretation of natural resources option

Freshman

Fall	Credits	Spring	Credits
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
NREM 110	1	NREM 120	3
Required Elective	3	ENGL 150	3
MATH 140**	3	MATH 145	3
CHEM 163	4	STAT 101/104	3-4
CHEM 163L	1	LIB 160	1
	16		17-18

Sophomore

Fall	Credits	Spring	Credits
A ECL 365	4	CHEM 231	3
NREM 211	1	CHEM 231L	1
A ECL 312	4	SP CM 212	3
Earth Science Elective	3	Free Elective/ Restricted Elective	6
ENGL 250	3	Required Elective	3
	15		16

Junior

Fall	Credits	Spring	Credits
PHYS 115	4	NREM 330	3
PHYS 115L	1	Communications Elective	3
Botany or Restricted Elective	3-4	A ECL 366	3
ENT 370	3	Required Elective	3
Required Elective	3	BIOL 366	4
Free Elective	3		
	17-18		16

Senior

Fall	Credits	Spring	Credits
Restricted Elective	6-7	Botany or Restricted Elective	3
Required Elective	3	Restricted Elective	3
Free Electives	7	Communications Elective	3
		NREM 303	1-3
		Free Electives (if needed)	8
	16-17		18-20

* To complete degree program in 4 years students must maintain an average of 16 credits per semester.

** Initial math course is determined on the basis of high school math and placement test scores. A non-credit course (Math 10) maybe be required at additional costs.

*** In scheduling coursework, students should pay particular attention to courses with limited offerings (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course).

Animal Ecology, B.S. - Pre-vet & wildlife care option

Freshman

Fall	Credits	Spring	Credits
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
NREM 110	1	NREM 120	3
Required Elective	3	ENGL 150	3
MATH 140	3	MATH 145	3
CHEM 163	4	STAT 101/104	3-4
CHEM 163L	1	LIB 160	1
	16		17-18

Sophomore

Fall	Credits	Spring	Credits
A ECL 365	4	CHEM 231	3
NREM 211	1	CHEM 231L	1
A ECL 312	4	SP CM 212	3
Restricted Elective	3	Free Elective/ Restricted Elective	6
ENGL 250	3	Required Elective	3
	15		16

Junior

Fall	Credits	Spring	Credits
PHYS 115 & 115L	5	NREM 330	3
Restricted Elective	3	AN S 214 or BMS 329	3
Required Elective	3	Natural History Elective	3
Free Elective	6	Required Elective	3
		Free Elective	6
	17		18

Senior

Fall	Credits	Spring	Credits
Restricted Elective	6	Restricted Elective	3
Genetics/Development Elective	3	Communications Elective	3
Required Elective	3	Free Elective	9
Communications Elective	3		

Free Elective	2	
	17	15

* To complete degree program in 4 years students must maintain an average of 16 credits per semester.

** In scheduling coursework, students should pay attention to courses with limited offerings, (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course).

\# Admission to the ISU College of Veterinary Medicine requires a different set of Chemistry and Physics courses. Students should plan to enroll in Chemistry 177, 177L, 178, 331, 331L and 332. The Physics requirement is PHYS 111.

Animal Ecology, B.S. - wildlife option

Freshman

Fall	Credits	Spring	Credits
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
NREM 110	1	NREM 120	3
MATH 140	3	ENGL 150	3
CHEM 163#	4	MATH 145	3
CHEM 163L#	1	LIB 160	1
Required Elective	3	STAT 101/104	3-4
	16		17-18

Sophomore

Fall	Credits	Spring	Credits
A ECL 365	4	CHEM 231#	3
NREM 211	1	CHEM 231L#	1
A ECL 312	4	SP CM 212	3
MATH Calculus Elective	4	Free Elective / Restricted Elective	6
ENGL 250	3	Required Elective	3
	16		16

Junior

Fall	Credits	Spring	Credits
PHYS 115	4	BIOL 366	4
PHYS 115L	1	Communications Elective	3
A ECL 371	3	Restricted Electives	6
Restricted Electives	6	Required Elective	3
Required Elective	3		
	17		16

Senior

Fall	Credits	Spring	Credits
A ECL 451	3	Restricted Electives	9
Restricted Electives	6	Communications Elective	3
Required Elective	3	Free Elective	3
Free Electives	6		
	18		15

* To complete degree program in four years students must maintain an average of 16 credits per semester.

** Initial math course is determined on the basis of high school math and placement test scores. A non-credit course (Math 10) maybe be required at additional costs.

*** In scheduling coursework, students should pay attention to courses with limited offerings, (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course). It is critical that students take A ECL 371 fall semester of the junior year and A ECL 451 fall semester of the senior year.

Courses primarily for undergraduates:

A ECL 312: Ecology

(Cross-listed with BIOL, ENSCI). (3-3) Cr. 4. F.SS.

Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L

Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats.

A ECL 312I: Ecology

(Cross-listed with ENSCI, IA LL). Cr. 4. SS.

An introduction to the principles of ecology at the population, community and ecosystem level. Field studies of local lakes, wetlands and prairies are used to examine factors controlling distributions, interactions, and roles of plants and animals in native ecosystems.

A ECL 321: Fish Biology

(2-3) Cr. 3. S.

Prereq: A ECL 365

Biology, ecology, and evolution of fishes. Emphasis on structure, physiology, and behavior, including a focus on the conservation and management of fishes and their habitats. Laboratory focus on fish morphology, survey methods, identification, distribution, habits, and habitats of fishes.

A ECL 326I: Ornithology
(Cross-listed with IA LL). Cr. 4. SS.
The biology, ecology, and behavior of birds with emphasis on field studies of local avifauna. Group projects stress techniques of population analysis and methodology for population studies.

A ECL 333: Fisheries Techniques
(Cross-listed with NREM). (1-3) Cr. 2. F.
Prereq: BIOL 212
Introduction to techniques used in the collection and interpretation of fish population data in the field and in the lab. Course objectives include an understanding of population survey methodology and improving student critical thinking and teamwork skills. Laboratory focuses on field trips and hands-on sampling experience.

A ECL 365: Vertebrate Biology
(Cross-listed with BIOL). (3-2) Cr. 4. F.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L
Evolution, biology, and classification of fish, amphibians, reptiles, birds, and mammals. Emphasis on a comparative analysis of the structure and function of organ systems. Laboratory exercises concentrate on morphology and identification of orders of vertebrates.

A ECL 366: Natural History of Iowa Vertebrates
(2-3) Cr. 3. S.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L
Vertebrate fauna of Iowa, including fishes, amphibians, reptiles, birds, and mammals. Species identification, habitat requirements, community structure and assessment, conservation issues that include historical population changes and value of wild animals to the region's ecological and economic health.

A ECL 371: Ecological Methods
(Cross-listed with BIOL). (2-3) Cr. 3. S.
Prereq: A ECL 312; STAT 101 or STAT 104
Quantitative techniques used in management of natural resources with emphasis on inventory and manipulation of habitat and animal populations.

A ECL 401: Intro to Aquatic Animal Medicine
(Cross-listed with B M S). (1-2) Cr. 1. S.
8 week course. Introductory course with focus on fin fish production, health and medicine. Course content will help define future roles for veterinarians, producers, and service providers. Emphasis will be placed on anatomy, pathology, infectious diseases, nutrition, regulatory constraints in production, food safety, and current research. Field trip to aquaculture facility.

A ECL 404I: Behavioral Ecology
(Cross-listed with IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: Two semesters of biology
Animal coloniality, courtship, territoriality, predator defense, habitat selection, foraging, mating systems, and parental care will be examined in the field in order to evaluate various ecological and evolutionary theories of animal behavior.

A ECL 415: Ecology of Freshwater Invertebrates, Plants, and Algae
(Dual-listed with A ECL 515). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A ECL 312
Identification, biology, and ecological requirements of freshwater invertebrates, plants and algae. Additional emphases on community sampling methods and analysis, and use of organisms as tools for aquatic ecosystem health assessment.

A ECL 418: Stream Ecology
(Dual-listed with A ECL 518). (Cross-listed with ENSCI). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A ECL 486
Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

A ECL 419I: Vertebrate Ecology and Evolution
(Cross-listed with IA LL). Cr. 4. SS.
Field and laboratory study of representative vertebrates of northwestern Iowa. Observations and experimentation emphasize ecological histories by integrating concepts of functional morphology, behavioral ecology, and evolutionary biology.

A ECL 420I: Amphibians and Reptiles
(Cross-listed with IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: Two semesters of biology
Ecology, behavior, and conservation biology of amphibians and reptiles with emphasis on their anatomy and morphology; temperature and water regulation; locomotion; life history; reproduction; population and community ecology; and conservation.

A ECL 425: Aquatic Insects
(Dual-listed with A ECL 525). (Cross-listed with ENT). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312 or equivalent
Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

A ECL 440: Fishery Management
(Dual-listed with A ECL 540). (2-3) Cr. 3. F.
Prereq: A ECL 312, A ECL 321, STAT 101 or STAT 104; credit or enrollment in A ECL 486
Biological basis of fishery management, fishery problems, and management practices for freshwater, anadromous, and marine fisheries.

A ECL 442: Aquaculture
(Dual-listed with A ECL 542). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 211 and BIOL 212.
Concepts related to the culture of aquatic organisms including culture systems, water quality, nutrition, genetics, diseases, and marketing.

A ECL 451: Wildlife Ecology and Management
(2-3) Cr. 3. F.
Prereq: A ECL 371
Ecological theory and practice of wildlife management, including, population ecology, habitat management, and current issues in the field. Course involves a series of case studies addressing actual wildlife issues using field and quantitative methods.

A ECL 454: Principles of Wildlife Disease
(Dual-listed with A ECL 554). (3-0) Cr. 3. S.
Prereq: Junior standing and at least 10 credits in biological sciences at the 300+ level
Ecological and epidemiological aspects of diseases as they relate to wildlife populations. Topics to be covered include: major classes of disease; detection, description, monitoring, and management of disease; characteristics and interactions between disease agents and wildlife hosts; relationships among wildlife, domestic animal, and human health.

A ECL 455: International Wildlife Issues
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A ECL 365, A ECL 312 or graduate standing; NREM 120
Biological, political, social, and economic factors affecting the management of international wildlife resources.
Meets International Perspectives Requirement.

A ECL 457: Herpetology
(Cross-listed with BIOL). (2-0) Cr. 2. F.
Prereq: BIOL 351 or BIOL 365
Biology, ecology, and evolution of amphibians (salamanders, frogs, caecilians) and reptiles (lizards, snakes, tuatara, turtles, crocodilians). Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of amphibians and reptiles in ecosystems, and conservation. Laboratory focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

A ECL 457L: Herpetology Laboratory
(Cross-listed with BIOL). (0-3) Cr. 1. F.
Prereq: BIOL 351 or BIOL/A ECL 365; concurrent registration in BIOL 457 or A ECL 457
Laboratory to accompany Biology/Animal Ecology 457. Focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

A ECL 458: Ornithology
(Cross-listed with BIOL). (2-0) Cr. 2. S.
Prereq: A ECL 365 or BIOL 351
Biology, evolution, ecology and taxonomy of birds. Emphasis on structure, physiology, behavior, communication, navigation, reproduction, and conservation.

A ECL 458L: Ornithology Laboratory
(Cross-listed with BIOL). (0-3) Cr. 1. S.
Prereq: BIOL 351 or AECL/BIOL 365. Concurrent enrollment in AECL/BIOL 458 is required.
Laboratory complements lecture topics with emphasis on external anatomy, identification and distribution of Midwest birds, and field trips.

A ECL 459: Mammalogy
(Cross-listed with BIOL). (2-0) Cr. 2. S.
Prereq: BIOL 351 or A ECL 365
Biology, ecology, and evolution of mammals. Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of mammals in ecosystems, and conservation.

A ECL 459L: Mammalogy Laboratory
(Cross-listed with BIOL). (0-3) Cr. 1. S.
Prereq: BIOL 351 or BIOL/AECL 365; concurrent enrollment in AECL 459 or BIOL 459 required.
Laboratory focus on identification, survey methods, distribution, habits, and habitats of mammals. Several field trips.

A ECL 480: Studies in Marine Biology
Cr. 1-8. Repeatable. SS.
Courses taken at Gulf Coast Research Laboratory and other marine biological stations are transferred to Iowa State University under this number.

A ECL 486: Aquatic Ecology
(Dual-listed with A ECL 586). (Cross-listed with BIOL, ENSCI). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

A ECL 486L: Aquatic Ecology Laboratory
(Dual-listed with A ECL 586L). (Cross-listed with BIOL, ENSCI). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

A ECL 489: Population Ecology
(Dual-listed with A ECL 589). (Cross-listed with BIOL). (2-2) Cr. 3. F.
Prereq: BIOL 312, STAT 101 or STAT 104, a course in calculus, or graduate standing
Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation.

Courses primarily for graduate students, open to qualified undergraduates:

A ECL 515: Ecology of Freshwater Invertebrates, Plants, and Algae
(Dual-listed with A ECL 415). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A ECL 312
Identification, biology, and ecological requirements of freshwater invertebrates, plants and algae. Additional emphases on community sampling methods and analysis, and use of organisms as tools for aquatic ecosystem health assessment.

A ECL 516: Avian Ecology
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A ECL 365, A ECL 312, or graduate standing
Current topics and theories including avian breeding and foraging ecology, population biology, community structure, habitat selection, field methodologies, and data interpretation.

A ECL 518: Stream Ecology
(Dual-listed with A ECL 418). (Cross-listed with ENSCI). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A ECL 486
Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

A ECL 520: Fisheries Science
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A ECL 312, A ECL 321
Concepts, approaches, and techniques for assessment of recreational and commercial fisheries. Scope will range from individual fish to entire ecosystems, both freshwater and marine.

A ECL 523I: Fish Ecology
(Cross-listed with IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Basic principles of fish interaction with the biotic and abiotic environment. Field methods, taxonomy, and biology of fish with emphasis on the fish fauna of northwestern Iowa.

A ECL 525: Aquatic Insects
(Dual-listed with A ECL 425). (Cross-listed with ENT). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312 or equivalent
Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

A ECL 526I: Advanced Field Ornithology
(Cross-listed with IA LL). Cr. 2. SS.
Prereq: Concurrent registration in IA LL 326I
Field study of birds of the upper Midwest; extended field trip to Minnesota and Wisconsin; individual or group project.

A ECL 531: Conservation Biology
(Cross-listed with EEOB). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 312; BIOL 313 or graduate standing
Examination of conservation issues from a population and a community perspective. Population-level analysis will focus on the role of genetics, demography, and environment in determining population viability. Community perspectives will focus on topics such as habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology.

A ECL 531I: Conservation Biology
(Cross-listed with EEOB, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: IA LL 312I
Population-and community-level examination of factors influencing the viability of plant and animal populations from both demographic and genetic perspectives; assessment of biodiversity; design and management of preserves.

A ECL 535I: Restoration Ecology
(Cross-listed with EEOB, ENSCI, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: A course in ecology
Ecological principles for the restoration of native ecosystems; establishment (site preparation, selection of seed mixes, planting techniques) and management (fire, mowing, weed control) of native vegetation; evaluation of restorations. Emphasis on the restoration of prairie and wetland vegetation.

A ECL 540: Fishery Management
(Dual-listed with A ECL 440). (2-3) Cr. 3. F.
Prereq: A ECL 312, A ECL 321, STAT 101 or STAT 104; credit or enrollment in A ECL 486
Biological basis of fishery management, fishery problems, and management practices for freshwater, anadromous, and marine fisheries.

A ECL 542: Aquaculture
(Dual-listed with A ECL 442). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 211 and BIOL 212.
Concepts related to the culture of aquatic organisms including culture systems, water quality, nutrition, genetics, diseases, and marketing.

A ECL 551: Behavioral Ecology
(2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: a course in ecology or animal behavior
The study of how an animal's behavior affects its ability to survive and reproduce in its environment. Course topics, such as foraging behavior, sexual selection, parental care, etc., represent the interface of ecology, evolution, and behavior.

A ECL 554: Principles of Wildlife Disease
(Dual-listed with A ECL 454). (3-0) Cr. 3. S.
Prereq: Graduate classification
Ecological and epidemiological aspects of disease as they relate to wildlife populations. Topics to be covered include: major classes of disease; detection, description, monitoring, and management of disease; characteristics and interactions between disease agents and wildlife hosts; relationship among wildlife, domestic animal, and human health.

A ECL 570: Landscape Ecology
(Cross-listed with EEOB). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Permission of instructor; EEOB 588; a course in calculus
The study of ecological and evolutionary processes within a spatial context with emphasis on behavior, population, and community dynamics.

A ECL 573: Techniques for Biology Teaching
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 573A: Techniques for Biology Teaching : Animal Biology
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 573G: Techniques for Biology Teaching: Limnology
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 573I: Techniques for Biology Teaching: Insect Ecology
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 573W: Techniques for Biology Teaching: Project WET
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 586: Aquatic Ecology
(Dual-listed with A ECL 486). (Cross-listed with EEOB, ENSCI). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

A ECL 586L: Aquatic Ecology Laboratory
(Dual-listed with A ECL 486L). (Cross-listed with EEOB, ENSCI). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

A ECL 589: Population Ecology
(Dual-listed with A ECL 489). (Cross-listed with EEOB). (2-2) Cr. 3. F.
Prereq: BIOL 312, STAT 101 or STAT 104, a course in calculus, or graduate standing
Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation.

A ECL 590: Graduate Independent Study
(Cross-listed with ANTHR, EEOB, IA LL). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

A ECL 590I: Special Topics: Graduate Independent Study
(Cross-listed with ANTHR, EEOB, IA LL). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

A ECL 599: Creative Component
Cr. arr.
Prereq: Nonthesis M.S. option only

Courses for graduate students:

A ECL 611: Analysis of Populations
(Cross-listed with EEOB). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 312; STAT 401; a course in calculus
Quantitative techniques for analyzing vertebrate population data to estimate parameters such as density and survival. Emphasis on statistical inference and computing.

A ECL 698: Animal Ecology Teaching Practicum
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification in animal ecology and permission of instructor
Graduate student experience in the animal ecology teaching program. Offered on a satisfactory-fail basis only.

A ECL 699: Research
Cr. arr. Repeatable.

A ECL 699I: Research
(Cross-listed with ANTHR, EEOB, GDCB, IA LL). Cr. 1-4. Repeatable.

Animal Science

The Department of Animal Science Undergraduate Program intends for its graduates to be able to explain the symbiotic relationship of animals and humans, to contribute to the solution of complex problems of animal enterprise management, and to apply their knowledge and skills in a technically demanding global community. Graduates of our program will be knowledgeable about sustainable animal production practices that also ensure animal health and well-being and stewardship of natural resources.

To enable learners to pursue a wide array of career interests, the department offers learning experiences ranging from the basic to the applied sciences. The overarching goals of the degree program are to provide a comprehensive animal science education in: science, animal management, and agri-business. Faculty in our program strive to create an environment for students to develop effective communication skills, develop skills that enable students to gather and integrate information to solve problems, become self-learners, become leaders and team builders, and to become aware of domestic and global issues driving changes in the animal industries. Learner outcomes for these goals, for each of our courses, and other information defining the program can be found at our web site: http://www.ans.iastate.edu/stud/ugrad/. Our program is designed to provide career skills appropriate to job market needs. Our faculty goals include providing superior academic advising to enable students to fulfill their objectives.

The department offers the degrees bachelor of science in animal science and bachelor of science in dairy science. A double major in animal and dairy science is not permitted. However, combining either the animal science or dairy science majors with other curricula is permitted. A limit of 6 credits each in Intercollegiate Judging (Animal Science 475), or any independent study course (490 courses) can be applied toward a degree. A limit of 4 credits of Undergraduate Teaching Experience (Animal Science 497) can be applied toward a degree.

Within the animal science major, specialized options in animal products, companion animal management, equine management, livestock management, pre-professional studies, and pre-veterinary medicine are available. The department offers a minor in Animal Science and a minor in Meat Science. Both the animal science curricula and dairy science curricula allow complementary work toward admission to veterinary medical school and other professional schools, which may be done while satisfying requirements for the bachelor of science degree. A program that combines bachelor of science and master of science in animal science is offered. In addition, a program that combines a bachelor of science and master of business administration is offered. The Department facilitates student participation in the Midwest Poultry Consortium and the Swine Science Online program to offer additional training in poultry and swine production, respectively.

Curriculum in Animal Science

Students majoring in animal science will complete the degree requirements listed below. If desired, a student may also choose a specialized option. To earn a degree in Animal Science from Iowa State University a minimum of 15 credits in Animal Science must be earned from courses taught in the Animal Science department at ISU. A minimum of 15 credits of animal science coursework must be earned at Iowa State University. A minimum of 15 credits must be completed from the courses listed to meet the Ethics, International Perspectives, U.S. Diversity, and Humanities and Social Sciences requirements.

Total Degree Requirement: 128 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspectives

Approved International Perspectives course	3

U.S. Diversity

Approved U. S. Diversity course	3

Communications Proficiency (with a C or better)

English composition		6
Speech fundamentals		3
Total Credits		9

Communication/Library

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
One of		3
SP CM 212	Fundamentals of Public Speaking	
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
COMST 214	Professional Communication	
One of:		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 312	Biological Communication	
ENGL 314	Technical Communication	
Total Credits		13

Humanities and Social Sciences

Approved Humanties course		3
Approved Social Science course		3
Total Credits		6

Ethics

Approved Ethics course		3

Mathematical Sciences

Note: The Pre-Graduate/Pre-Professional Studies Option requires MATH 160, MATH 165, or MATH 181

One course from the following:		3-4
MATH 140	College Algebra	
MATH 150	Discrete Mathematics for Business and Social Sciences	
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
One course from the following:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
STAT 226	Introduction to Business Statistics I	
Total Credits		6-8

Physical Sciences

A minimum of 8 credits are required. These requirements are specific to option and are listed with each option below.

Biological Sciences

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 313	Principles of Genetics	3
or GEN 320	Genetics, Agriculture and Biotechnology	
MICRO 201 & 201L	Introduction to Microbiology and Introductory Microbiology Laboratory	3-4
or MICRO 302 & 302L	Biology of Microorganisms and Microbiology Laboratory	
Total Credits		14-15

Business

One course from the following:		3
Note: The Livestock Management Option requires ACCT 284		
ACCT 284	Financial Accounting	
ECON 101	Principles of Microeconomics	
ECON 102	Principles of Macroeconomics	
Total Credits		3

Animal Science Core (required in every option)

AN S 101	Working with Animals	2
AN S 110	Orientation in Animal Science and ISU	1
AN S 114	Survey of the Animal Industry	2
AN S 210	Career Preparation in Animal Science	1
AN S 211	Issues Facing Animal Science	1
AN S 214	Domestic Animal Physiology	3
AN S 214L	Domestic Animal Anatomy and Physiology Lab	1
AN S 319	Animal Nutrition	3
AN S 320	Animal Feeds and Feeding	3
AN S 331	Domestic Animal Reproduction	3
AN S 352	Genetic Improvement of Domestic Animals	3
AN S 411	Addressing Issues in Animal Science	1
Total Credits		24

General Animal Science Option

CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	5
or CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
CHEM 331	Organic Chemistry I	3

or BBMB 221	Structure and Reactions in Biochemical Processes	
Three courses from the following:		9
AN S 216	Equine Science	
AN S 223	Poultry Science	
AN S 224	Companion Animal Science	
AN S 225	Swine Science	
AN S 226	Beef Cattle Science	
AN S 229	Sheep Science	
AN S 235	Dairy Cattle Science	
AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from the following:		2-4
AN S 313	Exercise Physiology of Animals	
AN S 324	Food Processing for Companion Animals	
AN S 336	Domestic Animal Behavior and Well-Being	
AN S 337	Lactation	
AN S 345	Growth and Development of Domestic Animals	
AN S 360	Fresh Meats	
BIOL 314	Principles of Molecular Cell Biology	
BIOL 352	Vertebrate Histology	
BIOL 353	Introductory Parasitology	
ENT 372	Livestock Entomology	
ENT 374	Insects and Our Health	
MICRO 310	Medical Microbiology	
VDPAM 487	Livestock Disease Prevention	
TSM 327	Animal Production Systems	
AGRON 334	Forage Crop Management	
One course from the following:		3
AN S 415	Equine Systems Management	
AN S 424	Companion Animal Systems Management	
AN S 425	Swine Systems Management	
AN S 426	Beef Cattle Systems Management	
AN S 429	Sheep Systems Management	
AN S 434	Dairy Systems Management	
One course from the following:		2-3
AN S 415	Equine Systems Management	
AN S 419	Advanced Animal Nutrition	
AN S 424	Companion Animal Systems Management	
AN S 425	Swine Systems Management	
AN S 426	Beef Cattle Systems Management	
AN S 429	Sheep Systems Management	
AN S 434	Dairy Systems Management	
AN S 460	Processed Meats	
FS HN 405	Food Quality Assurance	
FS HN 410	Food Analysis	
FS HN 420	Food Microbiology	
MICRO 407	Microbiological Safety of Foods of Animal Origins	
Total Credits		24-27

Additional free electives required for the Animal Science Option 23-29

Pre-Veterinary Medicine Option

BBMB 301	Survey of Biochemistry	3
CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
CHEM 332	Organic Chemistry II	3
PHYS 111	General Physics	5
Three courses from the following:		9
AN S 216	Equine Science	
AN S 223	Poultry Science	
AN S 224	Companion Animal Science	
AN S 225	Swine Science	
AN S 226	Beef Cattle Science	
AN S 229	Sheep Science	
AN S 235	Dairy Cattle Science	
AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from the following:		2-4
AN S 313	Exercise Physiology of Animals	
AN S 324	Food Processing for Companion Animals	
AN S 336	Domestic Animal Behavior and Well-Being	
AN S 337	Lactation	
AN S 345	Growth and Development of Domestic Animals	
AN S 360	Fresh Meats	
BIOL 314	Principles of Molecular Cell Biology	
BIOL 352	Vertebrate Histology	
BIOL 353	Introductory Parasitology	
ENT 372	Livestock Entomology	
ENT 374	Insects and Our Health	
MICRO 310	Medical Microbiology	
VDPAM 487	Livestock Disease Prevention	
One course from the following:		3
AN S 415	Equine Systems Management	

AN S 424	Companion Animal Systems Management	
AN S 425	Swine Systems Management	
AN S 426	Beef Cattle Systems Management	
AN S 429	Sheep Systems Management	
AN S 434	Dairy Systems Management	
One course from the following:		2-3
AN S 415	Equine Systems Management	
AN S 419	Advanced Animal Nutrition	
AN S 424	Companion Animal Systems Management	
AN S 425	Swine Systems Management	
AN S 426	Beef Cattle Systems Management	
AN S 429	Sheep Systems Management	
AN S 434	Dairy Systems Management	
AN S 460	Processed Meats	
FS HN 405	Food Quality Assurance	
FS HN 410	Food Analysis	
FS HN 420	Food Microbiology	
MICRO 407	Microbiological Safety of Foods of Animal Origins	
Total Credits		39-42

Additional free electives required for the Pre-veterinary Medicine Option 8-14

* The Iowa State University College of Veterinary Medicine academic requirements are met by completion of this option (http://vetmed.iastate.edu/academics/prospective-students/admissions/academic-requirements).

Livestock Management Option

ACCT 284	Financial Accounting	3
AGEDS 451	Agricultural Law	4
AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	3
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	5
or CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
CHEM 331	Organic Chemistry I	3
or BBMB 221	Structure and Reactions in Biochemical Processes	
ECON 230	Farm Business Management	3
ECON 334	Entrepreneurship in Agriculture	3
VDPAM 487	Livestock Disease Prevention	3
Two courses from the following:		6
AN S 223	Poultry Science	
AN S 225	Swine Science	
AN S 226	Beef Cattle Science	
AN S 229	Sheep Science	
AN S 235	Dairy Cattle Science	
One course from the following:		3
AN S 336	Domestic Animal Behavior and Well-Being	
AN S 337	Lactation	
AN S 345	Growth and Development of Domestic Animals	
AN S 360	Fresh Meats	
One course from the following:		3
AN S 425	Swine Systems Management	
AN S 426	Beef Cattle Systems Management	
AN S 429	Sheep Systems Management	
AN S 434	Dairy Systems Management	
One course from the following:		2-3
AN S 415	Equine Systems Management	
AN S 419	Advanced Animal Nutrition	
AN S 424	Companion Animal Systems Management	
AN S 425	Swine Systems Management	
AN S 426	Beef Cattle Systems Management	
AN S 429	Sheep Systems Management	
AN S 434	Dairy Systems Management	
AN S 460	Processed Meats	
FS HN 405	Food Quality Assurance	
FS HN 410	Food Analysis	
FS HN 420	Food Microbiology	
MICRO 407	Microbiological Safety of Foods of Animal Origins	
Total Credits		41-42

Course List Additional free electives required for the Livestock Management Option 8-12

Animal Products Option

AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	3
AN S 360	Fresh Meats	3
AN S 460	Processed Meats	3
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	5
or CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
CHEM 331	Organic Chemistry I	3
or BBMB 221	Structure and Reactions in Biochemical Processes	
Two courses from the following:		6
AN S 223	Poultry Science	

AN S 225	Swine Science	
AN S 226	Beef Cattle Science	
AN S 229	Sheep Science	
AN S 235	Dairy Cattle Science	
One course from the following:		3
AN S 425	Swine Systems Management	
AN S 426	Beef Cattle Systems Management	
AN S 429	Sheep Systems Management	
AN S 434	Dairy Systems Management	
One course from the following:		3
FS HN 405	Food Quality Assurance	
FS HN 410	Food Analysis	
FS HN 420	Food Microbiology	
MICRO 407	Microbiological Safety of Foods of Animal Origins	
Total Credits		29

Additional free electives required for the Animal Products Option 21-24

Pre-Graduate/Preprofessional Studies Option

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
Three courses from the following:		9
AN S 216	Equine Science	
AN S 223	Poultry Science	
AN S 224	Companion Animal Science	
AN S 225	Swine Science	
AN S 226	Beef Cattle Science	
AN S 229	Sheep Science	
AN S 235	Dairy Cattle Science	
AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from the following:		2-4
AN S 313	Exercise Physiology of Animals	
AN S 324	Food Processing for Companion Animals	
AN S 336	Domestic Animal Behavior and Well-Being	
AN S 337	Lactation	
AN S 345	Growth and Development of Domestic Animals	
AN S 360	Fresh Meats	
BIOL 314	Principles of Molecular Cell Biology	
BIOL 352	Vertebrate Histology	
BIOL 353	Introductory Parasitology	
ENT 372	Livestock Entomology	
ENT 374	Insects and Our Health	
MICRO 310	Medical Microbiology	
VDPAM 487	Livestock Disease Prevention	
One course from the following:		3
AN S 415	Equine Systems Management	
AN S 424	Companion Animal Systems Management	
AN S 425	Swine Systems Management	
AN S 426	Beef Cattle Systems Management	
AN S 429	Sheep Systems Management	
AN S 434	Dairy Systems Management	
One course from the following:		2-3
AN S 415	Equine Systems Management	
AN S 419	Advanced Animal Nutrition	
AN S 424	Companion Animal Systems Management	
AN S 425	Swine Systems Management	
AN S 426	Beef Cattle Systems Management	
AN S 429	Sheep Systems Management	
AN S 434	Dairy Systems Management	
AN S 460	Processed Meats	
FS HN 405	Food Quality Assurance	
FS HN 410	Food Analysis	
FS HN 420	Food Microbiology	
MICRO 407	Microbiological Safety of Foods of Animal Origins	
Three courses from the following:		9-13
BBMB 301	Survey of Biochemistry	
BBMB 404	Biochemistry I	
BBMB 405	Biochemistry II	
BBMB 420	Mammalian Biochemistry	
BIOL 314	Principles of Molecular Cell Biology	
BIOL 351	Comparative Chordate Anatomy	
BIOL 352	Vertebrate Histology	
BIOL 353	Introductory Parasitology	
BIOL 365	Vertebrate Biology	
BIOL 423	Developmental Biology	
BIOL 434	Endocrinology	
CHEM 211 & 211L	Quantitative and Environmental Analysis and Quantitative and Environmental Analysis Laboratory	
CHEM 332	Organic Chemistry II	
MATH 166	Calculus II	
or MATH 182	Calculus and Mathematical Modeling for the Life Sciences II	

MICRO 475	Immunology	
PHYS 111	General Physics	
PHYS 112	General Physics	
STAT 401	Statistical Methods for Research Workers	
STAT 402	Statistical Design and the Analysis of Experiments	
Total Credits		37-44

Additional free electives required for the Pre-Graduate/Preprofessional Studies Option 6-16

Companion Animal Management Option

AN S 224	Companion Animal Science	3
AN S 324	Food Processing for Companion Animals	3
AN S 424	Companion Animal Systems Management	3
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	5
or CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
CHEM 331	Organic Chemistry I	3
or BBMB 221	Structure and Reactions in Biochemical Processes	
One course from the following		3
ACCT 215	Legal Environment of Business	
ACCT 285	Managerial Accounting	
ECON 234	Small Business Management	
Two courses from the following:		6
AN S 216	Equine Science	
AN S 223	Poultry Science	
AN S 225	Swine Science	
AN S 226	Beef Cattle Science	
AN S 229	Sheep Science	
AN S 235	Dairy Cattle Science	
AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from the following:		3-4
AN S 313	Exercise Physiology of Animals	
AN S 336	Domestic Animal Behavior and Well-Being	
AN S 337	Lactation	
AN S 345	Growth and Development of Domestic Animals	
AN S 360	Fresh Meats	
BIOL 314	Principles of Molecular Cell Biology	
BIOL 352	Vertebrate Histology	
BIOL 353	Introductory Parasitology	
ENT 374	Insects and Our Health	
MICRO 310	Medical Microbiology	
One course from the following		2-3
AN S 415	Equine Systems Management	
AN S 419	Advanced Animal Nutrition	
AN S 425	Swine Systems Management	
AN S 426	Beef Cattle Systems Management	
AN S 429	Sheep Systems Management	
AN S 434	Dairy Systems Management	
AN S 460	Processed Meats	
FS HN 405	Food Quality Assurance	
FS HN 410	Food Analysis	
FS HN 420	Food Microbiology	
MICRO 407	Microbiological Safety of Foods of Animal Origins	
Total Credits		31-33

Additional free electives for the Companion Animal Management Option 17-22

Equine Management Option

AN S 216	Equine Science	3
AN S 415	Equine Systems Management	3
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	5
or CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
CHEM 331	Organic Chemistry I	3
or BBMB 221	Structure and Reactions in Biochemical Processes	
Five credits from:		5
AN S 116	Practicum in Safe Equine Handling and Welfare	
AN S 217	Equine Farm Practicum	
AN S 306	Equine Evaluation	
AN S 313	Exercise Physiology of Animals	
AN S 332	Laboratory Methods in Animal Reproduction Section 2: Horses	
AN S 399A	Animal Science Internship: Graded Internship Experience Equine Internship	
AN S 475E	Intercollegiate Judging Training and Competition: Horses	
AN S 490E	Independent Study: Equine Science	
AN S 493	Workshop in Animal Science Equine workshop	
Four credits from:		4
AGEDS 451	Agricultural Law	
AGRON 217	Weed Identification	
AGRON 317	Principles of Weed Science	
AGRON 334	Forage Crop Management	

AN S 116	Practicum in Safe Equine Handling and Welfare	
AN S 217	Equine Farm Practicum	
AN S 306	Equine Evaluation	
AN S 313	Exercise Physiology of Animals	
AN S 332	Laboratory Methods in Animal Reproduction Section 2: Horses	
AN S 399A	Animal Science Internship: Graded Internship Experience Equine Internship	
AN S 490E	Independent Study: Equine Science	
AN S 493	Workshop in Animal Science Equine Workshop	
AN S 475E	Intercollegiate Judging Training and Competition: Horses	
AN S 490E	Independent Study: Equine Science	
ECON 234	Small Business Management	
Two courses from the following		6
AN S 223	Poultry Science	
AN S 224	Companion Animal Science	
AN S 225	Swine Science	
AN S 226	Beef Cattle Science	
AN S 229	Sheep Science	
AN S 235	Dairy Cattle Science	
AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from:		2-3
AN S 419	Advanced Animal Nutrition	
AN S 424	Companion Animal Systems Management	
AN S 425	Swine Systems Management	
AN S 426	Beef Cattle Systems Management	
AN S 429	Sheep Systems Management	
AN S 434	Dairy Systems Management	
AN S 460	Processed Meats	
FS HN 405	Food Quality Assurance	
FS HN 410	Food Analysis	
FS HN 420	Food Microbiology	
MICRO 407	Microbiological Safety of Foods of Animal Origins	
Total Credits		31-32

Additional free electives required for the Equine Management Option 18-22

Minors: Animal Science and Meat Science

The department offers a minor in Animal Science. The minor requires:

AN S 101	Working with Animals	2
AN S 114	Survey of the Animal Industry	2
AN S 214	Domestic Animal Physiology	3
AN S 214L	Domestic Animal Anatomy and Physiology Lab	1
One course from the following:		3
AN S 216	Equine Science	
AN S 223	Poultry Science	
AN S 224	Companion Animal Science	
AN S 225	Swine Science	
AN S 226	Beef Cattle Science	
AN S 229	Sheep Science	
AN S 235	Dairy Cattle Science	
AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	
One course from the following:		3
AN S 313	Exercise Physiology of Animals	
AN S 319	Animal Nutrition	
AN S 331	Domestic Animal Reproduction	
AN S 345	Growth and Development of Domestic Animals	
AN S 352	Genetic Improvement of Domestic Animals	
One course from the following:		2-3
AN S 319	Animal Nutrition	
AN S 320	Animal Feeds and Feeding	
AN S 331	Domestic Animal Reproduction	
AN S 324	Food Processing for Companion Animals	
AN S 336	Domestic Animal Behavior and Well-Being	
AN S 337	Lactation	
AN S 345	Growth and Development of Domestic Animals	
AN S 352	Genetic Improvement of Domestic Animals	
AN S 360	Fresh Meats	
AN S 419	Advanced Animal Nutrition	
Total Credits		16-17

A total of 9 credits must be earned at Iowa State University in animal science coursework that meets a degree requirement for the B.S. degree in animal science. Students interested in the Animal Science minor should contact an Animal Science adviser.

Minor - Meat Science

The department offers a minor in Meat Science. The minor requires:

AN S 270	Foods of Animal Origin	2
AN S 270L	Foods of Animal Origin Laboratory	1
AN S 360	Fresh Meats	3
AN S 460	Processed Meats	3
One course from the following:		1

AN S 489	Issues in Food Safety	
AN S 490C	Independent Study: Meat Science	
Two courses from the following:		5-6
FS HN 311	Food Chemistry	
FS HN 403	Food Laws and Regulations	
FS HN 405	Food Quality Assurance	
FS HN 406	Sensory Evaluation of Food	
FS HN 410	Food Analysis	
FS HN 412	Food Product Development	
FS HN 419	Foodborne Hazards	
FS HN 420	Food Microbiology	
FS HN 471	Food Processing I	
MICRO 407	Microbiological Safety of Foods of Animal Origins	
Total Credits		15-16

Students majoring in Animal Science will not be allowed to count the 9 required credits (270, 270L, 360, 460) toward their Animal Science degree. Students interested in the Meat Science minor should contact an Animal Science adviser.

Animal Science, B.S. - GENERAL

Freshman

Fall	Credits	Spring	Credits
AN S 110	1	AN S 114	2
AN S 101	2	CHEM 177, 177L or CHEM 163, 163L	5
BIOL 211	3	Humanities - elective list	3
BIOL 211L	1	SP CM 212, AGEDS 311, or COMST 214	3
ENGL 150	3	STAT 101 104, or 226	3-4
LIB 160	1		
MATH 140, 150, 160, 165, or 181	3-4		
Soc. Sci. - elective list	3		
	17-18		16-17

Sophomore

Fall	Credits	Spring	Credits
AN S 211	1	AN S 210	1
AN S 200 - elective list	3	AN S 214	3
AN S 200 - elective list	3	AN S 214L	1
BIOL 212	3	AN S 200 - elective list	3
BIOL 212L	1	ENGL 250	3
BBMB 221	3	MICRO 201 & 201L or MICRO 302 & 302L	3-4
ECON 101, 102 or ACCT 284	3	Free elective	3
	17		17-18

Junior

Fall	Credits	Spring	Credits
AN S 319	3	AN S 320	3
AN S 331	3	AN S 352	3
GEN 320 or BIOL 313	3	AN S 300 - elective list	3
U.S. Diversity - elective list	3	Ethics -elective list	3
Free elective	3	Free elective	3
	15		15

Senior

Fall	Credits	Spring	Credits
AN S 411	1	AN S 400 - Option 2	3
AN S 400 - Option 1	3	International Perspective - elective list	3
ENGL 302, 309, 312, or 314	3	Free elective	3
Free elective	3	Free elective	3
Free elective	3	Free elective	4
Free elective	3		
	16		16

Important Note: This is only one of many equally-sound schedule sequences.

Free electives and specified group electives are chosen to complement the student's "specialized degree option' or other career interest. Lists of courses that satisfy group requirements are maintained int he Animal science advising offices. Degree options are explained in AN S 100 and through appointments with the stude4nt's academic adviser in Animal Science. Specialized options include: General Animal Science, Animal Products, Companion Animal Management, Equine Management, Livestock Management, Pre-Graduate Studies and Pre-Veterinary Medicine.

Animal Science, B.S. - pre-veterinary medicine

Freshman

Fall	Credits	Spring	Credits
AN S 110	1	AN S 114	2
AN S 101	2	CHEM 177	4
BIOL 211	3	CHEM 177L	1
BIOL 211L	1	Humanities - elective list	3
ENGL 150	3	SP CM 212, AGEDS 311, or COMST 214	3
LIB 160	1	STAT 101 or 226	3-4
MATH 140, 150, 160, 165, or 181	3-4		

Soc. Sci. - elective list	3		
	17-18		16-17

Sophomore

Fall	Credits	Spring	Credits
AN S 211	1	AN S 214	3
AN S 200 - elective list	3	AN S 214L	1
AN S 200 - elective list	3	AN S 200 - elective list	3
BIOL 212	3	CHEM 331	3
BIOL 212L	1	CHEM 331L	1
CHEM 178	3	ENGL 250	3
ECON 101, 102 or ACCT 284	3	Ethics - elective list	3
	17		17

Junior

Fall	Credits	Spring	Credits
AN S 210	1	AN S 320	3
AN S 319	3	AN S 352	3
AN S 331	3	AN S 300 - elective list	3
GEN 320 or BIOL 313	3	BBMB 301	3
CHEM 332	3	US Diversity - elective list	3
MICRO 201 & 201L or MICRO 302 & 302L	3-4		
	16-17		15

Senior

Fall	Credits	Spring	Credits
AN S 411	1	AN S 400 - Option 2	3
AN S 400 - Option 1	3	International Perspective - elective list	3
ENGL 302, 309, 312, or 314	3	Free elective	3
PHYS 111	5	Free elective	3
Free elective	3	Free elective	3
Free elective	2		
	17		15

Important Note: This is only one of many equally-sound schedule sequences.

* Credits currently required for application to Veterinary Medicine program at ISU (60 credits)

General Chemistry with lab (7)
Organic Chemistry with lab (7)
Biochemistry (3)
General Physics with lab (4)
General Biology with lab (8)
Genetics (3)
Mammalian Anatomy and/or Physiology (3)
English Composition (6)
Oral Communication (3)
Humanities and/or Social Sciences (8)
Other Electives (8)

Graduate Study

The department offers work for the degrees master of science and doctor of philosophy with majors in animal breeding and genetics; meat science; animal physiology; animal science; and an interdepartmental program in nutritional sciences which has an option in animal nutrition. Minor work is offered in these areas to students taking major work in other departments.

A strong undergraduate program is required for students interested in graduate study. Fundamental training in biology, chemistry, mathematics, and statistics is requisite to a satisfactory graduate program. Graduate programs in animal science include supporting work in areas such as agricultural engineering, agronomy; anatomy; biochemistry; chemistry; economics; environmental science; food science and human nutrition; genetics; microbiology; physics; physiology; and statistics. Students may choose graduate programs involving a co-major with one of these areas. Graduate work in meat science is offered as a co-major in animal science and food science and human nutrition.

The department also cooperates in the interdepartmental program in professional agriculture and interdepartmental majors in genetics, immunobiology, microbiology, MCDB (molecular, cellular, and developmental biology), neuroscience, nutritional sciences, and toxicology (see Index).

The foreign language requirement, if any, is established on an individual basis by the program-of-study committee appointed to guide the work of the student.

Courses primarily for undergraduates:

AN S 101: Working with Animals
(1-2) Cr. 2. F.S.
A hands-on introductory course in skills for proper care and management of domestic animals. Husbandry skills including health observation, animal movement, identification, management procedures, and environmental assessment are covered.

AN S 110: Orientation in Animal Science and ISU
(2-0) Cr. 1. F.S.
Orientation to the university and Department of Animal Science. Challenges and opportunities available to the professional animal agriculturalist. Professional goal setting, portfolio development, and development of interpersonal skills in the context of pursuing a career in animal science.

AN S 114: Survey of the Animal Industry
(2-0) Cr. 2. F.S.
Ways domestic animals serve the basic needs of humans for food, shelter, protection, fuel, and emotional well-being. Terminology, basic structures of the industries surrounding the production, care, and marketing of domestic animals in the U.S.

AN S 116: Practicum in Safe Equine Handling and Welfare
(0-3) Cr. 1. F.SS.
Development of best practices for safe horse handling and practical equine health care tasks. Course will focus on equine welfare and human safety as well as provide training in necessary every day skills needed to own a horse or to work at a horse farm. Certificate of Safe Equine Handling and Welfare available upon course completion. Offered on satisfactory - fail grading basis only. Offered on a satisfactory-fail basis only.

AN S 190: Livestock Handling, Safety and Welfare
Cr. 2.
Prereq: AN S 101
Understanding of animal perception to develop best care practices involved in handing of livestock species (beef, sheep, swine, dairy, equine, poultry). Intensive development of skills associated with handling and moving healthy and compromised livestock in respect to human and animal welfare. Integration of scientific and theoretical knowledge of biosecurity and animal-human interactions as it related to livestock handling and movement.

AN S 199: Marketing and Management of Livestock Events
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Credit or enrollment in AN S 101 or AN S 114
Management and coordination of livestock shows, sales and events, including program planning, staff and volunteer management, time management, publicity and promotion for fairs, shows, clinics, expos, and other events. For section E students are expected to take the fall and spring courses consecutively. Offered on a satisfactory-fail basis only. A maximum of two credits of AnS 199 may be applied toward the total credits required for graduation.

AN S 199A: Marketing and Management of Livestock Events: Beef
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Credit or enrollment in AN S 101 or AN S 114
Management and coordination of livestock shows, sales and events, including program planning, staff and volunteer management, time management, publicity and promotion for fairs, shows, clinics, expos, and other events. For section E students are expected to take the fall and spring courses consecutively. Offered on a satisfactory-fail basis only. A maximum of two credits of AnS 199 may be applied toward the total credits required for graduation.

AN S 199E: Marketing and Management of Livestock Events: Horses
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Credit or enrollment in AN S 101 or AN S 114
Management and coordination of livestock shows, sales and events, including program planning, staff and volunteer management, time management, publicity and promotion for fairs, shows, clinics, expos, and other events. For section E students are expected to take the fall and spring courses consecutively. Offered on a satisfactory-fail basis only. A maximum of two credits of AnS 199 may be applied toward the total credits required for graduation.

AN S 207: The Art and Heritage of Livestock
(3-0) Cr. 3.
Using art as a venue to understand the legacy and heritage of livestock production and livestock's contribution to civilization and society; livestock's contributions to warfare, social class, industry, economies, etc.; history of the impact of livestock on painting, poetry, music, sculpture, advertising, pop culture, movies, religion and sports in society.

AN S 210: Career Preparation in Animal Science
(0-2) Cr. 1. F.S.
Prereq: Sophomore classification in An S
Life skill development emphasized in the context of career preparation. Assist students with career goal clarification, interview skills, resume and cover letter preparation. Internship development, job shadowing, and exploration of career option.

AN S 211: Issues Facing Animal Science
(0-2) Cr. 1. F.S.
Prereq: AN S 114, sophomore classification
Overview of the factors that define contemporary ethical and scientifically based issues facing animal agriculture. Life skill development (including interactive skills, communication ability, organization, information gathering, and leadership skills) emphasized in the context of issues study. Offered on a satisfactory-fail basis only.

AN S 214: Domestic Animal Physiology
(3-0) Cr. 3. F.S.
Prereq: BIOL 212, CHEM 163 or CHEM 177
Introduction to anatomy and physiology of the muscular, renal, skeletal, neural, mammary, cardiovascular, respiratory, immune, endocrine, reproductive, and digestive systems of domestic animals.

AN S 214L: Domestic Animal Anatomy and Physiology Lab
(0-2) Cr. 1. F.S.
Prereq: Concurrent enrollment in AN S 214
Basic anatomy of domestic animals.

AN S 216: Equine Science
(2-2) Cr. 3. F.S.SS.
Prereq: AN S 101 or AN S 114; one course in biology
Introduction to contemporary concepts, and basic practices and decisions necessary when managing horses through stages of their lives.

AN S 217: Equine Farm Practicum
(1-2) Cr. 2. F.
Prereq: Student majoring in Animal Science, riding experience An S, credit or concurrent enrollment in AN S 216
Intensified management of the equine farm. Provide students with experiential learning in all phases of horse production and management. Students assist with general farm management, preparing horses for sale, marketing techniques and web design.

AN S 223: Poultry Science
(2-2) Cr. 3. F.
Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising poultry through their production cycle.

AN S 224: Companion Animal Science
(2-2) Cr. 3. S.
Prereq: Course in biology
Introduction of students to contemporary concepts, and basic practices and decisions necessary when caring for the companion animal through stages of its life.

AN S 225: Swine Science
(2-2) Cr. 3. F.S.
Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising swine through the vertically integrated production cycle. Only AN S 280 and AN S 280L or AN S 225 may count toward graduation.

AN S 226: Beef Cattle Science
(2-2) Cr. 3. F.S.
Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising beef cattle through the vertically integrated production cycle.

AN S 229: Sheep Science
(2-2) Cr. 3. S.
Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising sheep through their production cycle.

AN S 235: Dairy Cattle Science
(2-2) Cr. 3. F.
Prereq: AN S 101, AN S 114
Introduction to principles, practices and decisions necessary when raising dairy cattle through the vertically integrated production cycle.

AN S 270: Foods of Animal Origin
(2-0) Cr. 2. F.S.SS.
Prereq: BIOL 212, CHEM 163 or CHEM 177
Principles, practices and issues impacting the production, processing and preservation of safe, wholesome, nutritious, and palatable meat, dairy, and egg products. Product evaluation, classification, value, and utilization.

AN S 270L: Foods of Animal Origin Laboratory
(0-2) Cr. 1. F.S.
Prereq: Credit or current enrollment in AN S 270
Determination of composition and quality of meat, eggs and milk based on industry and USDA standards. Fundamentals of processing foods of animal orgin to add value, maintain quality and ensure safety.

AN S 280: Basic Swine Science
(2-0) Cr. 2.
Prereq: AN S 101 AN S 114
Basic disciplines and concepts involved in swine production including; industry structure, trends and statistics; production phases and buildings; genetic improvement; reproduction; nutrition; health and biosecurity; nutrient management; marketing and meat quality and career opportunities in the swine industry. Only AN S 280 and AN S 280L or AN S 225 may count toward graduation.

AN S 305: Livestock Evaluation
(0-6) Cr. 3. F.
Prereq: Junior classification; AN S 270L recommended
Fall semester leads to 475A or D. Breeding animal and market animal evaluation of beef, swine and sheep using contemporary techniques and tools. Communication and decision-making skills are practiced in the context of making selection decisions.

AN S 306: Equine Evaluation
(0-6) Cr. 3. S.
Prereq: sophomore classification or permission of instructor
Detailed visual evaluation of conformation and performance of the equine athlete. Decision-making skills are practiced in the context of making selection choices. Development of written and oral communication skills as students defend their judgments. Industry trends will be addressed.

AN S 313: Exercise Physiology of Animals
(2-0) Cr. 2. F.S.
Prereq: AN S 214, BIOL 211, one course in chemistry
Physiological adaptations to athletic training in canine and equine athletes. Topics of emphasis include exercise-related adaptations in metabolism, locomotion, the cardiovascular system, musculoskeletal system, and endocrine system. The roles of nutrition and conditioning programs are assessed.

AN S 317: Fundamentals of Equine Behavior and Training
(0-6) Cr. 1-3.
Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. A maximum of 4 credits of An S 317 may be applied toward graduation.

AN S 317A: Fundamentals of Equine Behavior and Training: Young Horses at Halter
(0-6) Cr. 1-3. F.
Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. A maximum of 4 credits of An S 317 may be applied toward graduation.

AN S 317B: Fundamentals of Equine Behavior and Training: Yearlings
(0-6) Cr. 3.
Prereq: Permission of instructor
Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. A maximum of 4 credits of An S 317 may be applied toward graduation.

AN S 317C: Fundamentals of Equine Behavior and Training: Two-year olds and older
(0-6) Cr. 3.
Modifying the behavior of the horse using systematic approaches to horse training emphasizing the psychology of training horses. Equipment and its use and preparation of horses for competition. A maximum of 4 credits of An S 317 may be applied toward graduation.

AN S 319: Animal Nutrition
(3-0) Cr. 3. F.S.
Prereq: AN S 214, course in organic chemistry or biochemistry
Structure and function of organic and inorganic nutrients. Digestion, absorption, metabolism and utilization of nutrients for maintenance and productive functions. Essential nutritive requirements of domestic livestock, poultry, and companion animals. Sources of nutrients, application of energy systems and concepts, and regulation of feed intake in animals.

AN S 320: Animal Feeds and Feeding
(2-2) Cr. 3. F.S.
Prereq: AN S 319
Composition, physical properties, and storage and processing of feedstuffs. Nutrient requirements of and diet formulation, and preparation systems for food and companion animal species at varying stages of age, activity or production. Manual and computer methodologies for diet formulation.

AN S 324: Food Processing for Companion Animals
(3-0) Cr. 3. F.
Prereq: AN S 319, Junior Classification
Food processing and nutrition for carnivorous companion animals. Topics covered include meat processing and meat preservation for companion animal diets, regulatory standards, cutting edge technologies for processing meat for companion animals, dietary needs of carnivorous companion animals, effect of different processing methods on safety and nutrient bioavailability.

AN S 331: Domestic Animal Reproduction
(3-0) Cr. 3. F.S.
Prereq: Course in physiology
Comparative anatomy, physiology, and endocrinology of domestic mammalian animal reproduction. Techniques for the control and manipulation of reproductive processes.

AN S 332: Laboratory Methods in Animal Reproduction
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in AN S 331
Reproductive anatomy with emphasis on the physiology of normal reproductive function; ways to control and improve reproduction; principles of semen collection and artificial insemination; pregnancy testing; selected laboratory exercises with written report.

AN S 332A: Laboratory Methods in Animal Reproduction: Livestock, Companion, and Laboratory Animals
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in AN S 331.
Comparative reproductive anatomy with emphasis on the physiology of normal reproductive function; ways to control and improve reproduction; principles of semen collection and artificial insemination; pregnancy testing; selected laboratory exercises with written report.

AN S 332E: Laboratory Methods in Animal Reproduction: Equine
(0-2) Cr. 1. S.
Prereq: Credit or enrollment in AN S 331.
Reproductive anatomy with emphasis on the physiology of normal reproductive function; breeding season management; ways to control and improve reproduction; semen collection, evaluation, and processing; artificial insemination; pregnancy testing; parturition in the mare, foal care; selected laboratory exercises with written report.

AN S 333: Embryo Transfer and Related Technologies
(3-0) Cr. 3. F.
Prereq: AN S 331 or AN S 332
Application of embryo transfer and related technologies to genetic improvement of mammalian livestock. Techniques for control of female reproduction, embryo collection and transfer, embryo cryopreservation, and embryo manipulation. Gender selection. Economic and genetic aspects of embryo transfer.

AN S 334: Embryo Transfer Laboratory
(0-3) Cr. 1. F.
Prereq: Credit or concurrent enrollment in AN S 333; AN S 332 or VDPAM 416; permission of instructor
Selected laboratory exercises related to embryo transfer such as synchronization of estrus, superovulation, detection of estrus, artificial insemination, embryo collection, embryo evaluation, microscopy, embryo cryopreservation, in vitro fertilization, embryo sexing, rectal palpation, and ultrasonography will be demonstrated and/or performed.

AN S 335: Dairy Cattle Evaluation
(0-6) Cr. 3. S.
Prereq: Sophomore classification
Evaluation of breeding animals for dairy herds. Comparative terminology, decision making, and presentation of oral reasons. Trips to dairy cattle farms. Livestock handling.

AN S 336: Domestic Animal Behavior and Well-Being
(2-2) Cr. 3. F.
Prereq: One course in physiology
Principles of behavior relative to animal care, management and environmental design to ensure animal well-being. Examination of basic neural-endocrine mechanisms involved in the animal's response to its environment. Awareness of animal protection, law and legislation. Methods to objectively assess animal well-being.

AN S 337: Lactation
(3-0) Cr. 3. S.
Prereq: AN S 214
The structure, development and evolution of the mammary gland. Mammary metabolism, milk synthesis; neural and endocrine regulation of mammary function. Immune function and health of the mammary gland. Current events related to lactation.

AN S 345: Growth and Development of Domestic Animals
(3-0) Cr. 3. S.
Prereq: AN S 214; BIOL 313 or GEN 320
Basic principles of animal growth and development covered at the tissue, cellular and molecular level. Emphasis placed on skeletal muscle, adipose, bone, and immune system growth and development. The effects of genetics, nutrition, and pharmaceuticals on growth.

AN S 352: Genetic Improvement of Domestic Animals
(2-2) Cr. 3. F.S.
Prereq: One course in statistics, BIOL 211, course in genetics
Principles of qualitative and quantitative genetics applied to creating change in domestic animals. Impact of selection and mating schemes in achieving breeding program goals. Applications and impacts of biotechnological advancements in genetic manipulation.

AN S 360: Fresh Meats
(3-0) Cr. 3. F.
Prereq: AN S 270; a course in organic or biochemistry
Impact of muscle structure, composition, rigor mortis, inspection, fabrication, handling, packaging and cooking on the palatability, nutritional value, yields, market value, and safety of fresh meat.

AN S 382: Swine Environment Management
(1-0) Cr. 1.
Prereq: AN S 225 or 280 and 280L. Recommended TSM 210.
Response of swine to thermal environment, ventilation system design and analysis, heating and cooling systems, and examples of various designs for all phases of production. Troubleshooting ventilation systems and energy analysis of production units.

AN S 383: Swine Manure and Nutrient Management
(1-0) Cr. 1.
Prereq: An S 225 or An S 280 and An S 280L.
Function, application, and advantages and disadvantages of nutrient management systems. Manure production rates, manure handling systems, storage and manure management planning for land application and odor mitigation strategies.

AN S 384: Swine Health and Biosecurity
(1-0) Cr. 1.
Prereq: AN S 225 or An S 280 and An S 280L. Recommended a course in microbiology.
Overview of standard biosecurity protocols and identification of behavior and clinical signs of illness in pigs. Treatment administration and prevention methods. Introduction to immune system function and basic swine disease transmission.

AN S 399: Animal Science Internship
Cr. arr. Repeatable. F.S.SS.

AN S 399A: Animal Science Internship: Graded Internship Experience
Cr. 2-6. Repeatable. F.S.SS.
Prereq: Permission of the instructor
Learning experience focused on professional development for a career related to animal science. Journal, presentation, and creative component.

AN S 399B: Animal Science Internship: Supervised Internship Experience
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the instructor
Learning experience focused on professional development for a career related to animal science. Journal, presentation, and creative component.

AN S 411: Addressing Issues in Animal Science
(0-2) Cr. 1. F.S.
Prereq: Senior classification in An S
Life skill development emphasized in the context of exploring one's perspective of the most pressing moral and scientific issues facing animal agriculture. Clarification and communication of personal conclusions in small and large group settings expected.

AN S 415: Equine Systems Management
(2-2) Cr. 3. F.S.
Prereq: AN S 216, AN S 319, AN S 320, AN S 331
Identification and development of financial and production goals in a horse business. Scientific approach to make decisions in management of enterprises in the horse industry.

AN S 419: Advanced Animal Nutrition
(2-0) Cr. 2. F.
Prereq: AN S 214, AN S 319, AN S 320
Detailed consideration of digestion, metabolism, and assimilation of nutrients. Recent advances and developments in basic nutrition.

AN S 424: Companion Animal Systems Management
(2-2) Cr. 3. S.
Prereq: AN S 224, AN S 319, AN S 320, AN S 331, AN S 352
Decisions facing the administrator of a companion animal enterprise. Financial and business goal identification, problem clarification, and resource allocation to manage the companion animal system.

AN S 425: Swine Systems Management
(2-2) Cr. 3. F.
Prereq: AN S 225, AN S 270, AN S 270L, AN S 319, AN S 320, AN S 331, AN S 352; ECON 230 or equivalent recommended
Decisions facing the administrator of a swine enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the swine enterprise.

AN S 426: Beef Cattle Systems Management
(2-2) Cr. 3. F.S.
Prereq: AN S 226, AN S 270, AN S 270L, AN S 319, AN S 320, AN S 331, AN S 352; ECON 230 or equivalent recommended
Decisions facing the administrator of a beef cow-calf or feedlot enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the beef enterprise.

AN S 429: Sheep Systems Management
(2-2) Cr. 3. S.
Prereq: AN S 229, AN S 319, AN S 320, AN S 331, AN S 352; AGRON 334 recommended; ECON 230 or equivalent recommended
Decisions facing the administrator of a sheep enterprise. Financial and production goal identification, problem clarification, and resource allocation to manage the sheep enterprise.

AN S 434: Dairy Systems Management
(3-0) Cr. 3. F.
Prereq: AN S 235, AN S 319, AN S 331, AN S 320, AN S 337, AN S 352; ECON 230 or equivalent recommended
The scientific foundation of dairy cattle management. The impact of dairy farm management practices on the biological processes of the cow. Integrates concepts from the disciplines of lactation, reproduction, nutrition, genetics, and animal health.

AN S 435: Applied Dairy Farm Evaluation
(2-2) Cr. 3. S.
Prereq: AN S S 434; ECON 230
Evaluate nutrition, reproduction, milk quality, breeding, and related management practices of commercial dairy herds in a case study format. Students will apply knowledge gained in the classroom to commercial dairy farm situations and develop skills in information gathering, decision making, problem solving, and interpersonal communications.

AN S 441: International Animal Agriculture
(Cross-listed with GLOBE). (3-0) Cr. 3. S.
Prereq: Two courses from AN S 223, AN S 225, AN S 226, AN S 229, AN S 235
An overview of animal agriculture with emphasis on animal agriculture in developing countries. Historical, economic, environmental; and political considerations will be assessed and evaluated. Issues related to gender, resilience and sustainability for different production systems will be investigated.
Meets International Perspectives Requirement.

AN S 460: Processed Meats
(Dual-listed with AN S 560). (2-2) Cr. 3. S.
Prereq: AN S 270
Physical, chemical and biological properties of meat important to processed meat product characteristics. Ingredients, technology and equipment used for cured meats, loaf products and fresh, cooked, dry and semi-dry sausage products.

AN S 475: Intercollegiate Judging Training and Competition
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475A: Intercollegiate Judging Training and Competition: Meat Animals
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475B: Intercollegiate Judging Training and Competition: Dairy Cattle
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475C: Intercollegiate Judging Training and Competition: Meats
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475D: Intercollegiate Judging Training and Competition: Meat Animal Evaluation
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475E: Intercollegiate Judging Training and Competition: Horses
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 475F: Intercollegiate Judging Training and Competition: Management Systems
(0-4) Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Specialized training in evaluation and grading of livestock, livestock products, and livestock production management plans. Maximum of 6 credits may be applied toward graduation.

AN S 480: Animal Industry Leadership Fellows
Cr. 1. Repeatable. F.S.
Prereq: A. AN S 226; permission of instructor C. AN S 225; permission of instructor
Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. This for-credit offering represents the central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only.

AN S 480A: Animal Industry Leadership Fellows: Beef
Cr. 1. Repeatable. F.S.
Prereq: AN S 226; permission of instructor
Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. This for-credit offering represents the central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only.

AN S 480C: Animal Industry Leadership Fellows: Pork
Cr. 1. Repeatable. F.S.
Prereq: AN S 225; permission of instructor
Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. This for-credit offering represents the central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only.

AN S 480G: Animal Industry Leadership Fellows: Poultry
Cr. 1. Repeatable. F.S.
Prereq: AN S 223; permission of instructor
Students broaden their perspective of the livestock industry through site visits, case-study (Fellows) projects, and cooperative learning experiences that capitalize on interaction skills in the context of studying the structure of the U.S. livestock industry. Central academic focus of the Iowa State University Animal Industry Leadership Fellows Program. Study is species specific, and enrollment is limited. Offered on a satisfactory-fail basis only.

AN S 489: Issues in Food Safety
(Cross-listed with FS HN, HSP M, VDPAM). (1-0) Cr. 1. S.
Prereq: Credit or enrollment in FS HN 101 or FS HN 272 or HSP M 233; FS HN 419 or FS HN 420; FS HN 403
Capstone seminar for the food safety minor. Case discussions and independent projects about safety issues in the food system from a multidisciplinary perspective.

AN S 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490A: Independent Study: Animal Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490B: Independent Study: Dairy Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490C: Independent Study: Meat Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490D: Independent Study: Companion Animal Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490E: Independent Study: Equine Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490G: Independent Study: Poultry Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of the instructor
Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490H: Independent Study: Honors

Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

Prereq: Permission of the instructor

Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 490I: Independent Study: Entrepreneurship

Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

Prereq: Permission of the instructor

Open to juniors and seniors in animal science and dairy science showing satisfactory preparation for problems chosen. Individual topic conference and preparation of report. A maximum of 6 credits of An S 490 may be applied toward the total credits required for graduation.

AN S 493: Workshop in Animal Science

Cr. 1-3. Repeatable.

Prereq: Permission of instructor

Workshop in livestock production. Includes current concepts in breeding, nutrition, reproduction, meats, and technologies that impact the animal industry.

AN S 495: Agricultural Travel Course Preparation

Cr. R. Repeatable. F.S.

Prereq: Permission of instructor

Limited enrollment. Students enrolled in this course will also register for Agron 495 and intend to register in Agron 496 and An S 496 the following term. Topics will include the agricultural industries, climate, crops, culture, history, livestock, marketing, soils, and preparation for travel to locations to be visited. Information normally available 9 months before departure.

AN S 496: Agricultural Travel Course

Cr. arr. Repeatable.

Prereq: Permission of instructor, 30 college credits

Limited enrollment. Students enroll in both An S 496 and Agron 496. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on livestock and crop production. Locations and duration of tours will vary. Summer tour will usually visit a northern location and winter tour will usually visit a southern location. Information usually available 9 months before departure. Tour expenses paid by students.

AN S 496A: Agricultural Travel Course: International Tour

Cr. arr. Repeatable.

Prereq: Permission of instructor, 30 college credits

Limited enrollment. Students enroll in both An S 496 and Agron 496. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on livestock and crop production. Locations and duration of tours will vary. Summer tour will usually visit a northern location and winter tour will usually visit a southern location. Information usually available 9 months before departure. Tour expenses paid by students.

Meets International Perspectives Requirement.

AN S 496B: Agricultural Travel Course: Domestic tour

Cr. arr. Repeatable.

Prereq: Permission of instructor, 30 college credits

Limited enrollment. Students enroll in both An S 496 and Agron 496. Tour and study of production methods in major crop and livestock regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, and other factors on livestock and crop production. Locations and duration of tours will vary. Summer tour will usually visit a northern location and winter tour will usually visit a southern location. Information usually available 9 months before departure. Tour expenses paid by students.

AN S 497: Undergraduate Teaching Experiences in Animal Science

Cr. 1-2. Repeatable, maximum of 4 credits. F.S.SS.

Prereq: Permission of instructor

Development of oral and written communication skills of technical concepts in animal science. Emphasis on organizational skills, conducting activities and interpersonal communication skills. Responsibilities in a class under direct supervision of a faculty member. A maximum of 4 credits of An S 497 may be applied toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

AN S 500: Computer Techniques for Biological Research

(2-0) Cr. 1. F.

Introduction to UNIX and SAS for solving research problems, including organization of data files, transfer of files between workstations, developing models, and techniques for analysis of designed experiments. Introduction to matrix algebra for solving animal breeding problems using MATLAB and computer simulation.

AN S 500A: Computer Techniques for Biological Research: UNIX and SAS
(2-0) Cr. 1. F.
First half semester course. Introduction to UNIX and SAS for solving research problems, including organization of data files, transfer of files between workstations, developing models, and techniques for analysis of designed experiments. Introduction to matrix algebra for solving animal breeding problems using MATLAB and computer simulation.

AN S 500B: Computer Techniques for Biological Research: Problem solving using matrix algebra
(2-0) Cr. 1. F.
Second half semester course. Introduction to UNIX and SAS for solving research problems, including organization of data files, transfer of files between workstations, developing models, and techniques for analysis of designed experiments. Introduction to matrix algebra for solving animal breeding problems using MATLAB and computer simulation.

AN S 501: Survey of Animal Disciplines
(1-0) Cr. 1. F.
Required for Animal Science graduate students. Orientation to departmental and graduate school policies and procedures. Discussion of programs of research and outreach in Animal Science. Issues impacting the animal industry. Offered on a satisfactory-fail basis only.

AN S 503: Seminar in Animal Production
(1-0) Cr. 1. Repeatable. F.
Prereq: Permission of instructor
Discussion and evaluation of current topics in animal production and management.

AN S 515: Integrated Crop and Livestock Production Systems
(Cross-listed with A B E, AGRON, SUSAG). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: SUSAG 509
Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms.

AN S 518: Digestive Physiology and Metabolism of Non Ruminants
(Cross-listed with NUTRS). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: AN S 419 or NUTRS 501
Digestion and metabolism of nutrients. Nutritional requirements and current research and feeding programs for poultry and swine.

AN S 520: Digestive Physiology and Metabolism of Ruminants
(Cross-listed with NUTRS). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: AN S 419 or NUTRS 501
Digestive physiology and nutrient metabolism in ruminant and preruminant animals.

AN S 533: Physiology and Endocrinology of Animal Reproduction
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: General physiology course
Development of structure and function of the reproductive system. Physiologic and endocrine aspects including puberty, gametogenesis, estrous cycle, pregnancy, maternal recognition, fertilization and early embryonic development.

AN S 536: Perinatology
(2-0) Cr. 2. S.
Prereq: One course in physiology; one course in biochemistry
Regulation of metabolism and development in the mammalian fetus and neonate is explored in a comparative manner. Emphasis will be on the dynamic changes in these relationships occurring at birth.

AN S 537: Topics in Animal Behavior, Welfare
(3-0) Cr. 3.
Prereq: permission of instructor; M.S. or Ph.D. student
Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

AN S 537A: Topics in Animal Behavior, Welfare: Animal Behavior
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor; M.S. or Ph.D. student
Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

AN S 537B: Topics in Animal Behavior, Welfare: Contemporary Issues.
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor; M.S. or Ph.D. student
Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

AN S 537C: Topics in Animal Behavior, Welfare: Animal Welfare
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: permission of instructor; M.S. or Ph.D. student
Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

AN S 537D: Topics in Animal Behavior, Welfare: Immune and Stress
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor; M.S. or Ph.D. student
Each semester, the students' focus is on different topics related to animal behavior, animal welfare and contemporary issues related to animal behavior and welfare. Each topic is separate and distinct, and students may enroll in multiple topics. This is an on-line course only. Each topic may be taken only one time for credit.

AN S 540: Livestock Immunogenetics
(Cross-listed with MICRO, V MPM). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: AN S 561 or MICRO 575 or V MPM 520
Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance.

AN S 549: Advanced Vertebrate Physiology I
(Cross-listed with KIN, NUTRS). (4-0) Cr. 4. F.
Prereq: Biol 335; credit or enrollment in BBMB 404 or BBMB 420
Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems.

AN S 552: Advanced Vertebrate Physiology II
(Cross-listed with KIN, NUTRS). (3-0) Cr. 3. S.
Prereq: BIOL 335; credit or enrollment in BBMB 404 or BBMB 420
Cardiovascular, renal, respiratory, and digestive physiology.

AN S 556: Current Topics in Genome Analysis
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BBMB 405 or GDCB 510
Introduction to principles and methodology of molecular genetics useful in analyzing and modifying large genomes.

AN S 560: Processed Meats
(Dual-listed with AN S 460). (2-2) Cr. 3. S.
Prereq: AN S 270
Physical, chemical and biological properties of meat important to processed meat product characteristics. Ingredients, technology and equipment used for cured meats, loaf products and fresh, cooked, dry and semi-dry sausage products.

AN S 561: Population and Quantitative Genetics for Breeding
(Cross-listed with AGRON). (4-0) Cr. 4. F.
Prereq: STAT 401
Population and quantitative genetics for plant and animal genetics. Study of the genetic basis and analysis of variation in quantitative traits in domestic or experimental populations using phenotypic and molecular marker data, including estimation of heritability and other genetic parameters, linkage analysis and mapping of quantitative trait loci, and the impact of inbreeding, heterosis, and genotype-by-environment interaction.

AN S 562: Methodologies for Population/Quantitative Genetics
(2-0) Cr. 2. S.
Prereq: AN S 561, STAT 402
Basic theory for genetic analysis of animal breeding data. Course A (1st half semester) covers linear models, selection index methods, and basic theory for best linear unbiased prediction. Course B (2nd half semester) best linear unbiased prediction, including genetic groups, environmental adjustment, repeated records, multiple trait models, maternal effects models, and theory for maximum likelihood estimation of genetic parameters.

AN S 562A: Methodologies for Population/Quantitative Genetics: Linear Models and Genetic Prediction
(2-0) Cr. 2. S.
Prereq: AN S 561, STAT 402
Basic theory for genetic analysis of animal breeding data. Course A (1st half semester) covers linear models, selection index methods, and basic theory for best linear unbiased prediction. Course B (2nd half semester) best linear unbiased prediction, including genetic groups, environmental adjustment, repeated records, multiple trait models, maternal effects models, and theory for maximum likelihood estimation of genetic parameters.

AN S 562B: Methodologies for Population/Quantitative Genetics: Advanced Genetic Prediction&Parameter Estimation
(2-0) Cr. 2. S.
Prereq: AN S 561, STAT 402
Basic theory for genetic analysis of animal breeding data. Course A (1st half semester) covers linear models, selection index methods, and basic theory for best linear unbiased prediction. Course B (2nd half semester) best linear unbiased prediction, including genetic groups, environmental adjustment, repeated records, multiple trait models, maternal effects models, and theory for maximum likelihood estimation of genetic parameters.

AN S 570: Advanced Meat Science and Applied Muscle Biology
(2-2) Cr. 3. S.
Prereq: AN S 460
Ante and postmortem factors impacting composition, structure, and chemistry of red meat and poultry muscle/meat, the conversion of muscle to meat, and the sensory and nutritional attributes of fresh meats. Oral research reports and a research proposal.

AN S 571: Advanced Meat Processing Principles and Technology
(2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: AN S 460 or AN S 570
Physical/chemical relationships during processing. Effects of modern technology, non-meat additives and preservation techniques on quality and safety of processed meat. Laboratory demonstration of principles and technology.

AN S 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590A: Special Topics: Animal Breeding
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590B: Special Topics: Animal Nutrition
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590C: Special Topics: Meat Animal Production
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590D: Special Topics: Dairy Production
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590E: Special Topics: Meat Science
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590F: Special Topics: Physiology of Reproduction
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590G: Special Topics: Muscle Biology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590H: Special Topics: Poultry Nutrition
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590I: Special Topics: Poultry Products
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590J: Special Topics: Experimental Surgery
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590K: Special Topics: Professional Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590L: Special Topics: Teaching
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590M: Special Topics: Molecular Biology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 590N: Special Topics: Ethology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Special topics in the animal sciences, offered on demand and may be conducted by guest professors.

AN S 599: Creative Component
Cr. 1-8. F.S.SS.
Prereq: Nonthesis M.S
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AN S 599A: Creative Component: Animal Breeding and Genetics
Cr. 1-8. F.S.SS.
Prereq: Nonthesis M.S
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AN S 599B: Creative Component: Animal Nutrition
Cr. 1-8. F.S.SS.
Prereq: Nonthesis M.S
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AN S 599C: Creative Component: Animal Physiology
Cr. 1-8. F.S.SS.
Prereq: Nonthesis M.S
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AN S 599D: Creative Component: Animal Science
Cr. 1-8. F.S.SS.
Prereq: Nonthesis M.S
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

AN S 599E: Creative Component: Meat Science
Cr. 1-8. F.S.SS.
Prereq: Nonthesis M.S
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

Courses for graduate students:

AN S 603: Seminar in Animal Nutrition
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor
Discussion of current literature; preparation and submission of abstracts.

AN S 618: Vitamins and Minerals
(Cross-listed with NUTRS). Cr. 2. Alt. S., offered even-numbered years.
Prereq: Biochemistry, physiology, basic nutrition
Understanding molecular aspects of vitamin and mineral metabolism and homeostasis in humans and animals. An in-depth examination of the chemistry of vitamins and minerals, including genetic mutations, proteins involved in absorption and excretion, and their necessity in biological processes.

AN S 619: Advanced Nutrition and Metabolism - Protein
(Cross-listed with NUTRS). (2-0) Cr. 2. F.
Prereq: BBMB 405
Digestion, absorption, and intermediary metabolism of amino acids and protein. Regulation of protein synthesis and degradation. Integration of cellular biochemistry and physiology of mammalian protein metabolism.

AN S 620: Advanced Nutrition and Metabolism - Energy
(Cross-listed with NUTRS). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: BBMB 405
Energy constituents of feedstuffs and energy needs of animals as related to cellular biochemistry and physiology. Interpretations of classical and current research.

AN S 633: Seminar in Animal Reproduction
(1-0) Cr. 1. Repeatable. F.
Prereq: Permission of instructor
Discussion of current literature and preparation of reports and seminars on selected topics concerning animal physiology.

AN S 652: Animal Breeding Strategies
(2-0) Cr. 2.
Prereq: AN S 561
Basic concepts and methods for design and evaluation of genetic improvement programs for livestock. Topic A. (1st half semester) Prediction of response to selection, selection index theory, multiple trait selection, inbreeding, crossbreeding, and marker-assisted selection. Topic B. (2nd half semester) Advanced concepts in design and evaluation of animal breeding programs, including modeling and optimization, derivation of economic values, gene-flow, and predicting rates of inbreeding. Each topic may be taken only one time for academic credit.

AN S 652A: Animal Breeding Strategies: Breeding Goals and Response to Selection
(2-0) Cr. 2.
Prereq: AN S 561
Basic concepts and methods for design and evaluation of genetic improvement programs for livestock. Topic A. (1st half semester) Prediction of response to selection, selection index theory, multiple trait selection, inbreeding, crossbreeding, and marker-assisted selection. Topic B. (2nd half semester) Advanced concepts in design and evaluation of animal breeding programs, including modeling and optimization, derivation of economic values, gene-flow, and predicting rates of inbreeding. Each topic may be taken only one time for academic credit.

AN S 652B: Animal Breeding Strategies: Design and Evaluation of Animal Breeding Programs
(2-0) Cr. 2.
Prereq: AN S 561
Basic concepts and methods for design and evaluation of genetic improvement programs for livestock. Topic A. (1st half semester) Prediction of response to selection, selection index theory, multiple trait selection, inbreeding, crossbreeding, and marker-assisted selection. Topic B. (2nd half semester) Advanced concepts in design and evaluation of animal breeding programs, including modeling and optimization, derivation of economic values, gene-flow, and predicting rates of inbreeding. Each topic may be taken only one time for academic credit.

AN S 653: Applied Animal Breeding Strategies
(2-0) Cr. 2. F.
Prereq: AN S 561 recommended
Industrial applications of breeding systems, selection methods, and new genetic technologies. One or more field trips to an industry breeding company.

AN S 653A: Applied Animal Breeding Strategies: Swine and Poultry
(2-0) Cr. 2. F.
Prereq: AN S 561 recommended
Industrial applications of breeding systems, selection methods, and new genetic technologies. One or more field trips to an industry breeding company.

AN S 653B: Applied Animal Breeding Strategies: Beef and Dairy
(2-0) Cr. 2. F.
Prereq: AN S 561 recommended
Industrial applications of breeding systems, selection methods, and new genetic technologies. One or more field trips to an industry breeding company.

AN S 655: Advanced Computational Methods in Animal Breeding and Genetics
(3-1) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: AN S 500, AN S 562, Com S 207
Computational methods and strategies for analysis of large data sets with animal breeding data for use in research and industry applications. Course A (1st half semester) Strategies for handling large sets and for prediction using best linear unbiased prediction using a formal language and utility programs. Course B (2nd half semester) Strategies for estimation of genetic parameters and for use of non-linear models for genetic analysis of categorical and survival type data.

AN S 655A: Computational Strategies for Predicting Breeding Values
(3-1) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: AN S 500, AN S 562, COM S 207
Computational methods and strategies for analysis of large data sets with animal breeding data for use in research and industry applications. Strategies for handling large sets and for prediction using best linear unbiased prediction using a formal language and utility programs.

AN S 655B: Computational Strategies for Genetic Parameter Estimation
(3-1) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: AN S 500, AN S 562, COM S 207
Computational methods and strategies for analysis of large data sets with animal breeding data for use in research and industry applications. Strategies for estimation of genetic parameters and for use of non-linear models for genetic analysis of categorical and survival type data.

AN S 656: Statistical Methods for Mapping Quantitative Trait Loci
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: AN S 562, STAT 447
Statistical methods for mapping quantitative trait loci in out-bred populations. Methods based on modeling covariances between relatives. Likelihood based methods using half-sib and full-sib families and extended pedigrees. Bayesian methods applied.

AN S 658: Seminar in Animal Breeding and Genetics
(1-0) Cr. 1. Repeatable. F.S.
Presentation of current research related to animal breeding and genetics.

AN S 670: Molecular Biology of Muscle
(Cross-listed with KIN). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BBMB 405, BBMB 420, or BBMB 502
Ultrastructure of muscle; chemistry, structure, function, and molecular biology of muscle proteins. Molecular aspects of muscle contraction, development and turnover. Cytoskeletal proteins and dynamics.

AN S 684: Seminar in Meat Science
(1-0) Cr. 1. Repeatable. S.
Prereq: Permission of instructor
Discussion and evaluation of current topics in research publications in meat science.

AN S 685: Seminar in Muscle Biology
(1-0) Cr. 1. Repeatable. S.
Prereq: Permission of instructor
Reports and discussion of recent literature and current investigations.

AN S 695: Seminar in Animal Science
(1-0) Cr. 1. Repeatable. S.
Reports and discussion of current issues and research in animal science. One credit is required for all M.S. degree candidates with graduate majors in the Department of Animal Science, and two credits are required for all Ph.D. candidates with graduate majors in the Department of Animal Science. Offered on a satisfactory-fail basis only.

AN S 699: Research
Cr. arr. Repeatable.

AN S 699A: Research: Animal Breeding
Cr. arr. Repeatable.

AN S 699B: Research: Animal Nutrition
Cr. arr. Repeatable.

AN S 699C: Research: Meat Animal Production
Cr. arr. Repeatable.

AN S 699D: Research: Dairy Production
Cr. arr. Repeatable.

AN S 699E: Research: Meat Science
Cr. arr. Repeatable.

AN S 699F: Research: Physiology of Reproduction
Cr. arr. Repeatable.

AN S 699G: Research: Muscle Biology
Cr. arr. Repeatable.

AN S 699H: Research: Poultry Nutrition
Cr. arr. Repeatable.

AN S 699I: Research: Poultry Products
Cr. arr. Repeatable.

AN S 699J: Research: Animal Ethology
Cr. arr. Repeatable.

Biology

Interdepartmental Undergraduate Program

Iowa State University is a major center for research and education in the biological sciences. With over 200 faculty in the life sciences, students have the opportunity to learn from some of the nation's leaders in biological research and teaching and to participate in innovative, meaningful research projects that explore frontiers of biology. Few other universities have such a wealth of faculty expertise available to undergraduate students, making Iowa State's Biology Program the logical choice for those who want to participate in a thriving academic community.

The faculties of the Department of Ecology, Evolution, and Organismal Biology and the Department of Genetics, Development, and Cell Biology jointly offer the undergraduate biology major. This high quality academic program has the flexibility to accommodate a range of career goals while taking advantage of the university's strengths in science and technology. A bachelor's degree in biology provides excellent preparation for graduate study in biological disciplines ranging from the molecular to the ecological levels, and for entrance into various professional schools, such as human medicine, physical therapy, or veterinary medicine. The major is well suited for those who plan to teach biology, who wish to enter government or industrial employment in health or environmental professions, or who prefer educational breadth as an end in itself. By working with our professional and faculty advisers, it is possible to design a unique program of study that will meet student needs and objectives.

Students with special interests and aptitudes should consider combining biology with a minor or a second major in another subject, such as chemistry, environmental studies, journalism, mathematics, music, statistics, or many other subjects offered by the university.

Customizing a degree

Biology encompasses an amazing diversity of disciplines and scales of study ranging from molecules to the biosphere. The Biology major offers a rich variety of coursework addressing most of the areas of biology. The major's curriculum requirements offer tremendous flexibility in creating an individualized program of study to facilitate achievement of a student's career goals, while simultaneously assuring some exposure to all areas of biology and providing complementary knowledge from supporting courses in chemistry, physics, and math/statistics.

While flexibility is the hallmark of the Biology major, the breadth of the field can also be challenging. Thus, in an effort to provide more guidance to students who desire such, the major also provides five advising tracks, or areas of specialization, for students who wish to focus on subfields of biology or who have specific career goals in mind. Course plans for each area of specialization are listed on the Biology web site. The areas are:

Pre-medical and Human Health Professions--This area emphasizes preparation for further study in medical school or allied human health professions such as dentistry, optometry, genetic counseling, physical therapy, occupational therapy, physician assistant, nursing, chiropractic, and others. It also will prepare students for a broad range of careers in

the biological sciences. Students are urged to determine the specific entrance requirements for the professional schools where they might study and to plan a program of study accordingly, in addition to following the basic plan.

Pre-veterinary--An eventual degree in Veterinary Medicine can lead to a wide variety of careers, including private clinical practice in small animal medicine or agricultural animal production. But, pre-veterinary students can also prepare themselves for careers in animal research, public health, laboratory animal medicine, food safety, regulatory medicine, and education. Specific requirements for entrance to the Iowa State Veterinary College or other schools should be consulted as programs of study are planned, in addition to following the basic plan.

Molecular and Cellular Biology--Students specializing in this field will explore the structure, function, and interactions of the molecules and sub-cellular features that make up living cells. This area is particularly designed for those who plan to pursue a career in research in molecular or cell biology or in related areas such as biochemistry, genetics, microbiology, developmental biology, human medicine, or veterinary medicine. Many students in this area will choose to go on to graduate school.

Ecology and Conservation Biology--Ecologists examine the interactions and relationships that living organisms have with each other and their environment. Conservation biologists study the nature and status of Earth's biodiversity with the aim of protecting species, their habitats, and ecosystems from excessive rates of extinction and loss. Students who choose this specialization may go on to work for a non-profit environmental group; an environmental consulting firm; a local, state, or federal agency; or other related organizations. Many students in this area will choose to go on to graduate school.

Evolution and Biodiversity--This area provides students with a sound understanding of evolutionary principles and the biological patterns that result from evolutionary change. Students have the opportunity to explore, in depth, the biodiversity found within a wide range of groups of organisms. Students who choose this specialization may go on to work for a non-profit environmental group; an environmental consulting firm; a local, state, or federal agency; or other related organizations. Many students in this area will choose to go on to graduate school.

Other opportunities

Teacher licensure--Biology majors seeking licensure to teach biology in secondary schools must meet requirements of the Teacher Education Program as well as those of the Biology Program. In addition, they must apply formally for admission to the teacher education program. See the section on Teacher Education for a list of licensure areas, degree requirements, and other information about this program.

Undergraduate research--Students who have interests in biological research are encouraged to become involved in the research projects of faculty members on campus. Those doing so may receive credit for the experience in BIOL 499 Undergraduate Research Experience. Making the effort to find a suitable research mentor and engaging in research work can be one of the most valuable experiences of an undergraduate education. Internship experiences are often available at other universities, zoos, museums, governmental and non-governmental entities focused on environmental issues, and industrial or government laboratories. Students participating in such projects may receive internship credit in BIOL 494 Biology Internship.

Field trip courses – The Biology Program offers two field trip courses: BIOL 393 (North American Field Trips in Biology) and BIOL 394 (International Field Trips in Biology). In recent years field trip opportunities to the Boundary Waters area of Minnesota, Honduras, and Spain have been available. These courses involve a pre-trip seminar followed by one-week to one-month long field trip at a time when academic year classes are not in session. The classes are low enrollment and allow extensive interaction between instructors and students in locations of biological interest.

International experience--Because major discoveries in science often result from global efforts, biology majors are encouraged to include an international or study abroad component in their degree programs. This can be done by participating in international field trips originating from the ISU campus in BIOL 394 International Field Trips in Biology. In addition, many students choose to study abroad, attending a university in another country for up to a year as an exchange student. Minors in a foreign language can also add an international emphasis to a degree in biology.

Courses offered at other locations

In addition to biological science courses taught on campus, students may take courses at various remote locations and arrange to have the credits count toward the advanced courses required in the biology major. Attending a summer field station adds an important component to an undergraduate program of study.

Gulf Coast Research Laboratory--The Gulf Coast Research Laboratory is affiliated with the University of Southern Mississippi. Iowa State students may register for marine biology courses and transfer credit to their degree programs under the number BIOL 480 Studies in Marine Biology. Written permission of the Biology Program Director is required for this arrangement.

Summer Biological Field Stations--Courses taken at summer field stations may be transferred to Iowa State University as credit in BIOL 481 Summer Field Studies. Such stations are found throughout the country and often offer courses that emphasize the adaptation of plants and

animals to unique environments. See www.biology.iastate.edu (http://www.biology.iastate.edu) for links to Iowa Lakeside Laboratory and other field stations in different biomes, e.g., marine/coastal, Great Lakes, taiga, deciduous forests, deserts, Rocky Mts., etc.

Organization for Tropical Studies--Iowa State students may register for courses in tropical biology taught in Costa Rica by the Organization for Tropical Studies. Credit is transferred to Iowa State as BIOL 482 Tropical Biology. For further information, contact the Biology Student Services Office in 103 Bessey Hall.

Undergraduate Study

Biology majors start their studies in the biological sciences by taking a two-semester long Principles of Biology course sequence:

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1

During the first year, students also take BIOL 110 Introduction to Biology and BIOL 111 Opportunities in Biology, which are half semester courses designed to introduce the student to the discipline of biology and opportunities for careers in biology. Students transferring into the Biology major take BIOL 112 in place of BIOL 110.

Students then explore, in any order depending on their interests, four upper-level core courses including: concepts of ecology in BIOL 312; the principles of genetics in BIOL 313 and BIOL 313L; cell and molecular biology in BIOL 314; and evolutionary biology in BIOL 315. Biology majors must take an additional 21 credits of advanced biological science courses at the 300 level, or above, from an approved list of courses. Many of these courses have as prerequisites BIOL 211/L and BIOL212/L, so students do not need to complete the four upper-level core courses before taking advanced courses. Of these advanced courses , at least 9 credits must be taken as BIOL courses, and a minimum of two BIOL laboratory or field courses must also be included.

Biology majors should carefully consider their selection of upper-level courses to allow them to emphasize one, or more, of the sub-disciplines of Biology relevant to their post-baccalaureate objectives. Most biology courses numbered 300 or above can be used to satisfy the additional credit requirement. Some courses taught in other departments can also be applied to the biology major. Advanced students should consider including 500 level courses in their programs. The Biology Program's web site has a complete listing of acceptable upper-level life science courses.

Biology majors must demonstrate competency in their understanding of the biological sciences. Thus, grades of C- or better in all biological science courses applied to the major are required. Furthermore, in order to graduate, a student must have a cumulative average in the major of at least 2.00.

General requirements

Students may earn the B.S. degree in Biology from either the College of Liberal Arts and Sciences or from the College of Agriculture and Life Sciences. Students in the College of Liberal Arts and Sciences must fulfill the foreign language and general education requirements for that college. Students in the College of Agriculture and Life Sciences must meet the general education requirements for that college. Contact the Student Services Office for details regarding differences in general education and course requirements that are specific to these colleges.

Supporting course requirements-- Understanding biology requires a basic understanding of the physical sciences and mathematics. Consequently, a minimum number of credits in general chemistry, organic chemistry, biochemistry, and physics is required. See the Biology Program Web Site for specific supporting science requirements.

The Math requirement is competency based. After demonstrating competency in algebra and trigonometry, biology majors must take two semesters of calculus; or two semesters of Statistics; or one semester of calculus and one semester of Statistics chosen from a list of approved courses available on the Biology Program Web Site and in the Biology Program Office.

Given the important role of communications in the modern sciences, biology majors must demonstrate communication competency by earning a minimum of C in ENGL 250 Written, Oral, Visual, and Electronic Composition or equivalent composition courses and in one advanced writing course numbered ENGL 302 through ENGL 316, or JL MC 347, or SP CM 212. (Students in the College of Agriculture and Life Sciences are required to earn a C or better in ENGL 150, as well.)

Minor

A minor in Biology is offered by the Biology Program. The minor requires 15 credits in Biology and includes the completion of the specific courses listed below and 7 credits in biology courses numbered 300 or above. Nine (9) credits of the required courses must apply only to the minor. For more information, see the Biology Program web site or contact the Student Services Office in 103 Bessey Hall.

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
Total Credits		8

Graduate Study

Biology is an undergraduate major only. Persons interested in graduate study in the biological sciences should apply directly to one of the life science graduate programs at Iowa State University. Interdepartmental graduate offerings in Bioinformatics and Computational Biology; Ecology and Evolutionary Biology; Genetics; Molecular, Cellular and Developmental Biology; Neuroscience; Plant Biology; Toxicology; Immunobiology; and Environmental Science are also available. (See Index.)

A non-thesis master's degree in Interdisciplinary Graduate Studies (biological sciences) has been established particularly for those who wish to have a more diversified program of advanced study than that generally permitted by specific departments and programs.

Curriculum in Biology

Administered by the Departments of Ecology, Evolution, and Organismal Biology; and Genetics, Development and Cell Biology. Students should consult the Biology Student Services Office, 103 Bessey (or biology@iastate.edu) for the appropriate course selections for professional or graduate school preparation.

Total Degree Requirement: 120 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

Biology: 23.5 cr.
All graded courses minimum C-; 2.00 GPA average required.

BIOL 110	Introduction to Biology	1
BIOL 111	Opportunities in Biology	0.5
BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 312	Ecology	4
BIOL 313	Principles of Genetics	3
BIOL 313L	Genetics Laboratory	1
BIOL 314	Principles of Molecular Cell Biology	3
BIOL 315	Biological Evolution	3
Total Credits		23.5

Advanced Biology: 21 cr.
All graded courses minimum C-; 2.00 GPA average required. See the Biology Program web site for list of approved Advanced Biology courses, or consult an adviser in the Biology Student Services office, 103 Bessey Hall.

Two Advanced BIOL courses with lab or field components (from approved list)	
Biology advanced courses (from approved list)	9
Additional approved biology advanced courses	12
Total Credits	21

Mathematical Sciences 7 cr.
Students in College of Agriculture and Life Sciences must have a Math and Statistics.

MATH 160 or 181 or 165 and STAT 101 or 104		
Or		
MATH 181 & MATH 182	Calculus and Mathematical Modeling for the Life Sciences I and Calculus and Mathematical Modeling for the Life Sciences II	8
Or		
MATH 165 & MATH 166	Calculus I and Calculus II	8
Or		
STAT 101 or 104 and STAT 301		4-7

Physical Sciences

General Chemistry: 5 cr. minimum		
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	5
Or		
CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	5
CHEM 178 & 178L	General Chemistry II and Laboratory in College Chemistry II	4
Organic Chemistry: 4 cr. minimum		
CHEM 231 & 231L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	4
Or		
CHEM 331 & 331L	Organic Chemistry I and Laboratory in Organic Chemistry I	4
Biochemistry: 3 cr.		
BBMB 316	Principles of Biochemistry	3
Or		
BBMB 404	Biochemistry I	3
Or		
BBMB 420	Mammalian Biochemistry	3
Physics: 5 cr. minimum		
PHYS 115 & 115L	Physics for the Life Sciences and Laboratory in Physics for the Life Sciences	5
Or		

PHYS 111	General Physics	10
& PHYS 112	and General Physics	

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communication/Information Literacy
Students must earn a C or better in ENGL 250 and the advanced communication course. Additionally, students in the College of Agriculture and Life Sciences must earn a C or better in ENGL 150.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
or ENGL 312	Biological Communication	
Total Credits		10

Humanities and Social Sciences
Chosen from approved lists.

LAS - Biology	
Note: Students must have completed 3 years of a single world language or take 4-8 credits of university level world language.	
Humanities	12
Social Sciences	9
Total Credits	21

Humanities and Social Sciences
Chosen from approved lists.

CALS - Biology	
Note: Students in CALS - Biology must take an approved speech course and an approved Math and Statistics course.	
Humanities	3
Social Sciences	3
Ethics	3
Total Credits	9

Biology, B.S.

Freshman

Fall	Credits	Spring	Credits
ENGL 150 or 250	3	BIOL 111	0.5
LIB 160	1	BIOL 212	3
BIOL 110	1	BIOL 212L	1
BIOL 211	3	Chemistry*	4
BIOL 211L	1	MATH/STAT Choice	4
CHEM 163/L or 177/L	5	Social Science Choice	3
Humanity	3		
	17		15.5

Sophomore

Fall	Credits	Spring	Credits
ENGL 250 or Elective	3	BIOL 313	3
Chemistry or Biochemistry*	4-3	BIOL 313L	1
BIOL 312	4	Biochemistry / Elective*	3
SP CM 212	3	Ethics	3
Advanced Biology	3	Advanced Biology with Lab	4
	17-16		14

Junior

Fall	Credits	Spring	Credits
BIOL 314	3	BIOL 315	3
PHYS 111 or PHYS 115*	5	PHYS 112 / Elective*	5-3
Advanced Biology	3	Advanced Biology	4
MATH/STAT Choice	4	U.S. Diversity / Elective	3
	15		15-13

Senior

Fall	Credits	Spring	Credits
Advanced Biology	4	Advanced Biology with Lab	4
International Perspective / Elective	3	Minor or Elective	11
Minor or Electives	8		
	15		15

* Students should meet with a Biology Program Adviser to determine the proper plans for chemistry, math and physics before selecting those options above.
Students must have 120 credits minimum to graduate
students are required to take 21 credits in advanced biology of which 9 credits must be from the Biology Program (BIOL), and 2 advanced BIOL courses must have a lab or field component.

Courses primarily for undergraduates:

BIOL 101: Introductory Biology
(3-0) Cr. 3. F.S.SS.
Life considered at cellular, organism, and population levels. Function and diversity of the living world. Presentation of basic biological principles as well as topics and issues of current human interest. Does not satisfy biology major requirements.

BIOL 110: Introduction to Biology
Cr. 1. F.
Orientation to the scope of the biological sciences, and discussion of professional opportunities. Required of first year biology majors. Offered on a satisfactory-fail basis only.

BIOL 111: Opportunities in Biology
(1-0) Cr. 0.5. S.
Introduction to biological science disciplines and professional opportunities through faculty presentations which examine a variety of current research topics. Offered on a satisfactory-fail basis only.

BIOL 112: Transfer Student Orientation
Cr. R. F.S.
Orientation to opportunities in Biology. Review of degree requirements and other information needed by students that have not participated in the first year Biology orientation courses. Offered on a satisfactory-fail basis only.

BIOL 155: Human Biology
(3-0) Cr. 3. F.S.
A survey course of human biology, including principal structures and functions of the body systems and the diseases and disorders associated with them. Designed to meet general education requirements in natural science. Not recommended for those seeking a career in the allied health professions or for students majoring in life science. Does not satisfy biology major requirements.

BIOL 173: Environmental Biology
(Cross-listed with ENV S). (3-0) Cr. 3. F.S.
An introduction to the structure and function of natural systems at scales from the individual to the biosphere and the complex interactions between humans and their environment. Discussions of human population growth, biodiversity, sustainability, resource use, and pollution. Does not satisfy biology major requirements.

BIOL 201: Introduction to Environmental Issues
(Cross-listed with ENSCI, ENV S). (2-0) Cr. 2. F.
Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change.

BIOL 204: Biodiversity
(Cross-listed with ENV S). (4-0) Cr. 2. S.
Prereq: One course in life sciences
Survey of the major groups of organisms and biological systems. Definition, measurements, and patterns of distribution of organisms. Sources of information about biodiversity. Does not satisfy biology major requirements. Half semester course.

BIOL 211: Principles of Biology I
(3-0) Cr. 3. F.S.
Prereq: High school biology
Introduction to the nature of life, including the diversity of microbial, plant, and animal life; the nature of heredity; evolution; and principles of ecology. Intended for life science majors.

BIOL 211L: Principles of Biology Laboratory I
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in BIOL 211
Laboratory to accompany 211.

BIOL 212: Principles of Biology II
(3-0) Cr. 3. F.S.
Prereq: High School Biology; high school chemistry or credit or enrollment in CHEM 163 or CHEM 177
Introduction to the chemical, molecular, and cellular basis of life; form and function of microbial, plant, and animal life. Intended for life science majors.

BIOL 212L: Principles of Biology Laboratory II
(0-3) Cr. 1. F.S.
Prereq: credit or enrollment in BIOL 212
Laboratory to accompany 212.

BIOL 251: Biological Processes in the Environment
(Cross-listed with ENSCI). (3-0) Cr. 3. S.
Plant and microbial processes in environmental systems including their interactions with human activities.

BIOL 255: Fundamentals of Human Anatomy
(3-0) Cr. 3. F.
Prereq: High School Biology and Chemistry, or BIOL 101
An introduction to human anatomy, beginning with cells and tissues, surveying all body systems, relating form to function. Systems covered include: integumentary, bones and joints, muscles, nervous, sensory, endocrine, circulatory, lymphatic, respiratory, digestive, urinary, and reproductive. Pre-Medical students should consider Biol 351 for their anatomy background. Does not satisfy biology major requirements.

BIOL 255L: Fundamentals of Human Anatomy Laboratory
(0-3) Cr. 1. F.
Prereq: Credit or enrollment in BIOL 255
Investigation of human anatomy using models and dissections of preserved organs and model mammals. Pre-Medical students should consider 351 for their anatomy background. Does not satisfy biology major requirements.

BIOL 256: Fundamentals of Human Physiology
(3-0) Cr. 3. S.
Prereq: High School Biology and Chemistry, or BIOL 101, or BIOL 255 (recommended)
An introduction to human physiology, studying the function of all body systems. Systems covered include: integumentary, bones and joints, muscles, nervous, sensory, endocrine, circulatory, lymphatic and immune, respiratory, digestive, urinary, and reproductive. Pre-Medical students should consider 335 for their physiology background. Does not satisfy biology major requirements.

BIOL 256L: Fundamentals of Human Physiology Laboratory
(0-3) Cr. 1. S.
Prereq: Credit or enrollment in BIOL 256
Student-conducted experiments investigating concepts of human physiology with computer data acquisition and analysis. Interpretation of experimental results and preparation of lab reports. Pre-Medical students should consider 335 for their anatomy and physiology background. Does not satisfy biology major requirements.

BIOL 307: Women in Science and Engineering
(Cross-listed with W S). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: a 200 level course in science, engineering or women's studies; ENGL 250
The interrelationships of women and science and engineering examined from historical, sociological, philosophical, and biological perspectives. Factors contributing to under-representation; feminist critiques of science; examination of successful strategies. Does not satisfy biology major advanced credit requirements.
Meets U.S. Diversity Requirement

BIOL 312: Ecology
(Cross-listed with A ECL, ENSCI). (3-3) Cr. 4. F.SS.
Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L
Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats.

BIOL 313: Principles of Genetics
(Cross-listed with GEN). (3-0) Cr. 3. F.S.SS.
Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L
Introduction to the principles of transmission and molecular genetics of plants, animals, and bacteria. Recombination, structure and replication of DNA, gene expression, cloning, quantitative genetics, and population genetics. Students may receive graduation credit for no more than one of the following: Gen 260, Gen 313 and 313L, Gen 320, Biol 313 and 313L, and Agron 320.

BIOL 313L: Genetics Laboratory
(Cross-listed with GEN). (0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in BIOL 313
Laboratory to accompany 313. Students may receive graduation credit for no more than one of the following: Biol 313 and 313L, Gen 260, Gen 313, Gen 320, and Agron 320.

BIOL 314: Principles of Molecular Cell Biology
(3-0) Cr. 3. F.S.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L
Integration of elementary principles of metabolism, bioenergetics, cell structure, and cell function to develop a molecular view of how the cell works.

BIOL 315: Biological Evolution
(3-0) Cr. 3. F.S.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L.
The mechanisms of evolution. Topics in microevolution: population genetics, natural selection, genetic variation, and adaptation. Macroevolution: speciation, extinction, phylogeny, and major evolutionary patterns.

BIOL 322: Introduction to Bioinformatics and Computational Biology
(Cross-listed with BCBIO, GEN). (3-0) Cr. 3. F.
Prereq: BIOL 212
Genome sequencing, assembly, structural and functional annotation, and comparative genomics. Investigating these topics will develop skills in programming and scripting (Perl and/or Python), the use of biological databases, sequence alignment, similarity search, identification of sequence patterns, construction of phylogenetic trees, and comparative genomics.

BIOL 328: Molecular and Cellular Biology of Human Diseases
Cr. 3. F.
Prereq: BIOL 212
Survey of molecular, genetic, and cellular aspects of human diseases. Fundamental concepts of cell biology and how they are linked to the pathologies of different classes of human diseases. Recent scientific advances with an emphasis on new methods of diagnosis and treatment.

BIOL 334: Metabolic Physiology of Mammals
(3-0) Cr. 3. S.
Prereq: BIOL 211, BIOL 212
Introduction to physiology of metabolic function in mammals and other animals. Metabolic processes and their interactions with various subsystems, approached from an organismal perspective. Integration of cellular, gastrointestinal, cardiovascular, respiratory, and renal processes, relevant to their control and integration at the nervous and endocrine system levels. Functional aspects of organismal physiology, energy and water balances, physiology of rest exercise, and environmental stress. Students cannot receive credit for both BIOL 334 and BIOL 335.

BIOL 335: Principles of Human and Other Animal Physiology
(3-3) Cr. 4. F.
Prereq: BIOL 314
Introduction to systemic functions with emphasis on mammals. Students cannot receive credit for both BIOL 334 and BIOL 335.

BIOL 336: Ecological and Evolutionary Animal Physiology
Cr. 3.
Prereq: BIOL 211, BIOL 212
Study of mechanisms by which animals perform life-sustaining functions; the evolution and adaptive significance of physiology traits, the diversity of physiological mechanisms, and how physiology and ecology interact.

BIOL 344: Human Reproduction
(Cross-listed with W S). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 212
Biology of human reproduction, including reproductive systems, hormones, and endocrinology of pregnancy, presented from a clinically-oriented perspective. Reviews health-related conditions such as infertility, sexually-transmitted diseases, and complicated pregnancy.

BIOL 349: The Genome Perspective in Biology
(Cross-listed with GEN). (2-2) Cr. 3. S.
Prereq: GEN 313 or GEN 320
Analysis of genome, RNA, and protein data using computer technology to answer biological questions on topics ranging from microbial diversity to human health. An introduction for students in the life sciences to the fields of genomics, bioinformatics and systems.

BIOL 350: Comprehensive Human Anatomy
(3-0) Cr. 3. F.
Prereq: Credit in BIOL 211 and BIOL 212
Comprehensive survey of human anatomy, emphasizing structural and functional relationships of major organ systems. Compartmental study of normal anatomy; practical clinical application of anatomical regions.

BIOL 351: Comparative Chordate Anatomy
(3-4) Cr. 5. S.
Prereq: BIOL 212, junior classification
The evolution of chordates as reflected in the anatomy of extinct and living forms. Lecture topics include the history and diversity of chordates, comparisons of anatomic structures among major groups, and the adaptive significance of anatomic structures. Laboratory involves dissection of representative species.

BIOL 352: Vertebrate Histology
(3-3) Cr. 4. S.
Prereq: BIOL 212
Microscopic structure of vertebrate tissues and organs, with an introduction to histological techniques.

BIOL 353: Introductory Parasitology
(Cross-listed with MICRO, V PTH). (3-0) Cr. 3. S.
Prereq: BIOL 212
Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites.

BIOL 354: Animal Behavior
(3-0) Cr. 3. F.
Prereq: BIOL 212
Ethological and sociobiological approaches to animal behavior. Genetic and developmental aspects of behavior, biological rhythms, orientation (including navigation, migration), communication, and social behavior (mating, aggression, parental care).

BIOL 354L: Laboratory in Animal Behavior
(0-3) Cr. 1. F.
Prereq: Credit or enrollment in BIOL 354
Laboratory techniques for observation, description and analysis of animal activities; independent projects.

BIOL 355: Plants and People
(3-0) Cr. 3. S.
Prereq: Credit in BIOL 211 and BIOL 211L
Uses of plants and fungi by humans and the importance of plants in the past, present, and future. Discussion of fruits, vegetables, grains, herbs, spices, beverages, oils, fibers, wood, medicines, and drugs, in the context of their agricultural, cultural, and economic roles in modern societies. Emphasis on origins and worldwide diversity of culturally important plants, their characteristics, and uses.

BIOL 356: Dendrology
(Cross-listed with FOR). (2-4) Cr. 4. F.
Prereq: BIOL 211
Identification and ecology of North American woody plant species. Importance of woody plants in timber production and wildlife habitat. Natural disturbances, human impacts, management and restoration concerns for major North American forest regions will be addressed.

BIOL 364: Invertebrate Biology
Cr. 3-4. F.
Prereq: BIOL 211, 212
Emphasis on diversity, development, physiology, and behavior of invertebrate organisms- the "spineless wonders" of the world. Laboratory involves hands-on study and investigation of living invertebrates.

BIOL 365: Vertebrate Biology
(Cross-listed with A ECL). (3-2) Cr. 4. F.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L
Evolution, biology, and classification of fish, amphibians, reptiles, birds, and mammals. Emphasis on a comparative analysis of the structure and function of organ systems. Laboratory exercises concentrate on morphology and identification of orders of vertebrates.

BIOL 366: Plant Systematics
(2-4) Cr. 4. S.
Prereq: BIOL 211
Introduction to plant phylogenetic systematics, plant classification, survey of flowering plant families, and identification and field study of local plants.

BIOL 370: GIS for Ecology and Environmental Science
(Cross-listed with ENSCI). Cr. 1-6. Repeatable. F.S.
Prereq: Six credits in biological and /or physical sciences, and permission of instructor.
Introduction to geographic information systems (GIS) with emphasis on ecological and environmental applications. No prior GIS experience required. Guided, individualized study of topics based on student background and interest. For students with prior experience, topics and activities are selected to build upon any previous experience and minimize duplication to previous GIS coursework. Potential topics include: basic concepts of GIS, data structures, database management, spatial analysis, modeling and visualization of ecological and environmental data. Case studies in ecological and environmental applications using ArcGIS. Offered on a satisfactory-fail basis only.

BIOL 371: Ecological Methods
(Cross-listed with A ECL). (2-3) Cr. 3. S.
Prereq: A ECL 312; STAT 101 or STAT 104
Quantitative techniques used in management of natural resources with emphasis on inventory and manipulation of habitat and animal populations.

BIOL 381: Environmental Systems I: Introduction to Environmental Systems
(Dual-listed with EEOB 581). (Cross-listed with ENSCI, ENV S, MICRO). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

BIOL 382: Environmental Systems II: Analysis of Environmental Systems
(Dual-listed with EEOB 582). (Cross-listed with ENSCI). (2-2) Cr. 3. S.
Prereq: ENSCI 381
Continuation of EnSci 381. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

BIOL 393: North American Field Trips in Biology
Cr. 1-4. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Extended field trips, usually during break periods, to North American locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule.

BIOL 393A: North American Field Trips in Biology: Pre-trip Seminar
(1-0) Cr. 1. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Discussion of relevant biological and cultural topics during semester preceding extended field trips to North American locations of interest to biologists.

BIOL 393B: North American Field Trips in Biology: North American Field trip
Cr. 1-3. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Extended field trip under supervision of faculty member, usually during break periods, to North American locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule. Report required.

BIOL 394: International Field Trips in Biology
Cr. 1-4. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Extended field trips, usually during break periods, to international locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule.
Meets International Perspectives Requirement.

BIOL 394A: International Field Trips in Biology: Pre-trip Seminar
(1-0) Cr. 1. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Discussion of relevant biological and cultural topics during semester preceding extended field trip to international locations of interest to biologists.
Meets International Perspectives Requirement.

BIOL 394B: International Field Trips in Biology: Field Trip to International Location
Cr. 1-3. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Extended field trips, under supervision of faculty member, usually during break periods, to international locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule.
Meets International Perspectives Requirement.

BIOL 402: Introduction to Pathology
(Cross-listed with V PTH). (3-0) Cr. 3. S.
Prereq: BIOL 211 and BIOL 212 with labs
Introductory exploration of pathology as a medical discipline. This includes study of disease mechanisms via an introduction to general pathology topics (cell degeneration, necrosis, disturbances of growth, disturbances of blood flow, inflammation, neoplasia) and organ system-specific response to injury.

BIOL 414: Life History and Reproductive Strategies
(Dual-listed with EEOB 514). (3-0) Cr. 3. F.
Prereq: BIOL 315 or equivalent recommended.
Evolution of ecological adaptations at the individual, population, and species level. Emphasis is on evolutionary mechanisms and adaptive strategies related to life histories and reproduction; age and size at maturity; lifespan and senescense; offspring size/number trade-offs; sex and mating systems; sex determination and sex ratios.

BIOL 423: Developmental Biology
(3-0) Cr. 3. S.
Prereq: BIOL 313
Principles of embryogenesis and animal development. Establishment of body axes, organ and limb development, and specification of cell fates. Emphasis on cell signaling and the control of gene expression within the context of a developing organism. Medically relevant subjects will be discussed, including stem cells, cancer biology, fertilization, and cloning.

BIOL 423L: Developmental Biology Laboratory
(0-3) Cr. 1. S.
Prereq: Credit or enrollment in BIOL 423 or permission of the instructor.
Experiments and explorations illustrating fundamental principles of multicellular development.

BIOL 428: Topics in Cell Biology
(3-0) Cr. 3. S.
Prereq: BIOL 314
Selected topics on biological structure and function at the cellular level. Emphasis on dynamic nature and regulation of cellular organization and the integration of cellular processes (systems biology). Original research articles will demonstrate interdisciplinary research strategies and how scientific investigation leads to knowledge and understanding of cell biology.

BIOL 430: Principles of Plant Physiology
(3-0) Cr. 3.
Prereq: BIOL 313 or GEN 320; BIOL 314 or BBMB 301; CHEM 231 or CHEM 332; PHYS 106, PHYS 115, or PHYS 111
An overview of classical and current concepts, principles, and approaches regarding the basic mechanisms of plant function underlying growth, development, and survival of plants. Topics covered include environmental and developmental signals, plant hormone action, signal transduction, mineral nutrition, water relations, metabolism, and photosynthesis.

BIOL 434: Endocrinology
(Dual-listed with EEOB 534). (3-0) Cr. 3. S.
Prereq: BIOL 211, BIOL 212
Chemical integration of vertebrate organisms. The structure, development, and evolution of the endocrine glands and the function and structure of their hormones.

BIOL 436: Neurobiology
(3-0) Cr. 3. F.
Prereq: BIOL 212
Basic principles of brain function and development. Signaling of nerve cells, synaptic transmission, structure/function of ion channels and receptors, memory and synaptic plasticity, movement and central control, sensation and sensory processing, construction of neural circuits, early brain development, complex brain functions in health and disease.

BIOL 439: Environmental Physiology
(Dual-listed with EEOB 539). Cr. 3-4. Alt. S., offered even-numbered years.
Prereq: BIOL 335; physics recommended
Physiological adaptations to the environment with an emphasis on vertebrates.

BIOL 444: Bioinformatic Analysis
(Cross-listed with BCB, BCBIO, COM S, CPR E, GEN). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

BIOL 451: Plant Evolution and Phylogeny
(Dual-listed with EEOB 551). (3-3) Cr. 4. F.
Prereq: BIOL 315 or equivalent.
Survey of land plant evolution; phylogenetic comparison of anatomical, reproductive, and life history specializations. Relationships among bryophytes, lycophytes, pteridophytes, gymnosperms, and angiosperms emphasizing significant evolutionary changes documented by paleobotanical, morphological, and molecular studies.

BIOL 454: Plant Anatomy
(3-3) Cr. 4. F.
Prereq: BIOL 212L; BIOL 366 recommended
Characteristics of cell and tissue types in vascular plants. Anatomy of developing and mature stems, roots, and leaves, including secondary (woody) growth. Introduction to the special anatomy of flowers and seeds.

BIOL 455: Bryophyte and Lichen Biodiversity
(Dual-listed with EEOB 555). Cr. 3.
Prereq: BIOL 211, BIOL 211L
Introduction to the biology and ecology of mosses, liverworts, and lichens. Emphasis on identification and diversity of local representatives of these three groups of organisms. Required field trips and service-learning.

BIOL 456: Principles of Mycology
(Cross-listed with MICRO). (2-3) Cr. 3. F.
Prereq: 10 credits in biological sciences
Morphology, diversity and ecology of fungi; their relation to agriculture and industry and human health.

BIOL 457: Herpetology
(Cross-listed with A ECL). (2-0) Cr. 2. F.
Prereq: BIOL 351 or BIOL 365
Biology, ecology, and evolution of amphibians (salamanders, frogs, caecilians) and reptiles (lizards, snakes, tuatara, turtles, crocodilians). Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of amphibians and reptiles in ecosystems, and conservation. Laboratory focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

BIOL 457L: Herpetology Laboratory
(Cross-listed with A ECL). (0-3) Cr. 1. F.
Prereq: BIOL 351 or BIOL/A ECL 365; concurrent registration in BIOL 457 or A ECL 457
Laboratory to accompany Biology/Animal Ecology 457. Focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

BIOL 458: Ornithology
(Cross-listed with A ECL). (2-0) Cr. 2. S.
Prereq: A ECL 365 or BIOL 351
Biology, evolution, ecology and taxonomy of birds. Emphasis on structure, physiology, behavior, communication, navigation, reproduction, and conservation.

BIOL 458L: Ornithology Laboratory
(Cross-listed with A ECL). (0-3) Cr. 1. S.
Prereq: BIOL 351 or AECL/BIOL 365. Concurrent enrollment in AECL/BIOL 458 is required.
Laboratory complements lecture topics with emphasis on external anatomy, identification and distribution of Midwest birds, and field trips.

BIOL 459: Mammalogy
(Dual-listed with EEOB 559). (Cross-listed with A ECL). (2-0) Cr. 2. S.
Prereq: BIOL 351 or A ECL 365
Biology, ecology, and evolution of mammals. Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of mammals in ecosystems, and conservation.

BIOL 459L: Mammalogy Laboratory
(Cross-listed with A ECL). (0-3) Cr. 1. S.
Prereq: BIOL 351 or BIOL/AECL 365; concurrent enrollment in AECL 459 or BIOL 459 required.
Laboratory focus on identification, survey methods, distribution, habits, and habitats of mammals. Several field trips.

BIOL 462: Evolutionary Genetics
(Cross-listed with GEN). (3-0) Cr. 3. F.
Prereq: BIOL 315
The genetic basis of evolutionary processes in higher organisms. The role of genetic variation in adaptation, natural selection, adaptive processes, and the influence of random processes on evolutionary change.

BIOL 464: Wetland Ecology
(Dual-listed with EEOB 564). (Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: 15 credits in biological sciences.
Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands.

BIOL 471: Introductory Conservation Biology
Cr. 3.
Prereq: BIOL 312
Examination of conservation issues from a population and community perspective. The role of genetics, demography, and environment in determining population viability, habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology.

BIOL 472: Community Ecology
(3-0) Cr. 3. S.
Prereq: BIOL 312
The effect of interspecific interactions on the structure and dynamics of natural and managed communities; including concepts of guild structure and trophic web dynamics and their importance to the productivity, diversity, stability, and sustainability of communities. The implications of interspecifc interactions in the management of wild species will be emphasized with illustrative case histories of interactions between plants, invertebrates, and vertebrates.

BIOL 474: Plant Ecology
(3-0) Cr. 3. S.
Prereq: BIOL 312
Principles of plant population and community ecology.

BIOL 476: Functional Ecology
(Dual-listed with EEOB 576). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312
The nature of adaptations to physical and biotic environments. Biophysical, biomechanical, and physiological bases of the structure, form, growth, distribution, and abundance of organisms.

BIOL 480: Studies in Marine Biology
Cr. 1-8. Repeatable.
Courses taken at Gulf Coast Research Laboratory and other marine biological stations are transferred to Iowa State University under this number.

BIOL 481: Summer Field Studies
Cr. 1-8. Repeatable.
Courses taken at summer biological field stations are transferred to Iowa State University under this number. See www.biology.iastate.edu for links to field stations located in different biomes: coastal, Great Lakes, taiga, deciduous forests, deserts, Rocky Mountains.

BIOL 482: Tropical Biology
Cr. 1-4. Repeatable, maximum of 8 credits.
Prereq: One year of college biology; knowledge of Spanish desirable but not required
Students registering for courses taught by the Organization for Tropical Studies will receive credit for this ISU course when requesting a transfer of credits.

BIOL 484: Ecosystem Ecology
(Cross-listed with ENSCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Combined 12 credits in biology, chemistry, and physics.
Introduction of the study of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations for ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues.

BIOL 486: Aquatic Ecology
(Dual-listed with EEOB 586). (Cross-listed with A ECL, ENSCI). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

BIOL 486L: Aquatic Ecology Laboratory
(Dual-listed with EEOB 586L). (Cross-listed with A ECL, ENSCI). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

BIOL 487: Microbial Ecology
(Dual-listed with EEOB 587). (Cross-listed with ENSCI, MICRO). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

BIOL 488: Identification of Aquatic Organisms
(0-3) Cr. 1. F.S.
On-line taxonomic and identification exercises to accompany 486. Instruction and practice in the identification of algae, aquatic macrophytes, zooplankton, and benthos.

BIOL 489: Population Ecology
(Dual-listed with EEOB 589). (Cross-listed with A ECL). (2-2) Cr. 3. F.
Prereq: BIOL 312, STAT 101 or STAT 104, a course in calculus, or graduate standing
Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation.

BIOL 490: Independent Study
Cr. 1. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Permission of instructor.
Independent study opportunities for undergraduate students in the biological sciences. No more than 9 credits in Biol 490 may be counted toward graduation and, of those, only 2 credits may be applied toward the Biology advanced course requirement.

BIOL 491: Undergraduate Teaching Experience
Cr. 1-2. Repeatable.
Prereq: Permission of supervising staff
For students registering to be undergraduate teaching assistants. Offered on a satisfactory-fail basis only. A maximum of 2 credits of BIOL 491 may be applied toward the Biology advanced course requirement.

BIOL 492: Preparing for Graduate School in the Biological Sciences
(1-0) Cr. 1. F.
Prereq: For life science majors; Minimum requirement: sophomore standing.
For students considering pursuing a graduate degree in the biological sciences. Professional development topics including the defining of academic and career areas of interest, finding and evaluating appropriate programs of graduate study, the graduate school application process, and developing a curriculum vita. Exploration of learning opportunities at field stations, research internships, and independent research activities.

BIOL 494: Biology Internship
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 8 credits in biology and permission of instructor
Professional experiences in biological sciences. Intended for Biology majors. No more than 9 credits in BIOL 494 may be counted toward graduation and, of those, only 6 credits may be applied toward the Biology advanced course requirement.

BIOL 495: Undergraduate Seminar
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Content varies from year to year and may include detailed discussion of special topics in biology, current issues in biology, or careers in biology.

BIOL 498: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the Biology Program cooperative education coordinator
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

BIOL 499: Undergraduate Research Experience
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Permission of instructor.
Research opportunities for undergraduate students in the biological sciences. Intended for Biology majors. No more than 9 credits in Biol 499 may be counted toward graduation and, of those, only 6 credits may be applied toward the Biology advanced course requirement.

Community Development

Interinstitutional Graduate Program

http://www.agonline.iastate.edu/programs/community-development-ms

Community Development deals with challenges faced by communities in the United States and other countries, particularly those in rural areas. Global economic restructuring and the devolution of government services have produced an environment in which Community Developers are called on to think and act in innovative ways.

Community Development is a progressive field, actively promoting positive social, economic, cultural and environmental change. It

encourages people to see the “whole picture,” engaging citizens in democratic decision making and action.

In the Great Plains IDEA Community Development Master's degree program, a diverse faculty from several institutions teaches critical thinking, ethical consideration, careful planning and involvement of all stakeholders. A Master's degree in Community Development equips the student with a breadth of perspective and depth of cutting-edge material in the field.

The Great Plains IDEA online Master's program is ideal for Community Development students and practitioners. Students seeking a professional career in Community Development can attain the necessary knowledge base without commuting or relocating. Community Development practitioners who wish to augment their training can use the skill set gained through the Community Development Master's degree to work most effectively in, or to advance beyond, their current position.

A Master's degree in Community Development is ideal for professionals in a wide variety of fields:

- Community and Regional Planning
- Sociology
- Economics
- Political science
- Geography
- Local Planning Departments
- Community Economic Development Organizations
- Cooperative Extension Services
- Housing Agencies
- Parks & Recreation
- Tribal Programs
- Non-Profit Organizations focusing on Community Enhancement

Students select one university to be their *"home institution"*, this is the university to which you apply, enroll and pay tuition. Students must meet the admissions requirements of the home institution. Contact the Campus Coordinators Casey Smith and Michelle Zander at agonlineservice.iastate.edu or 800-747-4478 for more information.

Participating Institutions:

- Iowa State University
- Kansas State University
- University of Nebraska
- North Dakota State University
- South Dakota State University

Community Development is an inter-institutional distance education program offered through the Web. The student selects a home institution, which grants the degree. After admission at the home institution, the student may take courses from any of the teaching institutions: Iowa State University, Kansas State University, University of Nebraska, North Dakota State University, and South Dakota State University.

At Iowa State University, Community Development is an area of specialization within the Interdisciplinary Graduate Studies degree program that consists of 37 semester credits for completion of the program. A thesis or creative component is required. A computer with minimum specifications, Web access, an email address and program forms are required for participating in the program.

Registration

Students choosing to receive their degree from Iowa State University complete all the admissions, registration and fee payment processes through ISU. See http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=70 for program requirements.

Courses primarily for graduate students, open to qualified undergraduates:

C DEV 502: Community and Natural Resource Management
(3-0) Cr. 3.
Detailed introduction to community resource management. Theoretical frameworks, methodological investigation, applied practices. Enhancement of ability of community development professionals to work with communities to plan, develop and monitor conversation and development of natural resources with multiple functions.

C DEV 503: Community Development I: Principles and Strategies of Community Change
(3-0) Cr. 3.
Analysis of principles and practices of community change and development. Use of case studies to relate community development approaches to conceptual models from diverse disciplines. Exploration of professional practice principles, and student construction of their personal framework for practicing community development.

C DEV 504: Community Analysis: Introduction to Methods
(3-0) Cr. 3.
Introduction to research methods relevant to community development. Formulate and begin a research effort, methods of data collection and how conceptual frameworks are used to develop the questions and analyze data. Emphasis on strategies for reporting findings and applying findings in community action and methods of evaluating the entire research process. Significant attention paid to issues of research ethics and inclusiveness.

C DEV 505: Community Development II: Organizing for Community Change
(3-0) Cr. 3.
Examines role of civil society in community planning efforts. Comparative approach to planning theories and approaches. Focus on change within communities and the roles of government, planners, and citizens in reacting to or shaping change. Dimensions of social capital and the context of change covered.

C DEV 506: Community and Regional Economic Analysis I
(3-0) Cr. 3.
Introduction to concepts of communities and regions, theories of economic growth, drivers of economic growth, the economic base of a community, sources of growth or decline in the community, roles of local government and institutions, and analytical tools. Strategies for local economic development will also be explored.

C DEV 507: Introduction to Native Communities
(3-0) Cr. 3.
A base knowledge course. For students currently working within, in partnership with, or considering working with Native communities. Basic understanding within the context of community development of the diversity of the tribal structures and cultures and the unique history and jurisdictional considerations of these nations. Working with tribes, Federal and Indian relations, and governance and cultural issues.

C DEV 508: Ecological Economics
(3-0) Cr. 3.
Approaches economy and community by looking at the inherent interdependence, jointness, and potential complimentarity between ecology and economy (utility) of a place.

C DEV 509: Building Native Community and Economic Capacity
(3-0) Cr. 3.
Focus on non-western approaches to helping Native communities build their capacity. Students will learn to take a participatory, culture-centered, and strength-based approach to development.

C DEV 510: Indian Country Agriculture and Natural Resources
(3-0) Cr. 3.
Introduction to the historical and contemporary issues related to natural resource management on Native American lands. Philosophical and economic arguments concerning natural resource conservation, preservation and extraction will be explored.

C DEV 512: Sustainable Communities
(3-0) Cr. 3.
Students will learn the conceptual relationships among Community and Sustainable Development and Sustainable Communities and examine the social, environmental, and economic aspects of sustainable communities. The course includes analysis of public policy impacts on community sustainability, practical actions for enhancing sustainability, and changing power dynamics and reward structures involved in incorporating sustainability into Community Development.

C DEV 513: Economic Development Strategies and Programs
(3-0) Cr. 3.
Course explores theories of local economic development and addresses the development issues faced by communities in the 21st century. Students will understand and apply concepts from economic development planning, economic analysis, business development, human resource development, community-based development, and high-technology development.

C DEV 520: Orientation in Community Development
(2-0) Cr. 2.
Introduction to the Community Development program. Focus on on-line delivery methods, graduate level research and writing, technology skills.

C DEV 521: Housing and Development
Cr. 3. S.
Prereq: None.
Review and evaluation of historical and current housing issues, production, and financial systems, including consideration of racial, ethnic, income, and gender issues as they relate to the role of housing developments and programs in community development.

C DEV 522: Community Leadership and Capacity Building
(3-0) Cr. 3.
Defining leadership and applying it to the workplace. Understanding of potential link between leadership and community capacity. Identifying strategies for leadership development in communities.

C DEV 523: Grantwriting for Community Development Professionals
(3-0) Cr. 3.
Basic Grant Development and Management will introduce students to the grant-getting process and provide an overview of what happens after a project is funded. The following topics will be covered: researching funding sources, generating cutting edge ideas, assessing needs, planning a project, establishing credibility, formulating a sustainable budget, designing an evaluation plan, managing the funded project, and disseminating project results.

C DEV 524: Non-Profit Management in Community Development
(3-0) Cr. 3.
Understanding of how non-profit organizations are run in order that they may participate more fully in community development efforts. Learning skills necessary to assist organizations to manage community development projects and programs, such as, budgeting, planning, personnel, facilities, volunteer management, and fundraising.

C DEV 525: Role of Tribal Colleges in Economic Development
(3-0) Cr. 3.
Focus on role of tribally-chartered colleges and universities in economic development within Native communities. Social capital analytic framework to examine and evaluate tribal college model of economic development.

C DEV 526: Immigration and Community Inclusion
(3-0) Cr. 3.
Mechanisms for community inclusion and exclusion in relation to immigration will be examined. Aspects of ethnicity, religion, occupation and transnationalism are addressed in terms of community mechanism for incorporating immigrants as community assets.

C DEV 527: Public and Non-Profit Budgeting
Cr. 3. SS.
Introduction to the fundamental theories and practices of budgeting in the public and non-profit sectors. Topics covered include overview of budgeting and budget reform, taxation, expenditures, budget preparation and adoption, budget implementation, and performance budgeting.

C DEV 528: Evaluation of Organizations and Programs
(3-0) Cr. 3.
Prereq: C DEV 504 with grade of C or better
Introduction to the philosophy, techniques, and methodologies of organizational and program evaluation. Overview of program evaluation and theory, techniques to evaluate program processes and performance, evaluation designs, assessing program efficiency, models to diagnose organizations, and methods to assess organizational performance.

C DEV 530: Toward Ethical Engagement
(3-0) Cr. 3.
Understanding what ethics are and identify ethical dimensions of a problem. Ability to employ ethical analysis and engagement strategies in public problem-solving.

C DEV 532: Community and Regional Economic Analysis II
(3-0) Cr. 3.
Prereq: C DEV 506
Substantive grounding in the theories and practice of measuring community economic dynamics; build solid foundation skills for applied community economic analysis.

C DEV 542: The Policy and Politics of Coastal Areas
(Cross-listed with POL S). (3-0) Cr. 3.
Exploration of political implications of coastal policy. Issues include: "Carrying capacity," zoning, regulation of human development activities, tradeoffs between conservation and jobs, the quality of coastal lifestyle, ways in which citizens participate in policy for coastal areas.

C DEV 590: Special Topics in Community Development
Cr. 1-3. Repeatable, maximum of 4 times. F.S.SS.
Special topics in Community Development. Independent Study, must get instructor approval.

C DEV 599: Creative Component
Cr. arr.
Students work with major professor to conduct research and carry out work on their creative component. Instructor permission required.

Courses for graduate students:

C DEV 699: Thesis Research
Cr. 1-6. F.S.SS.
Thesis Research.

Culinary Food Science (AGLS)

The Culinary Food Science degree program is a food science-based degree in which students develop basic culinary skills along with knowledge of the accompanying sciences. As a graduate, you'll combine food product development skills and entrepreneurial talents with scientific and technological knowledge.

The department also offers a culinary science minor.

Administered by the Department of Food Science and Human Nutrition

Total Degree Requirement: 120 cr.
Students must fulfill International Perspectives and U.S. Diversity requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communications and Library: 10 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 6-12 cr.

Select Humanities course from approved list		3

If H Sci student, select:		6
Additional Humanities course		
Additional Humanities or Social Science course		
ECON 101	Principles of Microeconomics	3

Ethics and Environmental: 3-6 cr.

FS HN 342	World Food Issues: Past and Present	3
If AgLS student, select from:		2-3
ENV S 120	Introduction to Renewable Resources	
ENV S 201	Introduction to Environmental Issues	

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from:		3-4
MATH 140	College Algebra	
MATH 143	Preparation for Calculus	
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Select at least 3 credits from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
Total Credits		6-8

Physical Sciences: 9 cr.

CHEM 163	College Chemistry	4
or CHEM 177	General Chemistry I	
CHEM 163L	Laboratory in College Chemistry	1
or CHEM 177L	Laboratory in General Chemistry I	
CHEM 231	Elementary Organic Chemistry	3
CHEM 231L	Laboratory in Elementary Organic Chemistry	1
Total Credits		9

Biological Sciences: 12-13 cr.

BBMB 301	Survey of Biochemistry	3
BIOL 211	Principles of Biology I	3
BIOL 212	Principles of Biology II	3
MICRO 201	Introduction to Microbiology	2-3
or MICRO 302	Biology of Microorganisms	
MICRO 201L	Introductory Microbiology Laboratory	1
or MICRO 302L	Microbiology Laboratory	
Total Credits		12-13

Animal Science Coursework: 6 cr.

AN S 270	Foods of Animal Origin	2
AN S 270L	Foods of Animal Origin Laboratory	1
AN S 460	Processed Meats	3
Total Credits		6

Food Science and Human Nutrition: 41 cr.

FS HN 101	Food and the Consumer	3
FS HN 104	Introduction to Professional Skills in Culinary Science	1
FS HN 110	Professional and Educational Preparation	1
FS HN 167	Introduction to Human Nutrition	3
FS HN 203	Contemporary Issues in Food Science and Human Nutrition	1
FS HN 214	Scientific Study of Food	3
FS HN 215	Advanced Food Preparation Laboratory	2
FS HN 265	Nutrition for Active and Healthy Lifestyles	3
FS HN 311	Food Chemistry	3
FS HN 311L	Food Chemistry Laboratory	1
FS HN 314	Foundations of Culinary Science	1
FS HN 403	Food Laws and Regulations	2
FS HN 405	Food Quality Assurance	3
FS HN 406	Sensory Evaluation of Food	3
FS HN 411	Food Ingredient Interactions and Formulations	2
FS HN 412	Food Product Development	3
FS HN 420	Food Microbiology	3
FS HN 480	Professional Communication in Food Science and Human Nutrition	1
Take one of the following courses for 2 credits:		2
FS HN 491B	Supervised Work Experience: Food Science	
or FS HN 491	Supervised Work Experience: Culinary Science	
Total Credits		41

Hotel, Restaurant, Institutional Management: 16 cr.

MKT 340	Principles of Marketing	3
HSP M 233	Hospitality Sanitation and Safety	3
HSP M 380	Quantity Food Production Management	3
HSP M 380L	Quantity Food Production and Service Management Experience	2
HSP M 383	Introduction to Wine, Beer, and Spirits	2
HSP M 487	Fine Dining Event Management	3
Total Credits		16

Electives 0-8 cr. Select from any university coursework to earn at least 120 total credits.

Go to FS HN courses.

Culinary Food Science, B.S.

First Year

Fall	Credits	Spring	Credits
FS HN 110	1	FS HN 101	3
CHEM 163 or 177	4	FS HN 104	1
CHEM 163L or 177L	1	FS HN 167	3
BIOL 211	3	BIOL 212	3
MATH 140, 143, 160, 165 or 181	3-4	ECON 101	3
ENGL 150	3	STAT 101 or 104	3-4
LIB 160	1		
	16-17		16-17

Second Year

Fall	Credits	Spring	Credits
CHEM 231	3	FS HN 265	3
CHEM 231L	1	BBMB 301	3
ENGL 250	3	MICRO 201 or 302	2-3
FS HN 203	1	MICRO 201L or 302L	1
HSP M 233	3	FS HN 214	3
SP CM 212	3	FS HN 215	2
	14		14-15

Third Year

Fall	Credits	Spring	Credits
AN S 270	2	FS HN 314	1
AN S 270L	1	FS HN 342	3
FS HN 311	3	FS HN 403	2
FS HN 311L	1	Humanities	3
FS HN 411	2	HSP M 380	3
FS HN 420	3	HSP M 380L	2
Humanities (H Sci) or ENV S course (AgLS)	2-3		
	14-15		14

Fourth Year

Fall	Credits	Spring	Credits
FS HN 406	3	AN S 460	3
FS HN 491B or 491D, Internship	2	FS HN 405	3
HSP M 383	2	FS HN 412	3
HSP M 487	3	FS HN 480	1
MKT 340	3	Humanities or Social Science (H Sci) or elective (AgLS)	3
U.S. Diversity course	3	Electives*	3
	16		16

* Chose elective courses to total equal to or greater than 120 credits.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

Dairy Science

Students majoring in Dairy Science will complete the degree requirements listed below. If desired, a student may also include the specialized option in pre-veterinary medicine. A minimum of 15 credits of animal science coursework must be earned at Iowa State University. A minimum of 15 credits must be completed from the courses listed to meet the Ethics, International Perspectives, U.S. Diversity, and Humanities and Social Sciences requirements.

Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspectives

Approved International Perspectives course	3

U.S. Diversity

Approved U.S. Diversity course	3

Communications Proficiency

English composition	6
Speech fundamentals	3
Total Credits	9

Communication/Library

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
One course from the following:		3
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
COMST 214	Professional Communication	
SP CM 212	Fundamentals of Public Speaking	
Total Credits		10

Humanities and Social Sciences

Approved Humanities course	3
Approved Social Science course	3
Total Credits	6

Ethics

Approved Ethics course		3

Mathematics and Business

One course from the following:		3
ECON 101	Principles of Microeconomics	
ECON 102	Principles of Macroeconomics	
ACCT 284	Financial Accounting	
One course from the following:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
STAT 226	Introduction to Business Statistics I	
One course from the following:		3-4
MATH 140	College Algebra	
MATH 150	Discrete Mathematics for Business and Social Sciences	
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Total Credits		9-11

Biological Sciences

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 313	Principles of Genetics	3
or GEN 320	Genetics, Agriculture and Biotechnology	
MICRO 201 & 201L	Introduction to Microbiology and Introductory Microbiology Laboratory	3-4
or MICRO 302 & 302L	Biology of Microorganisms and Microbiology Laboratory	
Total Credits		14-15

Physical Sciences

A minimum of 8 credits are required. These requirements are specific to option and are listed with each option below.

Dairy Sciences Option

AN S 101	Working with Animals	2
AN S 110	Orientation in Animal Science and ISU	1
AN S 114	Survey of the Animal Industry	2
AN S 210	Career Preparation in Animal Science	1
AN S 211	Issues Facing Animal Science	1
AN S 214	Domestic Animal Physiology	3
AN S 214L	Domestic Animal Anatomy and Physiology Lab	1
AN S 235	Dairy Cattle Science	3
AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	3
or FS HN 101	Food and the Consumer	
AN S 319	Animal Nutrition	3
AN S 320	Animal Feeds and Feeding	3
AN S 331	Domestic Animal Reproduction	3
AN S 337	Lactation	3
AN S 352	Genetic Improvement of Domestic Animals	3
AN S 411	Addressing Issues in Animal Science	1
AN S 434	Dairy Systems Management	3
AN S 435	Applied Dairy Farm Evaluation	3
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	5
or CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
CHEM 331	Organic Chemistry I	3
or BBMB 221	Structure and Reactions in Biochemical Processes	
Four credits (minimum) from the following:		4
AGRON 334	Forage Crop Management	
AN S 332	Laboratory Methods in Animal Reproduction	
or AN S 333	Embryo Transfer and Related Technologies	
AN S 336	Domestic Animal Behavior and Well-Being	
AN S 345	Growth and Development of Domestic Animals	
AN S 360	Fresh Meats	
AN S 415	Equine Systems Management	
AN S 419	Advanced Animal Nutrition	
AN S 424	Companion Animal Systems Management	
AN S 425	Swine Systems Management	
AN S 426	Beef Cattle Systems Management	
AN S 429	Sheep Systems Management	
AN S 460	Processed Meats	
ECON 332	Cooperatives	
ECON 336	Agricultural Selling	
FS HN 308	Dairy Products: Current Issues and Controversies	
FS HN 403	Food Laws and Regulations	
FS HN 405	Food Quality Assurance	
FS HN 410	Food Analysis	
MICRO 310	Medical Microbiology	
MICRO 353	Introductory Parasitology	
MICRO 374	Insects and Our Health	
MICRO 402	Microbial Genetics and Genomics	
MICRO 407	Microbiological Safety of Foods of Animal Origins	

MICRO 419	Foodborne Hazards	
MICRO 419	Foodborne Hazards	
FS HN 420	Food Microbiology	
MICRO 420	Food Microbiology	
MICRO 475	Immunology	
VDPAM 487	Livestock Disease Prevention	
Total Credits		51

Additional free electives for the Dairy Sciences option 26-29

Pre-Veterinary Medicine Option

AN S 101	Working with Animals	2
AN S 110	Orientation in Animal Science and ISU	1
AN S 114	Survey of the Animal Industry	2
AN S 210	Career Preparation in Animal Science	1
AN S 211	Issues Facing Animal Science	1
AN S 214	Domestic Animal Physiology	3
AN S 214L	Domestic Animal Anatomy and Physiology Lab	1
AN S 235	Dairy Cattle Science	3
AN S 270 & 270L	Foods of Animal Origin and Foods of Animal Origin Laboratory	3
or FS HN 101	Food and the Consumer	
AN S 319	Animal Nutrition	3
AN S 320	Animal Feeds and Feeding	3
AN S 331	Domestic Animal Reproduction	3
AN S 337	Lactation	3
AN S 352	Genetic Improvement of Domestic Animals	3
AN S 411	Addressing Issues in Animal Science	1
AN S 434	Dairy Systems Management	3
AN S 435	Applied Dairy Farm Evaluation	3
CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
CHEM 332	Organic Chemistry II	3
BBMB 301	Survey of Biochemistry	3
PHYS 111	General Physics	5
Four credits (minimum) from the following:		4
AGRON 334	Forage Crop Management	
AN S 332	Laboratory Methods in Animal Reproduction	
or AN S 333	Embryo Transfer and Related Technologies	
AN S 336	Domestic Animal Behavior and Well-Being	
AN S 345	Growth and Development of Domestic Animals	
AN S 360	Fresh Meats	
AN S 415	Equine Systems Management	
AN S 419	Advanced Animal Nutrition	
AN S 424	Companion Animal Systems Management	
AN S 425	Swine Systems Management	
AN S 426	Beef Cattle Systems Management	
AN S 429	Sheep Systems Management	
AN S 460	Processed Meats	
ECON 332	Cooperatives	
ECON 336	Agricultural Selling	
FS HN 308	Dairy Products: Current Issues and Controversies	
FS HN 403	Food Laws and Regulations	
FS HN 405	Food Quality Assurance	
FS HN 410	Food Analysis	
MICRO 310	Medical Microbiology	
MICRO 353	Introductory Parasitology	
MICRO 374	Insects and Our Health	
MICRO 402	Microbial Genetics and Genomics	
MICRO 407	Microbiological Safety of Foods of Animal Origins	
MICRO 419	Foodborne Hazards	
MICRO 421	Food Microbiology Laboratory	
Total Credits		66

Additional free electives for the Pre-Veterinary Medicine Option 11-14

* The Iowa State University College of Veterinary Medicine academic requirements are met by completion of this option (http://vetmed.iastate.edu/academics/prospective-students/admissions/academic-requirements).

Dairy Science, B.S. - general

Freshman

Fall	Credits	Spring	Credits
AN S 110	1	AN S 114	2
AN S 101	2	CHEM 177, 177L or 163. 163L	5
BIOL 211	3	Humanities - elecitve list	3
BIOL 211L	1	SP CM 212, AGEDS 311, or COMST 214	3
ENGL 150	3	STAT 101 or 104 or 226	3-4
LIB 160	1		
MATH 140, 150, 160, 165, or 181	3-4		

Social Science - elective list	3		
	17-18		16-17

Sophomore

Fall	Credits	Spring	Credits
AN S 211	1	AN S 210	1
AN S 235	3	AN S 270 & 270L or FS HN 101	3
BIOL 212	3	AN S 214	3
BIOL 212L	1	AN S 214L	1
BBMB 221	3	ENGL 250	3
ECON 101	3	MICRO 201 & 201L or MICRO 302 & 302L	3-4
Free elective	3	Free elective	3
	17		17-18

Junior

Fall	Credits	Spring	Credits
AN S 319	3	AN S 320	3
AN S 331	3	AN S 352	3
GEN 320 or BIOL 313	3	AN S 337	3
US diversity - elective list	3	Free elective	3
Free elective	3	Ethics - elective list	3
	15		15

Senior

Fall	Credits	Spring	Credits
AN S 411	1	AN S 435	3
AN S 434	3	International perspective - elective list	3
AN S elective	3	AN S elective	3
Free Elective	3	Free elective	3
Free elective	3	Free Elective	4
Free elective	3		
	16		16

Important Note: This is only one of many equally-sound schedule sequences.

Free electives and specified group electives are often chosen to complement the student's career focus. The student's academic adviser assists with developing scheduling schemes that prepare students individually for careers in the animal industry. They are explained fully in AN S 110 and through appointments with the student's adviser in Dairy Science. Typical career areas include Advanced Degree in Dairy Science, Business and Finance, Agriculture Promotion and Information, Dairy Food Industry, Agricultural Sales and Marketing, International Agriculture, Animal Production and General Agribusiness and Pre-Veterinary Medicine.

Dairy Science, B.S. - pre-veterinary medicine option

Freshman

Fall	Credits	Spring	Credits
AN S 110	1	AN S 114	2
AN S 101	2	CHEM 177	4
BIOL 211	3	CHEM 177L	1
BIOL 211L	1	Humanities - elective list	3
ENGL 150	3	SP CM 212, AGEDS 311, or COMST 214	3
LIB 160	1	STAT 101 or 104 or 226	3-4
MATH 140, 150, 160, 165, or 181	3-4		
Social Science - elective list	3		
	17-18		16-17

Sophomore

Fall	Credits	Spring	Credits
AN S 211	1	AN S 210	1
AN S 235	3	AN S 270 & 270L or FS HN 101	3
BIOL 212	3	AN S 214	3
BIOL 212L	1	AN S 214L	1
CHEM 178	3	CHEM 331	3
ECON 101	3	CHEM 331L	1
Ethics - elective list	3	ENGL 250	3
		Free elective	3
	17		18

Junior

Fall	Credits	Spring	Credits
AN S 319	3	AN S 320	3
AN S 331	3	AN S 352	3
GEN 320 or BIOL 313	3	AN S 337	3
CHEM 332	3	BBMB 301	3

MICRO 201L & 201L or MICRO 302 & 302L	3-4 US diversity - elective list	3
	15-16	15

Senior

Fall	Credits	Spring	Credits
AN S 411	1	AN S 435	3
AN S 434	3	International Perspective - elective list	3
AN S elective	3	AN S elective	3
PHYS 111	5	Free elective	3
Free elective	4	Free elective	4
	16		16

* Credits currently required for application to Veterinary Medicine program at ISU (60 credits)

General Chemistry with lab (7)
Organic Chemistry with lab (7)
Biochemistry (3)
General Physics with lab (4)
General Biology with lab (8)
Genetics (3)
Mammalian Anatomy and/or Physiology (3)
English Composition (6)
Oral Communication (3)
Humanities and/or Social Science (8)
Other Electives (8)

Diet and Exercise (AGLS)

Curriculum in Diet and Exercise B.S./M.S.

Administered by the Department of Food Science and Human Nutrition and Department of Kinesiology

This is an accelerated program with concurrent enrollment in the undergraduate and graduate degree programs. Courses included have been approved as meeting the academic requirements of the Didactic Program in Dietetics (DPD) in preparation for admission to accredited dietetics internship programs; the DPD is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics. There is a $30 fee for the verification statement of completion of the accredited dietetics program. Additionally, courses are included to meet the American College of Sports Medicine (ACSM) requirements for certification at the level of Certified Exercise Physiologist.

Total Degree Requirements: 124 cr. for bachelor's degree and 34-41 cr. for master's degree

Students must fulfill International Perspectives and U.S. Diversity requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements.

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communications and Library: 10 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		10

Social Sciences: 6 cr.

PSYCH 101	Introduction to Psychology	3
PSYCH 230	Developmental Psychology	3
Total Credits		6

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from:		3-4
MATH 140	College Algebra	
MATH 143	Preparation for Calculus	
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Select at least 3 credits from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
STAT 226	Introduction to Business Statistics I	
Total Credits		6-8

Physical Sciences: 13-17 cr.

Select from:		5-8
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	
CHEM 177 & 177L & CHEM 178	General Chemistry I and Laboratory in General Chemistry I and General Chemistry II	
CHEM 231	Elementary Organic Chemistry	3
CHEM 231L	Laboratory in Elementary Organic Chemistry	1
PHYS 115 or PHYS 111	Physics for the Life Sciences General Physics	4-5
Total Credits		13-17

Biological Sciences: 19 cr.

BBMB 301	Survey of Biochemistry	3

BIOL 211	Principles of Biology I	3
BIOL 212	Principles of Biology II	3
BIOL 255	Fundamentals of Human Anatomy	3
BIOL 255L	Fundamentals of Human Anatomy Laboratory	1
BIOL 256	Fundamentals of Human Physiology	3
BIOL 256L	Fundamentals of Human Physiology Laboratory	1
MICRO 201	Introduction to Microbiology	2
Total Credits		19

Diet and Exercise undergraduate courses to be completed or in progress when applying for admission to the program: 20-22 cr.

Select from:		1-2
FS HN 110	Professional and Educational Preparation	
KIN 252 & KIN 253	Disciplines and Professions in Kinesiology and Health and Orientation and Learning Community in Kinesiology and Health	
FS HN 167	Introduction to Human Nutrition	3
FS HN 214	Scientific Study of Food	3
FS HN 215 or FS HN 115	Advanced Food Preparation Laboratory Food Preparation Laboratory	1-2
FS HN 265	Nutrition for Active and Healthy Lifestyles	3
FS HN 340	Foundations of Dietetic Practice	1
FS HN 360	Advanced Human Nutrition and Metabolism	3
H S 110	Personal and Consumer Health	3
KIN 258	Physical Fitness and Conditioning	2
Total Credits		20-22

Acceptance into the BS/MS PROGRAM is required BEFORE spring semester of the THIRD year.

Humanities and Ethics: 6-9 cr.

Select 6 credits from approved Humanities list		6
Select 3 credits from approved Ethics list		3

Note: If ethics course is on the humanities list, it can meet both requirements.

Diet and Exercise remaining undergraduate courses to complete the bachelor's degree requirements: 43 cr.

H S 380	Worksite Health Promotion	3
A TR 220 or H S 305	Basic Athletic Training Instructor's First Aid and Cardio-pulmonary Resuscitation	2
KIN 259	Leadership Techniques for Fitness Programs	2
KIN 345	Management of Health-Fitness Programs and Facilities	3
KIN 358	Physiology of Exercise	3
Select from:		3
KIN 355	Biomechanics	
KIN 360	Sociology of Sport and Exercise	
KIN 366	Exercise Psychology	
KIN 372	Motor Control and Learning Across the Lifespan	
KIN 462	Medical Aspects of Exercise	3
FS HN 361	Nutrition and Health Assessment	2
FS HN 367	Medical Terminology for Health Professionals	1
FS HN 403	Food Laws and Regulations	2
FS HN 411	Food Ingredient Interactions and Formulations	2
FS HN 466	Nutrition Counseling and Education Methods	3
HSP M 380	Quantity Food Production Management	3
HSP M 380L	Quantity Food Production and Service Management Experience	2
HSP M 392	Foodservice Systems Management II	3
NUTRS 563	Community Nutrition *	3
NUTRS 564	Medical Nutrition and Disease II *	3
Total Credits		43

Diet and Exercise graduate courses to complete the master's degree requirements: 34-41 cr.

FS HN 581	Seminar **	1
FS HN 590C	Special Topics: Teaching **	1
FS HN 681	Seminar **	1
FS HN 682	Seminar Reflection **	R
NUTRS 501	Biochemical and Physiological Basis of Nutrition: Macronutrients and Micronutrients	4
NUTRS 561	Medical Nutrition and Disease I	4
NUTRS 563	Community Nutrition *	3
NUTRS 564	Medical Nutrition and Disease II *	3
KIN 501	Research Methods in Physical Activity	3
KIN 505	Research Laboratory Techniques in Exercise Physiology	2
Select 3-6 credits (FSHN students select 3 credits, KIN students select 6 credits) from:		3-6
KIN 511		
KIN 550	Advanced Physiology of Exercise I	
KIN 567	Exercise and Health: Behavior Change	
KIN 570	Physical Activity Assessment for Health Related Research	
KIN 551	Advanced Physiology of Exercise II	3
KIN 558	Physical Fitness - Principles, Programs and Evaluation	3
Select 2-3 credits for creative component or 6 credits for thesis research:		2-6

FS HN 599	Creative Component	
KIN 599	Creative Component	
KIN 699	Research	
NUTRS 699	Research in Nutritional Sciences	
STAT 401	Statistical Methods for Research Workers	4

* Course counts toward both bachelor's and master's degrees.

** Requirement for students in the FS HN Department.

Go to FS HN courses.

Go to KIN courses.

Diet and Exercise, B.S./M.S.

First Year

Fall	Credits	Spring	Credits
FS HN 110, or KIN 252 and 253	1-2	FS HN 167	3
CHEM 163 or 177	4	CHEM 178 (if CHEM 177 taken) or Elective	3
CHEM 163L or 177L	1	BIOL 212	3
BIOL 211	3	PSYCH 101	3
ENGL 150	3	H S 110	3
LIB 160	1		
MATH 140, 143, 160, 165, or 181	3-4		
	16-18		15

Second Year

Fall	Credits	Spring	Credits	Summer	Credits
CHEM 231	3	FS HN 265	3	A TR 220 (Or, H S 305 in spring or fall)	2
CHEM 231L	1	BBMB 301	3		
BIOL 255	3	BIOL 256	3		
BIOL 255L	1	BIOL 256L	1		
PSYCH 230	3	FS HN 214	3		
ENGL 250	3	FS HN 115 or 215	1-2		
MICRO 201	2				
	16		14-15		2

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
FS HN 340	1	Acceptance into the program required before spring of the third year		KIN 599 or FS HN 599 or KIN 699 or NUTRS 699	1-3
FS HN 360	3	FS HN 361	2	STAT 401	4
KIN 258	2	FS HN 367	1		
PHYS 115 (4 cr) or 111 (5 cr)	4-5	H S 380	3		
SP CM 212	3	HSP M 380	3		
STAT 101, 104, or 226	3-4	HSP M 380L	2		
Apply for admission to the BS/MS program by Oct. 1		KIN 259	2		
		KIN 358	3		
	16-18		16		5-7

Fourth Year

Fall	Credits	Spring	Credits	Summer	Credits
KIN 558 (offered odd years), or KIN 355, 360, 366, or 372	3	KIN 462	3	KIN 599 or FS HN 599 or KIN 699 or NUTRS 699	1-3
KIN 501	3	KIN 511, 550, 567, or 570	3	FS HN 403	2
KIN 505	2	KIN 551 (offered odd years, or HSP M 392)	3		
NUTRS 561	4	NUTRS 564	3		

NUTRS 563 (Time conflict with NUTRS 501 next fall)	3	FS HN 581 / FS HN 682 (FSHN Dept)	1
FS HN 682 (FSHN Dept)	0	Humanities/ Ethics course	3
	15		16 3-5

Fifth Year

Fall	Credits	Spring	Credits	Summer	Credits
FS HN 411	2	FS HN 466	3	KIN 699 or NUTRS 699 or KIN 599 or FS HN 599	1
Additional course: KIN 511, 550, 567, 570 (KIN Dept)	3	FS HN 590C (FSHN Dept)	1		
NUTRS 501	4	HSP M 392	3		
KIN 558 (offered odd yrs, or KIN 355, 360, 366, or 372)	3	KIN 345	3		
Humanities/ International Perspectives	3	KIN 699 or NUTRS 699 or KIN 599 or FS HN 599	2		
FS HN 682 (FSHN Dept)	0	FS HN 681 (FSHN Dept)	1		
	15		13		1

Footnote
- Planned course offerings may change, and students need to check the online Schedule of Classes each term to confirm course offerings: http://classes.iastate.edu/. This sequence is only an example.

Dietetics (AGLS)

Dietitians are nutrition experts who strive for optimal health and nutrition of individuals and the population. The curriculum for the dietetics program as well as the diet and exercise program meet the academic requirements of the Didactic Program in Dietetics and prepares students for a career in the field of dietetics. The program is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency for the Academy of Nutrition and Dietetics.

Administered by the Department of Food Science and Human Nutrition

The dietetics undergraduate curriculum meets the academic requirements as the Didactic Program in Dietetics and is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics. Graduates of the program are eligible to apply for admission to accredited supervised practice programs/dietetics internships. There is a $30 fee for the verification statement of completion of the accredited dietetics program.

Total Degree Requirement: 120 cr.
Students must fulfill International Perspectives and U.S. Diversity requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communications and Library: 10 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 6-12 cr.

Select Humanities course from approved list		3
PSYCH 101	Introduction to Psychology	3
If H Sci student, select:		6
Additional Humanities course		
Additional Humanities or Social Science course		

Ethics and Environmental: 3-6 cr.

FS HN 342	World Food Issues: Past and Present	3
If AgLS student, select from:		2-3
ENV S 120	Introduction to Renewable Resources	
ENV S 201	Introduction to Environmental Issues	

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from:		3-4
MATH 140	College Algebra	
MATH 143	Preparation for Calculus	
MATH 160	Survey of Calculus	

MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Select at least 3 credits from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
Total Credits		6-8

Physical Sciences: 9-12 cr.

Select from:		5-8
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	
CHEM 177 & 177L & CHEM 178	General Chemistry I and Laboratory in General Chemistry I and General Chemistry II	
CHEM 231	Elementary Organic Chemistry	3
CHEM 231L	Laboratory in Elementary Organic Chemistry	1
Total Credits		9-12

Biological Sciences: 20-21 cr.

BBMB 301	Survey of Biochemistry	3
BIOL 211	Principles of Biology I	3
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 255	Fundamentals of Human Anatomy	3
BIOL 255L	Fundamentals of Human Anatomy Laboratory	1
Select from:		3-4
BIOL 256 & 256L	Fundamentals of Human Physiology and Fundamentals of Human Physiology Laboratory	
BIOL 334	Metabolic Physiology of Mammals	
BIOL 335	Principles of Human and Other Animal Physiology	
MICRO 201	Introduction to Microbiology	2
MICRO 201L	Introductory Microbiology Laboratory	1
Total Credits		20-21

Food Science and Human Nutrition: 40-41 cr.

FS HN 110	Professional and Educational Preparation	1
FS HN 167	Introduction to Human Nutrition	3
FS HN 203	Contemporary Issues in Food Science and Human Nutrition	1
FS HN 214	Scientific Study of Food	3
FS HN 215	Advanced Food Preparation Laboratory	2
or FS HN 115	Food Preparation Laboratory	
FS HN 265	Nutrition for Active and Healthy Lifestyles	3
FS HN 340	Foundations of Dietetic Practice	1
FS HN 360	Advanced Human Nutrition and Metabolism	3
FS HN 361	Nutrition and Health Assessment	2
FS HN 362	Nutrition in Growth and Development	3
FS HN 367	Medical Terminology for Health Professionals	1
FS HN 403	Food Laws and Regulations	2
FS HN 411	Food Ingredient Interactions and Formulations	2
FS HN 461	Medical Nutrition and Disease I	4
FS HN 463	Community Nutrition	3
FS HN 464	Medical Nutrition and Disease II	3
FS HN 466	Nutrition Counseling and Education Methods	3
FS HN 480	Professional Communication in Food Science and Human Nutrition	1
Total Credits		41

Management: 11 cr.

HSP M 380	Quantity Food Production Management	3
HSP M 380L	Quantity Food Production and Service Management Experience	2
HSP M 391	Foodservice Systems Management I	3
HSP M 392	Foodservice Systems Management II	3
Total Credits		11

Electives: 0-13 cr. Select from any university coursework to earn at least 120 total credits.

Admission to the dietetics program: Students enter the university designated as pre-dietetics. During spring semester of the second year, interested students apply to the Didactic Program in Dietetics. Admission to the program is based on overall GPA (3.0 or above required), completion of required coursework, and completion of the application with interest in becoming a registered dietitian. Students then progress toward earning a Bachelor of Science degree in Dietetics and receive a Verification Statement upon graduation, which is needed to enter an accredited dietetics internship.

Go to FS HN courses.

Dietetics, B.S.

First Year

Fall	Credits	Spring	Credits
FS HN 110	1	FS HN 167	3
CHEM 163 or 177	4	CHEM 178 (if CHEM 177 taken) or elective*	3
CHEM 163L or 177L	1	BIOL 212	3
BIOL 211	3	BIOL 212L	1
MATH 140, 143, 160, 165 or 181	3	PSYCH 101	3

ENGL 150	3	Humanities Course	3
LIB 160	1		
	16		16

Second Year

Fall	Credits	Spring	Credits
CHEM 231	3	FS HN 265	3
CHEM 231L	1	BBMB 301	3
BIOL 255	3	BIOL 256 and 256, or 334 or 335	3-4
BIOL 255L	1	MICRO 201	2
ENGL 250	3	MICRO 201L	1
FS HN 203	1	Humanities course (H Sci) or Elective* (AgLS)	3
STAT 101 or 104	3-4	Apply for admission to the program by March 1	
	15-16		15-16

Third Year

Fall	Credits	Spring	Credits
Acceptance into the Didactic Program in Dietetics is required before the third year		FS HN 361	2
FS HN 340	1	FS HN 362	3
FS HN 360	3	FS HN 367	1
FS HN 214	3	HSP M 380	3
FS HN 215 or 115	1-2	HSP M 380L	2
SP CM 212	3	FS HN 342	3
Humanities/social sci. (H Sci) or ENV S (AgLS)	3	Elective*	1
	14-15		15

Fourth Year

Fall	Credits	Spring	Credits
FS HN 461	4	FS HN 464	3
FS HN 463	3	HSP M 392	3
HSP M 391	3	FS HN 403	2
FS HN 411	2	FS HN 480	1
FS HN 466	3	Electives*	5-6
	15		14-15

* Choose elective courses to total equal to or greater than 120 credits.

Note: This sequence is only an example, and the number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

Entomology

Undergraduate Study

Minor - Insect Science

The department offers a minor in Insect Science that may be earned by completing ENT 370 Insect Biology and 12 credits in courses selected from an approved list supplied by the department.

Minor - Emerging Global Diseases

Entomology administers the Emerging Global Diseases minor (see http://www.ent.iastate.edu/egd). Core courses address the biology of emerging disease agents (e.g., protozoa, fungi, microbes, and viruses), the clinical manifestations and epidemiology of emerging diseases, and the impact of those diseases on human interactions and socioeconomics. One course must be taken from each of three core areas:

Pathogens and Disease		
	MICRO 310	Medical Microbiology
	MICRO 353	Introductory Parasitology
Sociology and Economics		
	SOC 411	Social Change in Developing Countries
	SOC 345	Population and Society
	FS HN 342	World Food Issues: Past and Present
Arthropod-borne Diseases		
	ENT 374	Insects and Our Health
	ENT 574	Medical Entomology
	MICRO 353	Introductory Parasitology

The remainder of the credits (for a total of 15) may be selected from any of the above-listed courses not selected, and from other appropriate courses as approved by Emerging Global Diseases program advisers.

Graduate Study

The department offers work for the master of science and doctor of philosophy degrees with a major in entomology. Studies at the Ecosystem, Organismal, and Subcellar levels occur in the following areas: aquatic entomology, biological control, chemical ecology, ecology, host plant resistance, insecticide toxicology, medical/veterinary entomology, pathology, pest management, physiology, population genetics, or systematics.

Graduates have a broad understanding of entomology and related disciplines, and an in-depth command of their area of concentration. They are able to communicate effectively with scientific colleagues and the general public in both formal and informal settings. Graduates are able to address complex problems facing entomology or toxicology professionals, taking into account related ethical, social, legal, economic, and environmental issues. They are skilled in research methods, data

analyses, and interpretation of results. They also are skilled in working effectively with their colleagues, and writing concise and persuasive grant proposals. They have an understanding of and can critically evaluate current entomological literature.

Prerequisite to the entomology major and to minor graduate work in the department is completion of at least two years of zoological courses, for part of which credit in other closely allied biological sciences may be substituted. Specific course requirements for advanced degrees depend partly upon previous training and experience in the major field of specialization.

Any student receiving the M.S. in entomology shall have at least one course in insect physiology, one course in insect systematics, two courses of ENT 590 Special Topics (selected from topics A through D, F through I, M and N, inclusive), and at least 1 credit of ENT 600 Seminar.

Any student receiving the Ph.D. in entomology shall have at least one course in insect physiology, one course in insect systematics, four additional courses of ENT 590 Special Topics (selected from topics A through D and F through I, M through N inclusive), and at least 1 credit of ENT 600 Seminar. At least one 590 must be taken from each of these subgroups: Population (C, D, N); Organismal (A, B, F, M); and Suborganismal (G, H, I).

In addition, Ph.D. students majoring either in Entomology or Toxicology shall have two semesters of teaching experience, taken as ENT 590K Special Topics: Teaching Experience. both semesters or ENT 590K Special Topics: Teaching Experience. one semester and ENT 590L Special Topics: Extension Internship. the other semester.

A student can receive a Ph.D. minor in Entomology by taking 3 Entomology courses (500 level and above) for a total of 9 credits to be determined by the student's POS committee and approved by the Entomology Director of Graduate Education.

An option for an emphasis in molecular Entomology is available. Any student receiving the M.S. in entomology with an emphasis in molecular entomology is required to take:

ENT 555	Insect Physiology	4
ENT 590G	Special Topics: Molecular Entomology.	1-3
Plus one other course of 590 selected from topics A-D, F, H, I, M, N		
Plus one additional course in molecular entomology		
ENT 600	Seminar	1
BBMB 404	Biochemistry I	3
BBMB 542A	Introduction to Molecular Biology Techniques: DNA Techniques	1
And one course from the following:		
ENT 576	Systematic Entomology	
ENT 525	Aquatic Insects	
ENT 568	Advanced Systematics	

Any student receiving the Ph.D. in entomology with an emphasis in molecular entomology is required to take:

ENT 555	Insect Physiology	4
ENT 590G	Special Topics: Molecular Entomology.	1-3
Plus three other courses of 590 selected from topics A-D, F, H, I, M, N		9
One additional course in molecular entomology		3
ENT 600	Seminar	1
BBMB 542A	Introduction to Molecular Biology Techniques: DNA Techniques	1
Plus two other workshops selected from:		6
BBMB 542C	Introduction to Molecular Biology Techniques: Cell Techniques	
BBMB 542D	Introduction to Molecular Biology Techniques: Plant Transformation	
BBMB 542E	Introduction to Molecular Biology Techniques: Proteomics	
An additional course with a molecular component		3
Plus one from each of the following:		
Systematics		3
ENT 576	Systematic Entomology	
ENT 525	Aquatic Insects	
ENT 568	Advanced Systematics	
Biochemistry		3
BBMB 404	Biochemistry I	
BBMB 405	Biochemistry II	
BBMB 504	Amino Acids and Proteins	
BBMB 505	Bioenergetics and Metabolism	

Entomology participates in the interdepartmental majors in ecology and evolutionary biology; genetics; Microbiology; and molecular, cellular and developmental biology; and in the interdepartmental major and minor in toxicology (see Index).

The Federal Corn Insects and Crop Genetics Research Unit and the North Central Plant Introduction Station are available for advanced study in certain phases of entomological research.

More information about the department, such as current research, faculty resumes, physical facilities, and graduate students can be viewed on the department's website at www.ent.iastate.edu (http://www.ent.iastate.edu/assessment). Curriculum assessment for the department can be viewed here: http://www.ent.iastate.edu/assessment.

Courses primarily for undergraduates:

ENT 201: Introduction to Insects
(1-0) Cr. 1. F.S.SS.
5 weeks. Classroom section spring only. World Wide Web section of course offered summer and fall semesters. Biological and ecological aspects of insects.

ENT 211: Insects and Society
(2-0) Cr. 2. F.S.
Prereq: ENT 201
11 weeks. Classroom section spring only. World Wide Web section offered fall semester. The importance of insects in human well-being. Insect-human interactions. Primarily for nonscience and nonagriculture majors.

ENT 283: Pesticide Application Certification
(Cross-listed with AGRON, FOR, HORT). (2-0) Cr. 2. S.
Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized.

ENT 370: Insect Biology
(2-3) Cr. 3. F.
Prereq: BIOL 101 or BIOL 211
Structure, physiology, evolution, behavior, life histories, and recognition of insects. Collection required.

ENT 371I: Introduction to Insect Ecology
(Cross-listed with IA LL). (3-3) Cr. 4. Alt. SS., offered odd-numbered years.
Field and laboratory study of insects, their diversity, life history; emphasis on ecology and behavior.

ENT 372: Livestock Entomology
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Classroom and off-campus videotape sections. 12 weeks. Recognition, biology, behavior, economic importance, and management of insects and other arthropods affecting livestock and poultry production.

ENT 374: Insects and Our Health
(Cross-listed with MICRO). (3-0) Cr. 3. S.
Prereq: 3 credits in biological sciences
Identification, biology, and significance of insects and arthropods that affect the health of humans and animals, particularly those that are vectors of disease.
Meets International Perspectives Requirement.

ENT 374L: Insects and Our Health Laboratory
(Cross-listed with MICRO). (0-3) Cr. 1. Alt. S., offered even-numbered years.
Prereq: Credit or enrollment in ENT 374
Laboratory and field techniques for studying medical or public health entomology, including: collection, identification and maintenance of medically significant arthropods and experimental design and execution related to the biology of arthropods or arthropod-pathogen interactions.

ENT 375: Plant Protection Using Natural Enemies
(Dual-listed with ENT 575). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: ENT 370 or ENT 376
Overview of the biology, ecology, and classification of insect pathogens, predators, and parasitoids. Discussion of the use of these organisms in plant protection, including an emphasis on genetic alteration of natural enemies.

ENT 376: Fundamentals of Entomology and Pest Management
(2-3) Cr. 3. S.
Prereq: BIOL 101 or BIOL 211
Introduction to entomology and insect-pest management, including life processes, ecology, economics, tactics of population suppression, and ecological backlash.

ENT 410: Insect-Virus Interactions: a Molecular Perspective
(Dual-listed with ENT 510). (Cross-listed with MICRO). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: Permission of an instructor.
Overview of insect-virus interactions including insect immunity to viruses, genetic enhancement of viral insecticides, transgenic mosquitoes, disruption of virus transmission, and the role of insect and virus genomics in combating viral disease of both human and agricultural importance.

ENT 425: Aquatic Insects
(Dual-listed with ENT 525). (Cross-listed with A ECL). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312 or equivalent
Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

ENT 450: Pesticides in the Environment
(Dual-listed with ENT 550). (2-0) Cr. 2. S.
Prereq: 9 credits of biological sciences
Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere.

ENT 452: Integrated Management of Diseases and Insect Pests of Turfgrasses
(Dual-listed with ENT 552). (Cross-listed with HORT, PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HORT 351
Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

ENT 466: Ecosystem Service Management
(Dual-listed with ENT 566). (Cross-listed with ENSCI, NREM). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

ENT 471: Insect Ecology
(Dual-listed with ENT 571). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 9 credits biological sciences
The contribution of insects to ecosystem function is staggering. This course will focus on insect population ecology, predator-prey interaction and chemical ecology. The role of insects in nutrient cycling, pollination and pest management will be discussed with case studies used to highlight the applied nature of insect ecology and its relationship to agriculture.

ENT 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 15 credits in biological sciences, junior or senior classification
A maximum of 9 credits of all (university-wide) 490 credits may be applied toward graduation.

ENT 490E: Independent Study: Research or work experience.
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 15 credits in biological sciences, junior or senior classification
A maximum of 9 of all (university-wide) 490 credits may be used toward graduation.

ENT 490U: Independent Study: Laboratory teaching experience
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 15 credits in biological sciences, junior or senior classification. For students registering to be undergraduate laboratory assistants.
A maximum of 9 of all (university-wide) 490 credits may be used toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

ENT 510: Insect-Virus Interactions: a Molecular Perspective
(Dual-listed with ENT 410). (Cross-listed with MICRO). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: Permission of an instructor.
Overview of insect-virus interactions including insect immunity to viruses, genetic enhancement of viral insecticides, transgenic mosquitoes, disruption of virus transmission, and the role of insect and virus genomics in combating viral disease of both human and agricultural importance.

ENT 511: Integrated Management of Tropical Crops
(Cross-listed with HORT, PL P). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PL P 408 or PL P 416 or ENT 370 or ENT 376 or HORT 221
Applications of Integrated Crop Management principles (including plant pathology, entomology, and horticulture) to tropical cropping systems. Familiarization with a variety of tropical agroecosystems and Costa Rican culture is followed by 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects.
Meets International Perspectives Requirement.

ENT 525: Aquatic Insects
(Dual-listed with ENT 425). (Cross-listed with A ECL). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312 or equivalent
Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

ENT 530: Ecologically Based Pest Management Strategies
(Cross-listed with AGRON, PL P, SUSAG). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes.

ENT 550: Pesticides in the Environment
(Dual-listed with ENT 450). (Cross-listed with TOX). (2-0) Cr. 2. S.
Prereq: 9 credits of biological sciences
Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere.

ENT 552: Integrated Management of Diseases and Insect Pests of Turfgrasses
(Dual-listed with ENT 452). (Cross-listed with HORT, PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HORT 351
Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

ENT 555: Insect Physiology
(3-3) Cr. 4. Alt. S., offered even-numbered years.
Prereq: ENT 370
Life processes of the insects, including reviews of current problems in insect physiology.

ENT 566: Ecosystem Service Management
(Dual-listed with ENT 466). (Cross-listed with ENSCI, NREM). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

ENT 568: Advanced Systematics
(Cross-listed with EEOB). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Principles and practice of systematic biology; taxonomy, nomenclature and classification of plants and animals; sources and interpretation of systematic data; speciation; fundamentals of phylogenetic systematics.

ENT 570: Plant-Insect Interaction
(2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: 9 credits in biological sciences
Physiological, behavioral, ecological, and evolutionary factors that govern interactions between insects and plants, applications of this knowledge to agriculture, and important results from the study of natural systems. Additional topics covered during the semester include: tritrophic interactions, biological control of plants by insects, and pollination biology. Student-led discussions and draws on both the primary and secondary literature.

ENT 571: Insect Ecology
(Dual-listed with ENT 471). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 9 credits biological sciences
The contribution of insects to ecosystem function is staggering. This course will focus on insect population ecology, predator-prey interaction and chemical ecology. The role of insects in nutrient cycling, pollination and pest management will be discussed with case studies used to highlight the applied nature of insect ecology and its relationship to agriculture.

ENT 574: Medical Entomology
(3-3) Cr. 4. Alt. S., offered even-numbered years.
Prereq: 9 credits in biological sciences
Identification, biology, and significance of insects and other arthropods that attack people and animals, particularly those that are vectors of disease.

ENT 575: Plant Protection Using Natural Enemies
(Dual-listed with ENT 375). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: ENT 370 or ENT 376
Overview of the biology, ecology, and classification of insect pathogens, predators, and parasitoids. Discussion of the use of these organisms in plant protection, including an emphasis on genetic alteration of natural enemies.

ENT 576: Systematic Entomology
(3-6) Cr. 5. Alt. F., offered even-numbered years.
Prereq: ENT 370
Classification, distribution, and natural history of insects, including fundamentals of phylogenetic systematics, biogeography, taxonomic procedures, and insect collection and curation.

ENT 578: Global Protozoology - Molecular Biology of Protozoa
(Dual-listed with ENT 478). (Cross-listed with V PTH). (2-1) Cr. 3. F.
Prereq: Permission of instructor
Analysis of cellular systems, molecules, and organelles of pathogenic protozoan parasites. Emphasis is placed on processes and systems that are unique to protozoa, are important to understanding vector-parasite-host biology/ecology, or are targets of disease prevention/treatment programs for international disease control.

ENT 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: 15 credits in biological sciences.

ENT 590A: Special Topics: Biological Control and Pathology.
Cr. 1-3. Repeatable.

ENT 590B: Special Topics: Chemical Ecology and Behavior.
Cr. 1-3. Repeatable.

ENT 590C: Special Topics: Ecology and Pest Management.
Cr. 1-3. Repeatable.

ENT 590D: Special Topics: Evolution and Systematics.
Cr. 1-3. Repeatable.

ENT 590E: Special Topics: Special Research Topics.
Cr. 1-3. Repeatable.

ENT 590F: Special Topics: Medical and Veterinary Entomology.
Cr. 1-3. Repeatable.

ENT 590G: Special Topics: Molecular Entomology.
Cr. 1-3. Repeatable. Alt. F., offered even-numbered years.
Prereq: 15 credits in biological sciences.

ENT 590H: Special Topics: Physiology and Biochemistry.
Cr. 1-3. Repeatable.

ENT 590I: Special Topics: Toxicology
Cr. 1-3. Repeatable.

ENT 590K: Special Topics: Teaching Experience.
Cr. 1-3. Repeatable.

ENT 590L: Special Topics: Extension Internship.
Cr. 1-3. Repeatable.

ENT 590M: Special Topics: Immature Insects.
Cr. 1-3. Repeatable.

ENT 590N: Special Topics: Population Genetics.
Cr. 1-3. Repeatable.

Courses for graduate students:

ENT 600: Seminar
Cr. 1. F.S.SS.
Presentation of research results.

ENT 675: Insecticide Toxicology
(Cross-listed with TOX). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENT 555 or TOX 501
Principles of insecticide toxicology; classification, mode of action, metabolism, and environmental effects of insecticides.

ENT 699: Research
Cr. arr. Repeatable.

Environmental Science

College of Agriculture and Life Sciences

Interdepartmental Undergraduate Programs

Environmental Science provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems. The magnitude and complexity of environmental problems are creating a growing need for scientists with rigorous, interdisciplinary training in environmental science. The Environmental Science program is designed to prepare students for positions of leadership in this rapidly changing discipline. Environmental Science graduates have a solid foundation in biological and physical natural sciences and the specialized training necessary for integrated analysis of environmental systems.

Undergraduate Study

The Environmental Science undergraduate major is offered through both the College of Agriculture and Life Sciences and the College of Liberal Arts and Sciences. Environmental Science majors complete foundation courses in biology, chemistry, earth science, geology, physics and mathematics, plus a major consisting of an integrated core of Environmental Science courses and additional advanced course work in Environmental Science. Scientific rigor is stressed throughout the program, beginning with the foundation courses in the first two years of the curriculum. The upper level core courses emphasize a dynamic systems approach that provides a framework for integrating physical, chemical, and biological aspects of environmental systems.

Students seeking an Environmental Science major complete the following:

1. A foundation of approved supporting courses in science and mathematics including biology, chemistry, earth science, physics, calculus, and statistics.

2. 32 credits of course work in the major, including a required core of 20 credits.

A combined average grade of C or higher is required in courses applied in the major.

1. Environmental Science: 32 credits

ENSCI 110	Orientation to Environmental Science	1
ENSCI 201	Introduction to Environmental Issues	2
ENSCI 202	Exploration of Environmental and Sustainability Issues	1
ENSCI 203	Exploration of Environmental Science	1
ENSCI 250	Environmental Geography	3
ENSCI 251	Biological Processes in the Environment	3
ENSCI 381	Environmental Systems I: Introduction to Environmental Systems	3
ENSCI 382	Environmental Systems II: Analysis of Environmental Systems	3
ENSCI 384	Introduction to Ecosystems	3
Additional ENSCI choice courses		12
Total Credits		32

2. Mathematics & Statistics: 7-8 credits

Choose one of the following:		4
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Choose one of the following:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
Total Credits		7-8

3. Physical & Life Sciences: 21-24 credits

BIOL 101	Introductory Biology	3
or BIOL 211	Principles of Biology I	
Choose from one of the following:		5-6
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	

CHEM 167 & 167L	General Chemistry for Engineering Students and Laboratory in General Chemistry for Engineering	
CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
CHEM 201 & 201L	Advanced General Chemistry and Laboratory in Advanced General Chemistry	
Choose from one of the following:		3-4
CHEM 231 & 231L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	
CHEM 331 & 331L	Organic Chemistry I and Laboratory in Organic Chemistry I	
BBMB 221	Structure and Reactions in Biochemical Processes	
AGRON 259	Organic Compounds in Plants and Soils	
Choose from one of the following:		4-5
PHYS 111	General Physics	
PHYS 115	Physics for the Life Sciences	
PHYS 221	Introduction to Classical Physics I	
Choose 2 of the following:		6
AGRON 182	Introduction to Soil Science	
GEOL 100 or GEOL 201	The Earth / Geology for Engineers and Environmental Scientists	
MTEOR 206	Introduction to Weather and Climate	
BIOL 212	Principles of Biology II	
CHEM 178 & 178L	General Chemistry II and Laboratory in College Chemistry II	
Total Credits		21-24

4. Communications: 7-10 credits

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
Embedded communication coursework in ENSCI 203, 381 and 382		
Total Credits		7

Additional communication Courses required of majors in the College of Agriculture and Life Sciences

SP CM 212 or AGEDS 311	Fundamentals of Public Speaking / Presentation and Sales Strategies for Agricultural Audiences	3
Total Credits		3

5. General Education: 15-21 credits

General Education requirements in the College of Agriculture and Life Sciences

Humanities	3
Social Science	3
Ethics	3
International Perspectives course from university approved list	3
US Diversity course from university approved list	3
Total Credits	15

General Education requirements in the College of Liberal Arts and Sciences

Arts and Humanities courses from college approved list	12
Social Science courses from college approved list	9
(Select courses to include 3 cr. of International Perspectives and 3 cr. of US Diversity)	
Students must have completed 3 years of a single world language in high school or take 4-8 credits of World Languages at the university level	
Total Credits	21

Electives (28-35 credits)
120.0 Total Credits

Environmental Science, B.S.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	BIOL 211 & 211L or Elective	3-4
ENSCI 110[1]	1	CHEM 178	3
ENSCI 201[1]	2	CHEM 178L	1
CHEM 177	4	MATH 160, 165 or 181	4
CHEM 177L	1	Social Science or Humanities Choice[2]	3
LIB 160	1		
STAT 101 or 104	3		
	15		14-15

Sophomore

Fall	Credits	Spring	Credits
ENSCI 250[1]	3	ENSCI 251	3
Social Science or Humanities Choice[2]	3	Organic Chemistry Choice[3]	3
PHYS 115	4	Earth Science Choice[3]	3
ENGL 250	3	Social Science or Humanities Choice[2]	3
Elective	3	Communications (Speech)	3
	16		15

Junior

Fall	Credits	Spring	Credits
ENSCI 381[1]	3-4	ENSCI 382[1]	3
Environmental Science Choice[1]	3	ENSCI 384	3

Social Science or Humanities Choice[2]	3	Social Science or Humanities Choice[2]	3
Elective	6	Electives	6
	15-16		15

Senior

Fall	Credits	Spring	Credits
Environmental Science Choice[1]	3	Environmental Science Choice[1]	6
Elective	12	Elective	9
	15		15

1. Students complete at least 27 credits in Environmental Science including ENSCI 110,201, 250, 381, 382, and 15 additional credits of approved ENSCI coursework.
2. Students complete at least 15 credits in humanities and social science including at least 3 credits each in ethics, humanities, social science, U.S. Diversity, and International Perspectives from approved lists.
3. Students choose one course from the following Earth Science related courses: AGRON 182, BIOL 212, GEOL 100, GEOL 201, MTEOR 206. Students choose from one of the following Organic Chemistry options: CHEM 231 & 231L, CHEM 331 & 331L, BBMB 221, or AGRON 259.

Graduate Study

Contact information for the graduate program:

Melissa Stolt
mstolt@iastate.edu
515-294-1170
https://enscigrad.iastate.edu/

The Environmental Science graduate program offers an interdepartmental curriculum leading to M.S. and Ph.D. degrees with a major in Environmental Science. Faculty from the colleges of Agriculture and Life Sciences, Engineering, and Liberal Arts and Sciences cooperate to offer courses and research opportunities covering a broad array of environmental topics. Cooperating departments include Agricultural and Biosystems Engineering; Agronomy; Animal Science; Civil, Construction and Environmental Engineering; Ecology, Evolution and Organismal Biology; and Geological and Atmospheric Sciences.

Applicants should have completed an undergraduate or master's degree in one of the biological, chemical, physical, or engineering sciences or should have equivalent preparation.

The Environmental Science Graduate Program emphasizes fundamental concepts and research, which at the same time address major environmental issues. The curriculum is designed to provide the interdisciplinary approach needed in environmental science education and research. In addition to work in their chosen area of specialization, students are afforded a broad exposure to the biological, chemical and physical aspects of environmental systems and the specialized training necessary for integrated analysis of these systems.

Information on application procedures, curriculum requirements, and faculty research areas is available on the Environmental Science Graduate Program website (https://enscigrad.iastate.edu/).

Courses primarily for undergraduates:

ENSCI 110: Orientation to Environmental Science
(1-0) Cr. 1. F.
Prereq: Freshman classification in EnSci
Overview of Environmental Science curriculum and discussion of professional opportunities. Offered on a satisfactory-fail basis only.

ENSCI 201: Introduction to Environmental Issues
(Cross-listed with BIOL, ENV S). (2-0) Cr. 2. F.
Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change.

ENSCI 202: Exploration of Environmental and Sustainability Issues
(1-0) Cr. 1. F.
Prereq: Credit or enrollment in ENSCI 201
Exploration of specific environmental and sustainability issues; designed to complement ENSCI 201. Offered on a satisfactory-fail basis only.

ENSCI 203: Exploration of Environmental Science
(1-0) Cr. 1. S.
Prereq: ENSCI 202.
Continued exploration of specific environmental science issues developed in ENSCI 202. Topics may vary in different years. Offered on a satisfactory-fail basis only.

ENSCI 250: Environmental Geography
(Cross-listed with ENV S). (3-0) Cr. 3. F.
The distribution, origins and functions of the earth's physical systems and the spatial relationship between human activity and the natural world.

ENSCI 251: Biological Processes in the Environment
(Cross-listed with BIOL). (3-0) Cr. 3. S.
Plant and microbial processes in environmental systems including their interactions with human activities.

ENSCI 301: Natural Resource Ecology and Soils
(Cross-listed with NREM). (3-3) Cr. 4. F.
Prereq: BIOL 211, BIOL 211L; FOR 201 or a second course in biology
Effects of environmental factors on ecosystem structure and function using forest, prairie and agricultural ecosystems as models. Special emphasis is given to soil-forming factors and the role of soil in nutrient and water cycling and ecosystem dynamics. Additional emphasis is given to human influences on natural ecosystems and the role of perennial plant communities in agricultural landscapes.

ENSCI 312: Ecology
(Cross-listed with A ECL, BIOL). (3-3) Cr. 4. F.SS.
Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L
Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats.

ENSCI 312I: Ecology
(Cross-listed with A ECL, IA LL). Cr. 4. SS.
An introduction to the principles of ecology at the population, community and ecosystem level. Field studies of local lakes, wetlands and prairies are used to examine factors controlling distributions, interactions, and roles of plants and animals in native ecosystems.

ENSCI 324: Energy and the Environment
(Cross-listed with ENV S, GEOL, MTEOR). (3-0) Cr. 3. S.
Renewable and non-renewable energy resources. Origin, occurrence, and extraction of fossil fuels. Nuclear, wind, geothermal, biomass, hydroelectric, and solar energy. Biofuels. Energy efficiency. Environmental effects of energy production and use, including air pollution, acid precipitation, coal ash, mountaintop removal mining, oil drilling, hydraulic fracturing, groundwater contamination, nuclear waste disposal, and global climate change. Carbon sequestration and geoengineering solutions for reducing atmospheric CO2 concentrations.

ENSCI 345: Natural Resource Photogrammetry and Geographic Information Systems
(Cross-listed with NREM). (2-3) Cr. 3. S.
Prereq: Junior classification
Measurement and interpretation of aerial photos in resource management. Introduction to Geographic Information Systems (GIS) using ArcGIS including digitizing, development and query of attribute tables, georeferencing, and use of multiple GIS layers in simple spatial analyses.

ENSCI 360: Environmental Soil Science
(Cross-listed with AGRON). (2-2) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or ENSCI 250 or GEOL 201
Application of soil science to contemporary environmental problems; comparison of the impacts that different management strategies have on short- and long-term environmental quality and land development. Emphasis on participatory learning activities.

ENSCI 370: GIS for Ecology and Environmental Science
(Cross-listed with BIOL). Cr. 1-6. Repeatable. F.S.
Prereq: Six credits in biological and /or physical sciences, and permission of instructor.
Introduction to geographic information systems (GIS) with emphasis on ecological and environmental applications. No prior GIS experience required. Guided, individualized study of topics based on student background and interest. For students with prior experience, topics and activities are selected to build upon any previous experience and minimize duplication to previous GIS coursework. Potential topics include: basic concepts of GIS, data structures, database management, spatial analysis, modeling and visualization of ecological and environmental data. Case studies in ecological and environmental applications using ArcGIS. Offered on a satisfactory-fail basis only.

ENSCI 381: Environmental Systems I: Introduction to Environmental Systems
(Dual-listed with ENSCI 581). (Cross-listed with BIOL, ENV S, MICRO). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENSCI 382: Environmental Systems II: Analysis of Environmental Systems
(Dual-listed with ENSCI 582). (Cross-listed with BIOL). (2-2) Cr. 3. S.
Prereq: ENSCI 381
Continuation of EnSci 381. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENSCI 384: Introduction to Ecosystems
(3-0) Cr. 3. S.
Prereq: 12 credits of natural science including biology and chemistry
Biological and physical processes affecting material and energy flows in natural and managed ecosystems. Understanding and predicting climate and management impacts on ecosystem services and sustainability.

ENSCI 390: Internship in Environmental Science
Cr. arr. Repeatable. F.S.SS.
Prereq: Approval of the Environmental Science coordinator
Supervised off-campus work experience in the field of environmental science. Offered on a satisfactory-fail basis only.

ENSCI 391: Apprenticeship
Cr. arr. Repeatable. F.S.SS.
Prereq: Approval of the Environmental Science Coordinator
Practical experience in an approved setting such as a research laboratory, government office, or private office. Offered on a satisfactory-fail basis only.

ENSCI 402: Watershed Hydrology
(Dual-listed with ENSCI 502). (Cross-listed with GEOL, MTEOR, NREM). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

ENSCI 402I: Watershed Hydrology and Surficial Processes
(Cross-listed with AGRON, IA LL). Cr. 4. SS.
Prereq: Four courses in physical or biological sciences or engineering
Effects of geomorphology, soils, and land use on transport of water and materials (nutrients, contaminates) in watersheds. Fieldwork will emphasize investigations of the Iowa Great Lakes watershed.

ENSCI 404: Global Change
(Dual-listed with ENSCI 504). (Cross-listed with AGRON, ENV S, MTEOR). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

ENSCI 405: Environmental Biophysics
(Dual-listed with ENSCI 505). (Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)
Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

ENSCI 406: World Climates
(Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. S.
Prereq: AGRON 206/MTEOR 206
Distribution and causes of different climates around the world. Effects of climate and climate variations on human activities including society, economy and agriculture. Current issues such as climate change and international efforts to assess and mitigate the consequences of a changing climate. Semester project and in-class presentation required. Meets International Perspectives Requirement.

ENSCI 407: Watershed Management
(Dual-listed with ENSCI 507). (Cross-listed with ENV S, NREM). (3-3) Cr. 4. S.
Prereq: A course in general biology
Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers.

ENSCI 408: GIS and Natural Resources Management
(Dual-listed with ENSCI 508). (Cross-listed with A B E). (2-2) Cr. 3. F.
Prereq: Working knowledge of computers and Windows environment
Introduction to fundamental concepts and applications of GIS in natural resources management with specific focus on watersheds. Topics include: basic GIS technology, data structures, database management, spatial analysis, and modeling; visualization and display of natural resource data. Case studies in watershed and natural resource management using ArcView GIS.

ENSCI 408I: Aquatic Ecology
(Dual-listed with ENSCI 508I ENSCI 408I). (Cross-listed with IA LL). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

ENSCI 409: Field Methods in Hydrogeology
(Dual-listed with ENSCI 509). (Cross-listed with GEOL). (0-4) Cr. 3. Alt. SS., offered even-numbered years.
Prereq: GEOL/ENSCI 402 or GEOL/ENSCI 411 or C E 473
Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects.

ENSCI 411: Hydrogeology
(Dual-listed with ENSCI 511). (Cross-listed with GEOL). (3-2) Cr. 4. F.
Prereq: Four courses in biological or physical sciences
Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations.

ENSCI 414: Applied Groundwater Flow Modeling
(Dual-listed with ENSCI 514). (Cross-listed with GEOL). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: GEOL 411 or C E 473; MATH 165 or MATH 181
Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course.

ENSCI 415: Paleoclimatology
(Dual-listed with ENSCI 515). (Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in biological or physical science
Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods, utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~1 million years).

ENSCI 416: Hydrologic Modeling and Analysis
(Dual-listed with ENSCI 516). (Cross-listed with GEOL, MTEOR). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in Earth science, meteorology, or engineering; junior standing.
Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

ENSCI 418: Stream Ecology
(Dual-listed with ENSCI 518). (Cross-listed with A ECL). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A ECL 486
Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

ENSCI 419: Aqueous and Environmental Geochemistry
(Dual-listed with ENSCI 519). (Cross-listed with GEOL). (2-2) Cr. 3. S.
Prereq: CHEM 178, CHEM 178L; junior classification
Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling.

ENSCI 420: Environmental Engineering Chemistry
(Dual-listed with ENSCI 520). (Cross-listed with C E). (2-3) Cr. 3. F.
Prereq: C E 326, CHEM 178
Principles of chemical and physical phenomena applicable to the treatment of water and wastewater and natural waters; including chemical equilbria, reaction kinetics, acid-base equilibria, chemical precipitation, redox reactions, and mass transfer principles. Individual laboratory practicals and group projects required.

ENSCI 422I: Prairie Ecology
(Cross-listed with IA LL). Cr. 4. SS.
Prereq: Familiarity with basic principles in biological sciences and ecology
Basic patterns and underlying physical and biotic causes of both regional and local distributions of plants and animals of North American prairies; field and laboratory analyses and projects.

ENSCI 424: Air Pollution
(Dual-listed with ENSCI 524). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 424A: Air Polution: Air quality and effects of pollutants
(Dual-listed with ENSCI 524A). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 424B: Air Pollution: Climate change and causes
(Dual-listed with ENSCI 524B). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 424C: Air Pollution: Transportation Air Quality
(Dual-listed with ENSCI 524C). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

ENSCI 424D: Air Pollution: Off-gas treatment technology
(Dual-listed with ENSCI 524D). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

ENSCI 424E: Air Pollution: Agricultural sources of pollution
(Dual-listed with ENSCI 524E). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 426: Stable Isotopes in the Environment
(Dual-listed with ENSCI 526). (Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Four courses in biological or physical science
Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance.

ENSCI 437: Watershed Modeling and Policy
(Dual-listed with ENSCI 537). (Cross-listed with A B E). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CE 372 or equivalent
A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools.

ENSCI 446: Integrating GPS and GIS for Natural Resource Management
(Dual-listed with ENSCI 546). (Cross-listed with NREM). (2-3) Cr. 3. F.
Prereq: 12 credits in student's major at 300 level or above, NREM 345 or equivalent experience with ArcGIS
Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation.

ENSCI 451: Applied and Environmental Geophysics
(Dual-listed with ENSCI 551). (Cross-listed with GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar.

ENSCI 452: GIS for Geoscientists
(Dual-listed with ENSCI 552). (Cross-listed with AGRON, GEOL). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

ENSCI 459: Environmental Soil and Water Chemistry
(Dual-listed with ENSCI 559). (Cross-listed with AGRON). (3-3) Cr. 4. F.
Prereq: Two semesters of college-level chemistry, MATH 140, AGRON 182 (or equivalent) or AGRON 360; GEOL 100 and AGRON 354 recommended
An introduction to the chemical properties of soils, chemical reactions and transformations in soils and surface waters, and their impact on the environment. Topics include solution chemistry in soils and surface waters, solid-phase composition of soils, reactions at the solid-solution interface, and applications to contemporary environmental issues.

ENSCI 461I: Introduction to GIS
(Cross-listed with ENV S, IA LL, L A). Cr. 4. SS.
Descriptive and predictive GIS modeling techniques, spatial statistics, and map algebra. Application of GIS modeling techniques to environmental planning and resource management.

ENSCI 463: Soil Formation and Landscape Relationships
(Dual-listed with ENSCI 563). (Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. Credit for one of AGRON 463 or AGRON 463I may be applied for graduation.

ENSCI 463I: Soil Formation and Landscape Relationships
(Dual-listed with ENSCI 563I). (Cross-listed with AGRON, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

ENSCI 464: Wetland Ecology
(Dual-listed with ENSCI 564). (Cross-listed with BIOL). (3-0) Cr. 3. S.
Prereq: 15 credits in biological sciences.
Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands.

ENSCI 466: Ecosystem Service Management
(Dual-listed with ENSCI 566). (Cross-listed with ENT, NREM). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

ENSCI 477: Soil Physics
(Dual-listed with ENSCI 577). (Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 182 or equivalent and MATH 166 recommended
The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

ENSCI 479: Surficial Processes
(Dual-listed with ENSCI 579). (Cross-listed with GEOL). (2-3) Cr. 3. F.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips.

ENSCI 480: Engineering Analysis of Biological Systems
(Cross-listed with A B E). (2-2) Cr. 3. F.
Prereq: A B E 380 or permission of the instructor
Systems-level quantitative analysis of biological systems, including applications in foods, feeds, biofuels, bioenergy, and other biological systems. Introduction to economic analysis and life-cycle assessment of these systems at multiple production scales. Applying these tools to evaluate and improve cost and sustainability performance of these biological systems.

ENSCI 484: Ecosystem Ecology
(Cross-listed with BIOL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Combined 12 credits in biology, chemistry, and physics.
Introduction of the study of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations for ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues.

ENSCI 485: Soil and Environmental Microbiology
(Dual-listed with ENSCI 585). (Cross-listed with AGRON, MICRO). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

ENSCI 486: Aquatic Ecology
(Dual-listed with ENSCI 586). (Cross-listed with A ECL, BIOL). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

ENSCI 486L: Aquatic Ecology Laboratory
(Dual-listed with ENSCI 586L). (Cross-listed with A ECL, BIOL). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

ENSCI 487: Microbial Ecology
(Dual-listed with ENSCI 587). (Cross-listed with BIOL, MICRO). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

ENSCI 488: GIS for Geoscientists II
(Dual-listed with ENSCI 588). (Cross-listed with AGRON, GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

ENSCI 490: Independent Study
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval of the Environmental Science coordinator

ENSCI 490H: Independent Study: Honors
Cr. arr. Repeatable. F.S.SS.
Permission of instructor and approval of Environmental Science coordinator.

ENSCI 495: Current Topics and Case Studies in Environmental Science
Cr. 1-3.
Prereq: Junior classification in Environmental Science, permission of instructor
Current topics and case studies related to the analysis and management of environmental systems. Individual and/or group projects.

ENSCI 496: Travel Course
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings. A. International Tour B. Domestic Tour.

ENSCI 496A: Travel Course: International Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

ENSCI 496B: Travel Course: Domestic Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

ENSCI 498: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of Environmental Science Coordinator
Required of all cooperative education students. Students must register prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

ENSCI 502: Watershed Hydrology
(Dual-listed with ENSCI 402). (Cross-listed with GEOL, MTEOR, NREM). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

ENSCI 504: Global Change
(Dual-listed with ENSCI 404). (Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

ENSCI 505: Environmental Biophysics
(Dual-listed with ENSCI 405). (Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)
Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

ENSCI 507: Watershed Management
(Dual-listed with ENSCI 407). (Cross-listed with NREM). (3-3) Cr. 4. S.
Prereq: A course in general biology
Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers.

ENSCI 508: GIS and Natural Resources Management
(Dual-listed with ENSCI 408). (Cross-listed with A B E). (2-2) Cr. 3. F.
Prereq: Working knowledge of computers and Windows environment
Introduction to fundamental concepts and applications of GIS in natural resources management with specific focus on watersheds. Topics include: basic GIS technology, data structures, database management, spatial analysis, and modeling; visualization and display of natural resource data. Case studies in watershed and natural resource management using ArcView GIS.

ENSCI 508I: Aquatic Ecology
(Cross-listed with IA LL, NREM). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

ENSCI 509: Field Methods in Hydrogeology
(Dual-listed with ENSCI 409). (Cross-listed with GEOL). (0-4) Cr. 3. Alt. SS., offered even-numbered years.
Prereq: GEOL/ENSCI 402 or GEOL/ENSCI 411 or C E 473
Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects.

ENSCI 511: Hydrogeology
(Dual-listed with ENSCI 411). (Cross-listed with GEOL). (3-2) Cr. 4. F.
Prereq: Four courses in biological or physical sciences
Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations.

ENSCI 514: Applied Groundwater Flow Modeling
(Dual-listed with ENSCI 414). (Cross-listed with GEOL). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: GEOL 411 or C E 473; MATH 165 or MATH 181
Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course.

ENSCI 515: Paleoclimatology
(Dual-listed with ENSCI 415). (Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in biological or physical science
Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods; utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~ 1 million years).

ENSCI 516: Hydrologic Modeling and Analysis
(Dual-listed with ENSCI 416). (Cross-listed with GEOL, MTEOR). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in earth science, meteorology, or engineering; junior standing
Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

ENSCI 518: Stream Ecology
(Dual-listed with ENSCI 418). (Cross-listed with A ECL). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A ECL 486
Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

ENSCI 519: Aqueous and Environmental Geochemistry
(Dual-listed with ENSCI 419). (Cross-listed with GEOL). (2-2) Cr. 3. S.
Prereq: CHEM 178, CHEM 178L; junior classification
Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling.

ENSCI 520: Environmental Engineering Chemistry
(Dual-listed with ENSCI 420). (Cross-listed with C E). (2-3) Cr. 3. F.
Prereq: C E 326, CHEM 178
Principles of chemical and physical phenomena applicable to the treatment of water and wastewater and natural waters; including chemical equilbria, reaction kinetics, acid-base equilibria, chemical precipitation, redox reactions, and mass transfer principles. Individual laboratory practicals and group projects required.

ENSCI 521: Environmental Biotechnology
(Cross-listed with C E). (2-2) Cr. 3. F.
Prereq: C E 326
Fundamentals of biochemical and microbial processes applied to environmental engineering processes, role of microorganisms in wastewater treatment and bioremediation, bioenergetics and kinetics, metabolism of xenobiotic compounds, waterborne pathogens and parasites, and disinfection. Term paper and oral presentation.

ENSCI 522: Water Pollution Control Processes
(Cross-listed with C E). (2-2) Cr. 3.
Prereq: C E 521
Fundamentals of biochemical processes, aerobic growth in a single CSTR, multiple events in complex systems, and techniques for evaluating kinetic parameters; unit processes of activated sludge system, attached growth systems, stabilization and aerated lagoon systems, biosolids digestion and disposal, nutrient removal, and anaerobic treatment systems.

ENSCI 523: Physical-Chemical Treatment Process
(Cross-listed with C E). (2-2) Cr. 3.
Prereq: C E 520
Material and energy balances. Principles and design of physical-chemical unit processes; including screening, coagulation, flocculation, chemical precipitation, sedimentation, filtration, lime softening and stabilization, oxidation, adsorption, membrane processes, ion exchange and disinfection; recovery of resources from residuals and sludges; laboratory exercises and demonstrations; case studies in mineral processing and secondary industries.

ENSCI 524: Air Pollution
(Dual-listed with ENSCI 424). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 524A: Air Polution: Air quality and effects of pollutants
(Dual-listed with ENSCI 424A). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 524B: Air Pollution: Climate change and causes
(Dual-listed with ENSCI 424B). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 524C: Air Pollution: Transportation Air Quality
(Dual-listed with ENSCI 424C). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

ENSCI 524D: Air Pollution: Off-gas treatment technology
(Dual-listed with ENSCI 424D). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

ENSCI 524E: Air Pollution: Agricultural sources of pollution
(Dual-listed with ENSCI 424E). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 526: Stable Isotopes in the Environment
(Dual-listed with ENSCI 426). (Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Four courses in biological or physical science
Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance.

ENSCI 528: Solid and Hazardous Waste Management
(Cross-listed with C E). (3-0) Cr. 3.
Prereq: C E 326 or background courses in both environmental chemistry and microbiology; junior or higher standing
Evaluation, characterization, assessment, planning and design of solid and hazardous waste management systems, regulatory requirements, material characterization and collection, minimization and recycling, energy and materials recovery, composting, off-gas treatment, incineration, stabilization, and landfill design. Design of treatment and disposal systems, including physical, chemical, and biological treatment, solidification, incineration, secure landfill design, and final disposal site closure plus restoration.

ENSCI 531: Design and Evaluation of Soil and Water Conservation Systems
(Cross-listed with A B E). (2-3) Cr. 3. F.
Prereq: E M 378 or CH E 356
Hydrology and hydraulics in agricultural and urbanizing watersheds. Design and evaluation of systems for the conservation and quality preservation of soil and water resources. Use and analysis of hydrologic data in engineering design; relationship of topography, soils, crops, climate, and cultural practices in conservation and quality preservation of soil and water for agriculture. Small watershed hydrology, water movement and utilization in the soil-plant-atmosphere system, agricultural water management, best management practices, and agricultural water quality. Graduate students will prepare several research literature reviews on topics covered in the class in addition to the other assignments.

ENSCI 532: Nonpoint Source Pollution and Control
(Cross-listed with A B E). (3-0) Cr. 3.
Prereq: A B E 431 or C E 372 or instructor permission
Characteristics and courses of non-point source (NPS) pollution in agricultural and urban watersheds, computer modeling and NPS pollution for terrestrial and aquatic systems, strategies to control and manage NPS pollution of water bodies, total maximum daily loads (TMDLs) and integrated watershed management. Graduate students are required to review research papers and develop/deliver lecture models on assigned topics.

ENSCI 533: Erosion and Sediment Transport
(Cross-listed with A B E, NREM). (2-3) Cr. 3. F.
Prereq: C E 372 or GEOL/ENSCI/MTEOR 402, MATH 166 or equivalent
Soil erosion processes, soil loss equations and their application to conservation planning, sediment properties, initiation of sediment motion and over land flow, flow in alluvial channels and theory of sediment transport, channel stability, reservoir sedimentation, wind erosion, BMPs for controlling erosion.

ENSCI 534: Contaminant Hydrogeology
(Cross-listed with GEOL). (3-0) Cr. 3. S.
Prereq: GEOL 511 or equivalent
Theory and practical considerations of fate and transport of solutes through porous geologic materials. Organic and inorganic contaminants in industrial and agricultural settings. Subsurface microbiology and biodegradation of aromatic and chlorinated hydrocarbons. Investigation of coupled processes (diffusion, advection, dispersion, sorption, and biodegradation) using computer models. Soil and groundwater monitoring and remediation strategies.

ENSCI 535: Restoration Ecology
(Cross-listed with EEOB, NREM). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 366 or BIOL 474 or graduate standing
Theory and practice of restoring animal and plant diversity, structure and function of disturbed ecosystems. Restored freshwater wetlands, forests, prairies and reintroduced species populations will be used as case studies.

ENSCI 535I: Restoration Ecology
(Cross-listed with A ECL, EEOB, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: A course in ecology
Ecological principles for the restoration of native ecosystems; establishment (site preparation, selection of seed mixes, planting techniques) and management (fire, mowing, weed control) of native vegetation; evaluation of restorations. Emphasis on the restoration of prairie and wetland vegetation.

ENSCI 536: Design and Evaluation of Soil and Water Monitoring Systems
(Cross-listed with A B E). (2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 431/A B E 531
Development of monitoring systems that support effective planning, performance evaluation, modeling, or environmental impact assessment of soil-, water-, and waste-management systems. Typical soil and water pollutants and physical, chemical, and biological characteristics that affect sample location and timing. Sample collection, documentation, chain-of-custody, and quality assurance procedures. In addition to other assignments, graduate students will prepare several research literature reviews on topics covered in the class and develop monitoring plans.

ENSCI 537: Watershed Modeling and Policy
(Dual-listed with ENSCI 437). (Cross-listed with A B E). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CE 372 or equivalent
A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools.

ENSCI 546: Integrating GPS and GIS for Natural Resource Management
(Dual-listed with ENSCI 446). (Cross-listed with NREM). (2-3) Cr. 3. F.
Prereq: 12 credits in student's major at 300 level or above, NREM 345 or equivalent experience with ArcGIS
Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation.

ENSCI 551: Applied and Environmental Geophysics
(Dual-listed with ENSCI 451). (Cross-listed with GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar.

ENSCI 552: GIS for Geoscientists
(Dual-listed with ENSCI 452). (Cross-listed with AGRON, GEOL). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

ENSCI 553: Soil-Plant Relationships
(Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 354
Composition and properties of soils in relation to the nutrition and growth of plants.

ENSCI 558: Laboratory Methods in Soil Chemistry
(Cross-listed with AGRON). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: AGRON 354 and CHEM 211
Experimental and descriptive inorganic and organic analyses. Operational theory and principles of applicable instruments, including spectrophotometry, atomic and molecular absorption and emission spectroscopy, mass spectrometry, X-ray diffraction and fluorescence, gas and ion chromatography, and ion-selective electrodes.

ENSCI 559: Environmental Soil and Water Chemistry
(Dual-listed with ENSCI 459). (Cross-listed with AGRON). (3-3) Cr. 4. F.
Prereq: Two semesters of college-level chemistry, MATH 140, AGRON 182 (or equivalent) or AGRON 360; GEOL 100 and AGRON 354 recommended
An introduction to the chemical properties of soils, chemical reactions and transformations in soils and surface waters, and their impact on the environment. Topics include solution chemistry in soils and surface waters, solid-phase composition of soils, reactions at the solid-solution interface, and applications to contemporary environmental issues.

ENSCI 563: Soil Formation and Landscape Relationships
(Dual-listed with ENSCI 463). (Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. Credit for one of AGRON 463 or AGRON 463I may be applied for graduation.

ENSCI 563I: Soil Formation and Landscape Relationships
(Dual-listed with ENSCI 463I). (Cross-listed with AGRON, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

ENSCI 564: Wetland Ecology
(Dual-listed with ENSCI 464). (Cross-listed with EEOB). (3-0) Cr. 3. S.
Prereq: 15 credits in biological sciences.
Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands.

ENSCI 564I: Wetland Ecology
(Cross-listed with EEOB, IA LL). Cr. 4. SS.
Prereq: Ia LL 312I
Ecology, classification, creation, restoration, and management of wetlands. Field studies will examine the composition, structure and functions of local natural wetlands and restored prairie pothole wetlands. Individual or group projects.

ENSCI 566: Ecosystem Service Management
(Dual-listed with ENSCI 466). (Cross-listed with ENT, NREM). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

ENSCI 571: Surface Water Hydrology
(Cross-listed with C E). (3-0) Cr. 3. S.
Prereq: C E 372
Analysis of hydrologic data including precipitation, infiltration, evapotranspiration, direct runoff and streamflow; theory and use of frequency analysis; theory of streamflow and reservoir routing; use of deterministic and statistical hydrologic models. Fundamentals of surface water quality modeling, point and non-point sources of contamination. Design project.

ENSCI 572: Analysis and Modeling Aquatic Environments
(Cross-listed with C E). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: C E 372
Principles of surface water flows and mixing. Introduction to hydrologic transport and water quality simulation in natural water systems. Advection, diffusion and dispersion, chemical and biologic kinetics, and water quality dynamics. Applications to temperature, dissolved oxygen, primary productivity, and other water quality problems in rivers, lakes and reservoirs. Deterministic vs. stochastic models.

ENSCI 573: Groundwater Hydrology
(3-0) Cr. 3. F.
Prereq: C E 372
Principles of groundwater flow, hydraulics of wells, superposition, slug and pumping tests, streamlines and flownets, and regional groundwater flow. Contaminant transport. Computer modeling. Design project. Extra assignments required for graduate students.

ENSCI 575: Soil Formation and Transformation
(Cross-listed with AGRON). (3-0) Cr. 3. F.
Prereq: AGRON 463 or equivalent
Advanced study of soil formation, emphasizing relationships among soils, landscapes, environment, humans, and land use.

ENSCI 577: Soil Physics
(Dual-listed with ENSCI 477). (Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 182 or equivalent and MATH 166 recommended
The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

ENSCI 578: Laboratory Methods in Soil Physics
(Cross-listed with AGRON). (0-3) Cr. 1. S.
Prereq: concurrent enrollment in AGRON 477 or AGRON 577
Methods of measuring soil physical properties such as texture, density, and water content, and transport of heat, water, and gases.

ENSCI 579: Surficial Processes
(Dual-listed with ENSCI 479). (Cross-listed with GEOL). (2-3) Cr. 3. F.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips.

ENSCI 581: Environmental Systems I: Introduction to Environmental Systems
(Dual-listed with ENSCI 381). (Cross-listed with EEOB). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENSCI 582: Environmental Systems II: Analysis of Environmental Systems
(Dual-listed with ENSCI 382). (Cross-listed with EEOB). (2-2) Cr. 3. S.
Prereq: ENSCI 381
Continuation of EnSci 381. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENSCI 584: Advanced Ecosystem Ecology
(Cross-listed with EEOB). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Combined 12 credits in biology, chemistry, and physics.
Advanced studies of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations and modern approaches to ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues.

ENSCI 585: Soil and Environmental Microbiology
(Dual-listed with ENSCI 485). (Cross-listed with AGRON, MICRO). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

ENSCI 586: Aquatic Ecology
(Dual-listed with ENSCI 486). (Cross-listed with A ECL, EEOB). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

ENSCI 586L: Aquatic Ecology Laboratory
(Dual-listed with ENSCI 486L). (Cross-listed with A ECL, EEOB). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

ENSCI 587: Microbial Ecology
(Dual-listed with ENSCI 487). (Cross-listed with EEOB, MICRO). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

ENSCI 588: GIS for Geoscientists II
(Dual-listed with ENSCI 488). (Cross-listed with AGRON, GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

ENSCI 590: Special Topics
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of major professor in Environmental Science faculty
Literature reviews and conference in accordance with needs and interest of the student.

ENSCI 599: Creative Component
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of major professor in Environmental Science faculty
Creative component for nonthesis master of science degree.

Courses for graduate students:

ENSCI 685: Advanced Soil Biochemistry
(Cross-listed with AGRON, MICRO). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: AGRON 585
Chemistry of soil organic matter and biochemical transformations brought about by microorganisms and enzymes in soils.

ENSCI 698: Seminar in Environmental Science
Cr. 1. Repeatable. S.
Reports and discussion of recent research and literature.

ENSCI 699: Research
Cr. arr. Repeatable. F.S.SS.

Food Science (AGLS)

Food science is a degree program focused on food issues from the time crops leave the field until consumers buy the food products. Food scientists apply basic science (chemistry, biology, physics) to improve processing, preservation, and safety of food and to develop new food products. There are two options in food science, and both options are approved by the Institute of Food Technologists: food science and technology option, and food science and industry option.

The department also offers a food science minor.

Administered by the Department of Food Science and Human Nutrition

Students select one of the following options and complete all requirements for that option: food science and technology option or food science and industry option. Courses listed below are required for all of the options, except where specified by option below.

Total Degree Requirement: 120 cr.
Students must fulfill International Perspectives and U.S. Diversity requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communications and Library: 10 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 6-12 cr.

Select Humanities course from approved list		3
ECON 101	Principles of Microeconomics	3
If H Sci student, select:		6

Additional Humanities course		
Additional Humanities or Social Science course		

Ethics and Environmental: 3-6 cr.

FS HN 342	World Food Issues: Past and Present	3
If AgLS student, select from:		2-3
ENV S 120	Introduction to Renewable Resources	
ENV S 201	Introduction to Environmental Issues	

Mathematical Sciences: 7-12 cr.
Food science and technology option:

Select from:		8
MATH 165 & MATH 166	Calculus I and Calculus II	
or		
MATH 181 & MATH 182	Calculus and Mathematical Modeling for the Life Sciences I and Calculus and Mathematical Modeling for the Life Sciences II	
Select at least 3 credits from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
STAT 105	Introduction to Statistics for Engineers	
Total Credits		11-12

Food science and industry option:

Select at least 4 credits from:		4
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Select at least 3 credits from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
STAT 105	Introduction to Statistics for Engineers	
Total Credits		7-8

Physical Sciences: 13-25 cr.
Food science and technology option:

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
CHEM 332	Organic Chemistry II	3
PHYS 111	General Physics	5
PHYS 112	General Physics	5
Total Credits		25

Food science and industry option:

Select from:		5-8
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	
CHEM 177 & 177L & CHEM 178	General Chemistry I and Laboratory in General Chemistry I and General Chemistry II	
CHEM 231	Elementary Organic Chemistry	3
CHEM 231L	Laboratory in Elementary Organic Chemistry	1
PHYS 115 or PHYS 111	Physics for the Life Sciences General Physics	4-5
Total Credits		13-17

Biological Sciences: 12-13 cr.
Food science and technology option:

BBMB 301	Survey of Biochemistry	3
BIOL 211	Principles of Biology I	3
BIOL 212	Principles of Biology II	3
MICRO 302	Biology of Microorganisms	3
MICRO 302L	Microbiology Laboratory	1
Total Credits		13

Food science and industry option:

BBMB 301	Survey of Biochemistry	3
BIOL 211	Principles of Biology I	3
BIOL 212	Principles of Biology II	3
MICRO 201 or MICRO 302	Introduction to Microbiology Biology of Microorganisms	2-3
MICRO 201L or MICRO 302L	Introductory Microbiology Laboratory Microbiology Laboratory	1
Total Credits		12-13

Food Science and Human Nutrition: 44 cr.

FS HN 101	Food and the Consumer	3
FS HN 110	Professional and Educational Preparation	1
FS HN 167	Introduction to Human Nutrition	3
FS HN 203	Contemporary Issues in Food Science and Human Nutrition	1
FS HN 311	Food Chemistry	3
FS HN 311L	Food Chemistry Laboratory	1
FS HN 351	Introduction to Food Engineering Concepts	3
FS HN 403	Food Laws and Regulations	2
FS HN 405	Food Quality Assurance	3

FS HN 406	Sensory Evaluation of Food	3
FS HN 410	Food Analysis	3
FS HN 411	Food Ingredient Interactions and Formulations	2
FS HN 412	Food Product Development	3
FS HN 420	Food Microbiology	3
FS HN 421	Food Microbiology Laboratory	3
FS HN 471	Food Processing I	3
FS HN 472	Food Processing II	3
FS HN 480	Professional Communication in Food Science and Human Nutrition	1
Total Credits		44

Food science and industry option:

Select 6 credits from the following business courses: 6

ACCT 215	Legal Environment of Business
ACCT 284	Financial Accounting
ACCT 285	Managerial Accounting
ECON 301	Intermediate Microeconomics
ECON 320	Labor Economics
MGMT 310	Entrepreneurship and Innovation
MGMT 370	Management of Organizations
MGMT 371	Organizational Behavior
MGMT 414	International Management
MGMT 472	Management of Diversity
MIS 301	Management Information Systems
MKT 340	Principles of Marketing
MKT 447	Consumer Behavior
MKT 448	Global Marketing
Total Credits	6

Electives: 0-23 cr. Select from any university coursework to earn at least 120 total credits.

Go to FS HN courses.

Food Science, B.S. - Food science & industry option

First Year

Fall	Credits	Spring	Credits
FS HN 101	3	FS HN 167	3
FS HN 110	1	CHEM 178 (if CHEM 177 was taken) or elective*	3
CHEM 163 or 177	4	BIOL 212	3
CHEM 163L or 177L	1	MATH 160, 165, or 181	4
BIOL 211	3	ECON 101	3
ENGL 150	3		
LIB 160	1		
	16		16

Second Year

Fall	Credits	Spring	Credits
CHEM 231	3	BBMB 301	3
CHEM 231L	1	FS HN 203	1
PHYS 115 (4cr) or 111 (5cr)	4-5	MICRO 201 or 302	2-3
ENGL 250	3	MICRO 201L or 302L	1
STAT 101 or 104 or 105	3-4	Humanities/Social Sci. (H Sci) or ENV S (AgLS)	2-3
		Humanities (H Sci) or elective (AgLS)*	3
	14-16		12-14

Third Year

Fall	Credits	Spring	Credits
FS HN 311	3	FS HN 342	3
FS HN 311L	1	FS HN 351	3
FS HN 420	3	FS HN 403	2
SP CM 212	3	FS HN 405	3
Humanities course	3	FS HN 421	3
Elective*	1	Elective*	2
	14		16

Fourth Year

Fall	Credits	Spring	Credits
FS HN 406	3	FS HN 412	3
FS HN 410	3	FS HN 472	3
FS HN 411	2	FS HN 480	1
FS HN 471	3	Business course	3
Business Course	3	U.S. Diversity (if not already taken) or Elective*	3
Elective*	2	Elective*	3
	16		16

* Choose elective courses to total equal to or greater than 120 credits.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point considerations.

Food Science, B.S. - Food science and technology option

First Year

Fall	Credits	Spring	Credits
FS HN 110	1	FS HN 101	3
CHEM 177	4	FS HN 167	3

CHEM 177L	1	CHEM 178	3
BIOL 211	3	BIOL 212	3
ENGL 150	3	MATH 166 or 182	4
LIB 160	1		
MATH 165 or 181	4		
	17		16

Second Year

Fall	Credits	Spring	Credits
CHEM 331	3	CHEM 332	3
CHEM 331L	1	FS HN 203	1
PHYS 111	5	PHYS 112	5
ENGL 250	3	MICRO 302	3
STAT 101, 104, or 105	3-4	MICRO 302L	1
		Elective*	2
	15-16		15

Third Year

Fall	Credits	Spring	Credits
BBMB 301	3	FS HN 351	3
FS HN 311	3	FS HN 403	2
FS HN 311L	1	FS HN 405	3
FS HN 420	3	FS HN 421	3
SP CM 212	3	ECON 101	3
Humanities course	3		
	16		14

Fourth Year

Fall	Credits	Spring	Credits
FS HN 406	3	FS HN 342	3
FS HN 410	3	FS HN 412	3
FS HN 411	2	FS HN 472	3
FS HN 471	3	FS HN 480	1
Humanities/Social Sci. (H Sci) or ENV S (AgLS)	2-3	US Diversity (if not already taken) or elective*	3
Humanities (H Sci) or elective (AgLS)*	1-3		
	14-17		13

* Choose elective courses to total equal to or greater than 120 credits.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

Forestry

The forestry curriculum offers courses dealing with the management of forest ecosystems for multiple benefits including biodiversity, recreation, water, wilderness, wildlife, and wood and fiber. Conservation and preservation of natural resources are emphasized. The department offers work for the Bachelor of Science degree with a major in forestry and options in forest ecosystem management, interpretation of natural resources, urban and community forestry, natural resource conservation and restoration, or sustainable materials science and technology. All options lead to a professional degree in forestry (Bachelor of Science). The forestry major has been accredited by the Society of American Foresters (SAF) since 1935. The Council for Higher Education Accreditation recognizes SAF as the specialized accrediting body for forestry education in the United States. The primary goal of the undergraduate curriculum in forestry is to educate foresters to be capable of scientifically managing the nation's forest lands and related ecosystems - private and public.

Graduates understand and can apply scientific principles associated with forests, forest ecosystem management, and wood and non-wood products. Graduates are able to communicate effectively and work well in teams. They are capable of preparing and delivering effective oral and written communication of scientific and technical decisions to professional and lay audiences. They are proficient in technical skills such as measurements, computer usage, inventory, economic analysis, data and situation analysis, and ecosystem assessment. They recognize the importance of ethics in forestry and are sensitive to cultural diversity and broad environmental concerns.

Graduates of the forest ecosystem management option are skilled at understanding how forests function and how forests can be managed to produce desired goods (wood, fiber, recreation, wildlife habitat) and services (clean water, carbon sequestration, wilderness) in the long-run. They are skilled at interpretation of interactions and effects of abiotic and biotic factors in forests and quantification of bio-physical, social, and economic outputs from forest ecosystems. They are skilled at complex decision-making involving private and public forest resources where ethical, legal, social, economic, and ecological dimensions are explicitly considered.

Graduates of the interpretation of natural resources option are skilled at communicating with the public about the values associated with forest ecosystems and providing educational programs for all ages.

Graduates of the urban and community forestry option are able to combine biological, social, legal, and economic expertise to effectively manage trees or forests in an urban setting. They are skilled at decision-making related to site assessment, and long-term management of urban trees and forests to achieve multiple goals.

Graduates of the natural resource conservation and restoration option are skilled at assessing the natural functions of the environment and human

impacts. They are skilled at interpretation of forest and other natural environments and making decisions relating to their conservation and preservation.

Graduates of the sustainable materials science and technology option understand the anatomical, physical, and chemical properties of wood and other bio-renewable materials and know wood processing operations involved in drying, composite materials manufacturing, and chemical treatment.

In consultation with their adviser, students can select elective courses related to elective courses in the forest ecosystem management option to emphasize forest ecology; wildlife, wilderness, and recreation management; water quality and erosion protection; quantitative-analytical techniques; business and marketing; and other areas related to natural resource management. Elective courses in the urban and community forestry option can be selected to emphasize plant health, policy and planning, ecology, hydrology, sociology, business administration, or horticulture/design. Elective courses related to the natural resource conservation and restoration option can be selected to emphasize, ecology, wildlife, recreation, nature interpretation, landscape design, sociology and ethics of conservation and preservation. Similarly, elective courses in the sustainable materials science and technology option can be selected to emphasize wood production, bio-renewable materials, wood fiber, business and marketing, and quality assurance. Elective courses in the interpretation of natural resources option can be selected to emphasize natural history, animal ecology, and environmental education.

Many private firms as well as national, regional, state, and local agencies seek forestry graduates to fill positions in management of natural resources for commodity and non-commodity multiple benefits. Graduates in forestry are prepared to be involved with evolving forestry systems, such as agroforestry and urban forestry. Wood processing industries, such as composite products, plywood, particle board, lumber, and pulp and paper offer professional opportunities in production, product development, quality control, and marketing.

With advanced graduate study, the range of professional job opportunities for a person with a B.S. in forestry is expanded. Opportunities include research and education as well as more specialized managerial and administrative positions with private firms and public agencies.

During fall semester of the second year of study (sophomore year, typically), forestry students are required to enroll in the department's integrated forestry modules consisting of:

FOR 201	Forest Biology	2
FOR 202	Sustainable Materials: Wood Utilization	2
FOR 203	Resource Measurements/Evaluation	2
FOR 204	Forest Ecosystem Decision-Making	2
FOR 205	Integrated Forestry Laboratory	3
FOR 206	Fall Forestry Camp	4

That semester, consisting entirely of forestry coursework, is designed to give students an early understanding of the many aspects of forestry and how they are interrelated. In addition to work in the classroom, students will spend time in laboratory and field work each week. A 3-week off-campus fall camp during the semester will reinforce concepts learned both in the classroom and during laboratory/field sessions. Transfer students should check with the department for counsel on timing their completion of the integrated forestry modules.

Forestry Minor

The department offers a minor in forestry which can be earned by completion of a minimum of 15 credits in forestry courses. Students wishing to emphasize management and environmental aspects of forestry must select at least 15 credits from the following courses:

ENSCI 345	Natural Resource Photogrammetry and Geographic Information Systems	3
FOR 302	Silviculture	3
FOR 356	Dendrology	4
FOR 416	Forest Insects and Diseases	3
FOR 416L	Forest Insects and Diseases Laboratory	1
FOR 442	Dynamics of Forest Stands	3
FOR 451	Forest Resource Economics and Quantitative Methods	4
FOR 452	Ecosystem Management	3
FOR 475	Urban Forestry	3
NREM 120	Introduction to Renewable Resources	3
NREM 301	Natural Resource Ecology and Soils	4
NREM 345	Natural Resource Photogrammetry and Geographic Information Systems	3
NREM 390	Fire Ecology and Management	3
NREM 407	Watershed Management	4
NREM 446	Integrating GPS and GIS for Natural Resource Management	3
NREM 471	Agroforestry Systems; Local and Global Perspectives	3

Sustainable materials science and technology emphasis: FOR 280 Wood Properties and Identification and an additional 12 credits from the following courses:

FOR 480	Wood Anatomy and Fiber Analysis	3
FOR 481	Conversion of Lignocellulosic Materials	3

FOR 485	Wood and Natural Fiber Composites	3
FOR 486	Drying Processes for Wood and Other Lignocellulosic Materials	3
FOR 487	Physical Properties of Wood	4
NREM 490B	Independent Study: Forestry	1-4

Curriculum in Forestry

Total Degree Requirement: 128 cr.

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communications Proficiency (with a C or better):

English composition		6
Speech fundamentals		3
Total Credits		9

Communication/Library: 13 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
One course from:		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 312	Biological Communication	
ENGL 314	Technical Communication	
Total Credits		13

Humanities and Social Sciences: 6 cr.

6 cr. from approved list.

Ethics: 3 cr.

3 cr. from approved list.

Life Sciences: 6 cr.

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
Total Credits		4

Mathematics, Physical and Life Sciences: 22 cr.

MATH 140	College Algebra	3
MATH 150	Discrete Mathematics for Business and Social Sciences	3
CHEM 163	College Chemistry	4
CHEM 163L	Laboratory in College Chemistry	1
AGRON 182	Introduction to Soil Science	3
BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
One course from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
Total Credits		21-22

Forestry: 29 cr.

NREM 104	Practical Work Experience	R
NREM 110	Orientation in Natural Resource Ecology and Management	1
NREM 120	Introduction to Renewable Resources	3
NREM 211	Careers in Natural Resources	1
FOR 201	Forest Biology	2
FOR 202	Sustainable Materials: Wood Utilization	2
FOR 203	Resource Measurements/Evaluation	2
FOR 204	Forest Ecosystem Decision-Making	2
FOR 205	Integrated Forestry Laboratory	3
FOR 206	Fall Forestry Camp	4
FOR 302	Silviculture	3
FOR 451	Forest Resource Economics and Quantitative Methods	4
FOR 454	Forestry Practicum	3
Total Credits		30

Electives: Students majoring in forestry are required to choose one of the following options at the end of their sophomore year: forest ecosystem management; sustainable material science and technology; urban and community forestry; natural resource conservation and restoration; or interpretation of natural resources.

Forest Ecosystem Management

FOR 280	Wood Properties and Identification	4
FOR 356	Dendrology	4
PL P 416	Forest Insects and Diseases	3
PL P 416L	Forest Insects and Diseases Laboratory	1
FOR 442	Dynamics of Forest Stands	3
FOR 452	Ecosystem Management	3
NREM 301	Natural Resource Ecology and Soils	4
NREM 345	Natural Resource Photogrammetry and Geographic Information Systems	3
One course from:		3-4
MATH 151	Calculus for Business and Social Sciences	
or MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
One course from:		3-4

A ECL 366	Natural History of Iowa Vertebrates	
ECON 380	Energy, Environmental and Resource Economics	
NREM 390	Fire Ecology and Management	
NREM 407	Watershed Management	
NREM 446	Integrating GPS and GIS for Natural Resource Management	
NREM 471	Agroforestry Systems; Local and Global Perspectives	
One course from:		3
NREM 385	Natural Resource Policy	
or NREM 460	Controversies in Natural Resource Management	
Total Credits		34-36

Interpretation of Natural Resources

A ECL 365	Vertebrate Biology	4
A ECL 366	Natural History of Iowa Vertebrates	3
BIOL 366	Plant Systematics	4
ENT 370	Insect Biology	3
FOR 452	Ecosystem Management	3
NREM 303	Internship	1-3
NREM 330	Principles of Interpretation	3
One course from:		3-4
BIOL 474	Plant Ecology	
FOR 356	Dendrology	
One course from:		3-4
AGRON 206	Introduction to Weather and Climate	
ASTRO 120	The Sky and the Solar System	
GEOL 100	The Earth	
GEOL 101	Environmental Geology: Earth in Crisis	
GEOL 108	Introduction to Oceanography	
One course from:		3
NREM 385	Natural Resource Policy	
NREM 460	Controversies in Natural Resource Management	
Total Credits		30-34

Natural Resource Conservation and Restoration

A ECL 366	Natural History of Iowa Vertebrates	3
FOR 356	Dendrology	4
FOR 452	Ecosystem Management	3
NREM 301	Natural Resource Ecology and Soils	4
NREM 390	Fire Ecology and Management	3
NREM 407	Watershed Management	4
MATH 151	Calculus for Business and Social Sciences	3-4
or MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
PL P 416	Forest Insects and Diseases	3
PL P 416L	Forest Insects and Diseases Laboratory	1
One course from:		3
NREM 345	Natural Resource Photogrammetry and Geographic Information Systems	
NREM 446	Integrating GPS and GIS for Natural Resource Management	
One course from:		3
NREM 385	Natural Resource Policy	
NREM 460	Controversies in Natural Resource Management	
Three credit hours from approved list of electives		3
Total Credits		37-38

Sustainable Materials Science and Technology

FOR 280	Wood Properties and Identification	4
FOR 480	Wood Anatomy and Fiber Analysis	3
FOR 481	Conversion of Lignocellulosic Materials	3
FOR 485	Wood and Natural Fiber Composites	3
FOR 486	Drying Processes for Wood and Other Lignocellulosic Materials	3
FOR 487	Physical Properties of Wood	4
MATH 151	Calculus for Business and Social Sciences	3
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	4
TSM 270	Principles of Injury Prevention	3
or TSM 310	Total Quality Improvement	
Total Credits		30

Urban and Community Forestry

FOR 280	Wood Properties and Identification	4
C R P 201	The North American Metropolis	3-4
or C R P 301	Planning Methods Studio	
HORT 342	Landscape Plant Installation, Establishment, and Maintenance	3
FOR 356	Dendrology	4
FOR 452	Ecosystem Management	3
FOR 475	Urban Forestry	3
MATH 151	Calculus for Business and Social Sciences	3-4
or MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
PL P 416	Forest Insects and Diseases	3
PL P 416L	Forest Insects and Diseases Laboratory	1
SOC 310	Community	3

or SOC 382	Environmental Sociology	
One course from:		3
NREM 385	Natural Resource Policy	
NREM 460	Controversies in Natural Resource Management	
Total Credits		33-35

Forestry, B.S. - forest ecosystem management option

Freshman

Fall	Credits	Spring	Credits
BIOL 211	3	MATH 150	3
BIOL 211L	1	CHEM 163	4
NREM 110	1	CHEM 163L	1
ENGL 150	3	STAT 101	4
MATH 140**	3	LIB 160	1
NREM 120	3	NREM 211	1
SOC 130/134	3	Free Elective	3
	17		17

Sophomore

Fall	Credits	Spring	Credits
FOR 201	2	SP CM 212	3
FOR 202	2	ENGL 250	3
FOR 203	2	BIOL 212	3
FOR 204	2	BIOL 212L	1
FOR 205	3	FOR 280	4
FOR 206	4	Free Elective	3
	15		17

Junior

Fall	Credits	Spring	Credits
MATH 151/181	3	FOR 302	3
FOR 356	4	FOR 451	4
NREM 301	4	Required Electives	6
NREM 345 or FOR 342	3	Free Elective	3
Required Elective	3		
	17		16

Senior

Fall	Credits	Spring	Credits
FOR 342 or NREM 345	3	Policy Elective	3
FOR 416	3	FOR 454	3
FOR 452	3	Required Elective	3
Communications Elective	3	Free Elective	6
Free Electives	3		
	15		15

* To complete degree program in 4 years students must maintain an average of 16 credits per semester.

** Initial math course is determined on the basis of high school math and placement test scores. A non-credit math course (MATH 10) may be required at additional course.

*** In scheduling coursework, students should pay particular attention to courses with limited offerings (e.g., offered only on alternate years) and to course sequences (i.e., where a course serves as a prerequisite for another course).

Note: In addition to coursework listed above, students must complete departmental requirements for Practical Work Experience requirement (NREM 104). See

Courses primarily for undergraduates:

FOR 201: Forest Biology

(2-0) Cr. 2. F.

Prereq: Concurrent enrollment in FOR 202, FOR 203, FOR 204, FOR 205, and FOR 206

Discussion of ecological concepts, individual tree structure and growth, variation and diversity in tree populations. Physical environment of trees and forests, ecological processes in forest communities, and introduction to different regional forest communities.

FOR 202: Sustainable Materials: Wood Utilization

(2-0) Cr. 2. F.

Prereq: Concurrent enrollment in FOR 201, FOR 203, FOR 204, FOR 205, and FOR 206

Basis for use of wood as an industrial raw material for lumber, composites, pulp and paper, energy and chemicals. Implications of use of alternative renewable and non-renewable materials for societal infrastructure and consumer goods.

FOR 203: Resource Measurements/Evaluation

(2-0) Cr. 2. F.

Prereq: Concurrent enrollment in FOR 201, FOR 202, FOR 204, FOR 205, and FOR 206; MATH 140

Survey techniques involved in quantification, valuation, and evaluation of tree and stand growth and other variables in the forest environment (e.g., recreational use, wildlife habitat value, biomass, and solid wood).

FOR 204: Forest Ecosystem Decision-Making
(2-0) Cr. 2. F.
Prereq: Concurrent enrollment in FOR 201, FOR 202, FOR 203, FOR 205, and FOR 206
Methods of decision-making related to forest ecosystems including communications, teams and conflict resolution. Current issues relating to public, private, and urban forests; quantification of processes, services, and goods produced by the forest and expected by the public such as wildlife, water, range, recreation, wilderness, biodiversity, as well as wood and fiber products.

FOR 205: Integrated Forestry Laboratory
(0-8) Cr. 3. F.
Prereq: Concurrent enrollment in FOR 201, FOR 202, FOR 203, FOR 204, and FOR 206
Field and laboratory exercises integrating the evaluation and management of forest goods, services, and the processing of wood products.

FOR 206: Fall Forestry Camp
Cr. 4. F.
Prereq: Concurrent enrollment in FOR 201, FOR 202, FOR 203, FOR 204, and FOR 205
Three-week field camp to address topics and issues covered in 201, 202, 203, 204, and 205.

FOR 280: Wood Properties and Identification
(3-3) Cr. 4. S.
Properties of wood and how they relate to its successful use. Comparative anatomical characteristics, scientific nomenclature, and hand lens identification of commercially important North American woods.

FOR 283: Pesticide Application Certification
(Cross-listed with AGRON, ENT, HORT). (2-0) Cr. 2. S.
Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized.

FOR 290: Special Problems
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290A: Special Problems: Leadership in Forestry Teams (LIFT) Learning Community
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290B: Special Problems: Forest Ecosystem Management
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290C: Special Problems: Natural Resource Conservation
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290D: Special Problems: Urban and Community Forestry
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290E: Special Problems: Wood Science and Technology
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 302: Silviculture
(2-3) Cr. 3. S.
Prereq: FOR 201
Manipulation of forest vegetation based on ecological principles for the production of goods and services.

FOR 356: Dendrology
(Cross-listed with BIOL). (2-4) Cr. 4. F.
Prereq: BIOL 211
Identification and ecology of North American woody plant species. Importance of woody plants in timber production and wildlife habitat. Natural disturbances, human impacts, management and restoration concerns for major North American forest regions will be addressed.

FOR 358: Forest Herbaceous Layer: Ecology and Identification.
(Cross-listed with NREM). (0.5-1) Cr. 1. S.
Prereq: BIOL 212
Survey of the major plant families, general, and representative species of the forest herbaceous layer. Functional ecology and restoration.

FOR 416: Forest Insects and Diseases
(Cross-listed with PL P). (3-0) Cr. 3. F.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent.
Nature of insects and pathogens of forest and shade trees; their role in the dynamics of natural and managed forest ecosystems; and the management of indigenous and exotic pests.

FOR 416L: Forest Insects and Diseases Laboratory
(Cross-listed with PL P). (0-3) Cr. 1. F.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent. Credit or enrollment in Pl P 416.
Laboratory experience working with insect and fungal pests of trees.

FOR 442: Dynamics of Forest Stands
(2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: NREM 301, FOR 302, STAT 101 or their equivalents
Change in forest species composition and structure at the stand and landscape scales resulting from site quality, tree growth, competition, succession, and disturbance. Methods for assessing tree growth and reconstructing past stand development. Applications to forest and savanna management.

FOR 451: Forest Resource Economics and Quantitative Methods
(3-3) Cr. 4. S.
Prereq: FOR 203, MATH 150
Application of economic principles to forest resource management considering both market and non-market goods and services. Methods of identifying and specifying problems in the management and use of forest resources. Application of mathematical and statistical models to the solution of managerial problems.

FOR 452: Ecosystem Management
(Dual-listed with FOR 552). (Cross-listed with NREM). (2-3) Cr. 3. S.
Prereq: Senior classification, and NREM 120 or its equivalent
Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints.

FOR 454: Forestry Practicum
(1-4) Cr. 3. S.
Prereq: 20 credits in student's major at 300 level or above
Integrated decision-making related to the conservation, management, and preservation of private and public forests, wildlands, urban/community forests, and/or the production and utilization of wood products. Student teams work with a client and develop management plans that incorporate ecological, social, economic, ethical, and institutional/political factors. Effective teamwork, written/oral/visual communication, and problem-solving stressed. Multiple trips to project site and client.

FOR 475: Urban Forestry
(Cross-listed with HORT). (2-3) Cr. 3. F.
Prereq: Junior or senior classification, 3 credits in biology
Discussion of establishment and management of woody perennials in community-owned urban greenspaces, consideration of urban site and soil characteristics, plant physiology, plant culture, urban forest valuation, inventory methods, species selection, and urban forest maintenance (health care and pest management).

FOR 480: Wood Anatomy and Fiber Analysis
(2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: FOR 280 or permission of instructor
Microscopic anatomy and ultrastructure of wood and other industrial lignocellulosic materials. Microscopy techniques for fiber analysis. Comparison of fiber properties.

FOR 481: Conversion of Lignocellulosic Materials
(2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: FOR 280 or equivalent
Chemical properties of lignocellulosic materials. Wood chemistry. Various conversion processes. Pulp and paper technology. Biobased products. Other fiber products. Cellulose derivatives. Term paper and/or student project required for graduate level.

FOR 485: Wood and Natural Fiber Composites
(2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: FOR 280 or TSM 240
Consolidation behavior of wood and other lignocellulosic materials. Principles of adhesion. Manufacturing processes for wood and lignocellulose composites such as plywood, oriented strand products, laminated lumber, particleboard, medium density fiberboard, and bast fiber products. Extrusion processing of natural fiber/plastic composites.

FOR 486: Drying Processes for Wood and Other Lignocellulosic Materials
(2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: FOR 280 or TSM 240
Principles of moisture relations in hygroscopic materials; adsorption, desorption, equilibrium moisture content. Transport processes in natural materials such as wood. Drying processes for wood and other lignocellulosic materials. Influence of moisture on dimensional stability and durability of wood and lignocelluosic composites.

FOR 487: Physical Properties of Wood
(3-3) Cr. 4. Alt. S., offered even-numbered years.
Prereq: FOR 280
Mechanical, thermal, electrical, and acoustical properties of wood. Lumber grading and stress rating, nondestructive evaluation of wood and wood composite products.

Courses primarily for graduate students, open to qualified undergraduates:

FOR 552: Ecosystem Management
(Dual-listed with FOR 452). (Cross-listed with NREM). (2-3) Cr. 3. S.
Prereq: Senior classification, and NREM 120 or its equivalent
Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints.

FOR 599: Creative Component
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599A: Creative Component: Forest Biology
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599B: Creative Component: Forest Biometry
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599C: Creative Component: Forest and Recreation Economics
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599D: Creative Component: Forest Management and Administration
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599E: Creative Component: Wood Science
Cr. 1-12. Repeatable, maximum of 12 credits.

Courses for graduate students:

FOR 696: Research Seminar
(Cross-listed with AGRON, BBMB, GDCB, HORT, PLBIO). Cr. 1. Repeatable. Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

FOR 699: Research
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699A: Research: Forest Biology - Wood Science
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699B: Research: Forest Biometry
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699C: Research: Forest Economics
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699D: Research: Forest Management and Administration
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699E: Research: Wood Science
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699F: Research: Plant Physiology
Cr. 1-12. Repeatable, maximum of 12 credits.

Genetics

Alan M. Myers, Chair, Genetics Major Committee

Genetics is the scientific study of heredity. Understanding the basis of heredity is fundamental to all aspects of the life sciences, from the most basic molecular study to applied studies of agricultural species. At Iowa State University the study of the life sciences is interdepartmental, involving faculty in the basic, agricultural, and veterinary sciences. Faculty in 20 different departments are involved in genetics research. This large group of faculty presents a broad range of possibilities for students to learn from faculty who are at the forefront of research in many areas of genetics.

Undergraduate Study

Undergraduate study in genetics is jointly administered by three departments: the Roy J. Carver Department of Biochemistry, Biophysics, and Molecular Biology; the Department of Genetics, Development, and Cell Biology; and the Department of Ecology, Evolution, and Organismal Biology. Undergraduate degrees are offered through both the College of Agriculture and Life Sciences and the College of Liberal Arts and Science. Programs of study for genetics majors leading to a B.S. degree are available.

Training in genetics may lead to employment in teaching, research, or a variety of health-related professions. Although some students find employment directly after their baccalaureate training, many students continue their education in graduate or professional programs. Students with the B.S. degree may find employment in the biotechnology, health, or food industries. Recent graduates have also developed careers in conservation biology, technical writing, science journalism, technical sales, and business.

The required course work and associated electives provide students with the foundation in basic life sciences, mathematics, chemistry, and physics that is essential for professions involving modern biological/biomedical sciences. As part of these courses students develop skills in problem solving, critical thinking, writing, and research-related activities in the biological sciences.

Specific entrance requirements for medical and health-related professions are established by the professional schools. Students interested in fulfilling pre-professional requirements for such professions as dentistry, human medicine, genetic counseling, optometry, pharmacy, physical therapy, physicians assistant, and veterinary medicine can major in genetics while fulfilling the pre-professional requirements.

Curriculum in Genetics - Requirements

Total Degree Requirement: 120 cr.

A maximum of 65 cr. from a two-year institution can be applied that may include up to 16 technical cr.; up to 9 Pass-Not Pass cr. of free electives can be applied; a cumulative GPA of at least 2.0 is required for graduation. Program-approved lists can be found on the Genetics website.

1. Genetics and Life Sciences

A grade of C– or better is required in all Genetics and Life Science courses.

A. Courses required of all Genetics majors

GEN 110	Genetics Orientation	1

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
GEN 313	Principles of Genetics	3
GEN 313L	Genetics Laboratory	1
BIOL 314	Principles of Molecular Cell Biology	3
BIOL 315	Biological Evolution	3
One of the following:		
GEN 349	The Genome Perspective in Biology	
GEN 444	Bioinformatic Analysis	
GEN 322	Introduction to Bioinformatics and Computational Biology	
GEN 409	Molecular Genetics	3
GEN 410	Analytical Genetics	3
One of the following:		
GEN 462	Evolutionary Genetics	
EEOB 561	Evolutionary and Ecological Genomics	
EEOB 563	Molecular Phylogenetics	
GEN 491	Undergraduate Seminar	1
MICRO 302	Biology of Microorganisms	3
Total Credits		29

B. Course required of majors in the College of Agriculture and Life Sciences only

A minimum of 3 cr. of coursework in the area of environmental science from program approved list	3
Total Credits	3

2. Advanced Sciences Electives: 6 cr. from program approved list

A grade of C- or better is required in each course. No more than 3 cr. of GEN 490, 490R, 490H, 492, 496, 499, or 499H may be used to meet this requirement.

3. Mathematical Sciences

Complete at least one calculus course from MATH, minimum of 4 credits.		4
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Complete at least one course from STAT, minimum of 3 credits.		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
Complete at least one additional course from MATH or STAT, minimum of 4 credits.		4
MATH 166	Calculus II	
MATH 182	Calculus and Mathematical Modeling for the Life Sciences II	
STAT 301	Intermediate Statistical Concepts and Methods	
STAT 401	Statistical Methods for Research Workers	
Total Credits		11-12

4. Supporting Sciences

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 178L	Laboratory in College Chemistry II	1
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
CHEM 332	Organic Chemistry II	3
CHEM 332L	Laboratory in Organic Chemistry II	1
PHYS 111	General Physics	5
or PHYS 221	Introduction to Classical Physics I	
PHYS 112	General Physics	5
or PHYS 222	Introduction to Classical Physics II	
Choose one of the following options		6-7
Option 1		
BBMB 404	Biochemistry I	
And one of the following:		
BBMB 405	Biochemistry II	
BBMB 411	Techniques in Biochemical Research	
CHEM 211 & 211L	Quantitative and Environmental Analysis and Quantitative and Environmental Analysis Laboratory	
CHEM 325	Chemical Thermodynamics	
Option 2		
BBMB 420	Mammalian Biochemistry	
And one of the following:		
BBMB 411	Techniques in Biochemical Research	
CHEM 211 & 211L	Quantitative and Environmental Analysis and Quantitative and Environmental Analysis Laboratory	
CHEM 325	Chemical Thermodynamics	
Total Credits		33-34

5. International Perspectives: 3 cr. from university approved list

This course can satisfy **both** the university requirement for International Perspectives and the college requirement for a General Education elective (item 8) if the selection appears on both lists of approved courses.

6. U.S. Diversity: 3 cr. from university approved list

This course can satisfy **both** the university requirement for U.S. Diversity and the college requirement for a General Education elective (item 8) if the selection appears on both lists of approved courses.

7. Communications/Information Literacy

A. Courses required of all Genetics majors

Grades of C or better are required in ENGL 250 and advanced writing. (The College of Agriculture and Life Sciences requires a C or better in ENGL 150, as well.)

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	
LIB 160	Information Literacy	1
One advanced English writing course from program approved list		3
Total Credits		10

B. Course required of majors in the College of Agriculture and Life Sciences only.

A grade of C or better is required by the college.

SP CM 212	Fundamentals of Public Speaking	3
or AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
Total Credits		3

8. General Education electives

Courses from college approved lists that also appear on university approved lists of U.S. Diversity or International Perspectives courses can be used to satisfy both requirements.

A. College of Agriculture and Life Sciences

Humanities course from college approved list	3
Social Science course from college approved list	3
Ethics course from college approved list	3
Total Credits	9

B. College of Liberal Arts and Sciences

Humanities courses from college approved list; one of these should be a Science/Humanities bridge course from program approved list	12
Social Science courses from college approved list	9
Students must have completed 3 years of a single world language in high school or take 4-8 credits of World Languages at the university level.	
Total Credits	21

Undergraduate Minor

The minor in Genetics may be earned by completing the following courses. At least 9 cr. must be used **only** to fulfill the requirements of the minor and not be applied to any other major, college, or university requirement.

GEN 313	Principles of Genetics	3
GEN 313L	Genetics Laboratory	1
BIOL 314	Principles of Molecular Cell Biology	3
GEN 410	Analytical Genetics	3
GEN 409	Molecular Genetics	3
Two or more additional credits in Genetics at the 300 level or above.		2
Total Credits		15

Genetics, B.S.

Freshman

Fall	Credits	Spring	Credits
GEN 110	1	ENGL 250 or Social Sciences Choice	3
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
CHEM 177	4	CHEM 178	3
CHEM 177L	1	CHEM 178L	1
ENGL 150 or 250	3	MATH/ STAT choice or Humanities Choice	3-4
LIB 160	1	Consider Research (HON 290 or GEN 499)	0-2
MATH/ STAT choice or Humanities Choice	3-4		
	17-18		14-17

Sophomore

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 313	3	BIOL 314	3	Consider Internship, Study Abroad	
BIOL 313L	1	CHEM 332	3		
CHEM 331	3	CHEM 332L	1		
CHEM 331L	1	MICRO 302	3		
SP CM 212	3	MATH/ STAT Choice or Social Sciences*	3-4		
MATH/ STAT Choice or Social Sciences*	3-4	Ethics Choice	3		
	14-15		16-17		0

Junior

Fall	Credits	Spring	Credits	Summer	Credits
GEN 409 (or GEN 410)	3	GEN 410 (or GEN 409)	3	Consider Research with Faculty	
PHYS 111 (or PHYS 221)	5	PHYS 112 (or PHYS 221)	5		
U.S. Diversity/ Social Sciences Choice	3	BIOL 315	3		
BIOL 315	3	or Bioinformatics Choice			
BBMB 404	3	BBMB 405	3		
		GEN 491 (or Fall of Senior Year)	1		
	17		15		0

Senior

Fall	Credits	Spring	Credits
GEN 462	3	Advanced Science Electives	3-6
STAT 301 (or Advanced Science Elective)	4	International Perspectives/ Humanities	3
ENGL 312 (or other ENGL 302-316)	3	True Electives	3-6
Environmental Awareness Choice	3-4		
	13-14		9-15

Courses primarily for undergraduates:

GEN 110: Genetics Orientation

(1-0) Cr. 1. F.

This course is intended for first year students and others new to the genetics major. Discussion of university policies and resources, requirements of the major, career opportunities, and other topics related to the first year experience.

GEN 112: Genetics Orientation for Transfer Students

(0.5-0) Cr. 0.5. S.

Eight-week course for external transfer students and internal change of major students. Discussion of university policies and resources, requirements of the major, and career opportunities. Only one of GEN 110 or 112 may count toward graduation.

GEN 298: Cooperative Education

Cr. R. F.S.SS.

Prereq: Permission of department cooperative education coordinator; sophomore classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

GEN 313: Principles of Genetics
(Cross-listed with BIOL). (3-0) Cr. 3. F.S.SS.
Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L
Introduction to the principles of transmission and molecular genetics of plants, animals, and bacteria. Recombination, structure and replication of DNA, gene expression, cloning, quantitative genetics, and population genetics. Students may receive graduation credit for no more than one of the following: Gen 260, Gen 313 and 313L, Gen 320, Biol 313 and 313L, and Agron 320.

GEN 313L: Genetics Laboratory
(Cross-listed with BIOL). (0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in BIOL 313
Laboratory to accompany 313. Students may receive graduation credit for no more than one of the following: Biol 313 and 313L, Gen 260, Gen 313, Gen 320, and Agron 320.

GEN 320: Genetics, Agriculture and Biotechnology
(Cross-listed with AGRON). (3-0) Cr. 3. F.S.
Prereq: BIOL 212
Transmission genetics with an emphasis on applications in agriculture, the structure and expression of the gene, how genes behave in populations and how recombinant DNA technology can be used to improve agriculture. Credit for graduation will not be allowed for more than one of the following: Gen 260, 313, 320 and Biol 313 and 313L.

GEN 322: Introduction to Bioinformatics and Computational Biology
(Cross-listed with BCBIO, BIOL). (3-0) Cr. 3. F.
Prereq: BIOL 212
Genome sequencing, assembly, structural and functional annotation, and comparative genomics. Investigating these topics will develop skills in programming and scripting (Perl and/or Python), the use of biological databases, sequence alignment, similarity search, identification of sequence patterns, construction of phylogenetic trees, and comparative genomics.

GEN 340: Human Genetics
(3-0) Cr. 3. F.S.SS.
Prereq: BIOL 313 or GEN 313
Fundamental concepts and current issues of human genetics. Human chromosome analysis, pedigree analysis, gene mapping, the human genome project, sex determination, genetics of the immune system, genetics of cancer, gene therapy, the genetic basis of human diversity, eugenics.

GEN 349: The Genome Perspective in Biology
(Cross-listed with BIOL). (2-2) Cr. 3. S.
Prereq: GEN 313 or GEN 320
Analysis of genome, RNA, and protein data using computer technology to answer biological questions on topics ranging from microbial diversity to human health. An introduction for students in the life sciences to the fields of genomics, bioinformatics and systems.

GEN 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

GEN 402: Microbial Genetics and Genomics
(Cross-listed with MICRO). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MICRO 302, Biol 313
The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics.

GEN 409: Molecular Genetics
(3-0) Cr. 3. F.S.
Prereq: BIOL 313
The principles of molecular genetics. Gene structure and function; molecular mechanisms of DNA replication, recombination and repair, transcription and translation, regulation of gene expression.

GEN 410: Analytical Genetics
(3-0) Cr. 3. F.S.
The principles and practice of genetic analysis. Mendelian genetic analysis, mutational, transgenic, and genomic analysis of gene function, linkage and gene mapping, chromosomal aberrations, aneuploidy and polyploidy, extrachromosomal inheritance, analysis of genetic pathways.

GEN 444: Bioinformatic Analysis
(Cross-listed with BCB, BCBIO, BIOL, COM S, CPR E). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

GEN 462: Evolutionary Genetics
(Cross-listed with BIOL). (3-0) Cr. 3. F.
Prereq: BIOL 315
The genetic basis of evolutionary processes in higher organisms. The role of genetic variation in adaptation, natural selection, adaptive processes, and the influence of random processes on evolutionary change.

GEN 490: Independent Study
Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: GEN 313, junior or senior classification, permission of instructor
Independent study in any area of genetics. Students may use no more than 9 credits of university-wide 490 credits (including Gen 490) toward the total of 120 credits required for graduation.

GEN 491: Undergraduate Seminar
(1-0) Cr. 1. F.S.
Prereq: GEN 409
Communication within the discipline based on comprehension, discussion, presentation, and critical evaluation of original research literature; survey of career paths within the genetics disciplines and approaches to obtaining positions; exposure to research publication and grantsmanship processes; ethical issues in genetics research; outcomes assessment activities.

GEN 492: Laboratory Teaching Experience
Cr. 1-2. Repeatable, maximum of 9 credits. F.S.
Prereq: GEN 313, junior or senior classification, permission of instructor
For students registering to be undergraduate laboratory assistants. Offered on a satisfactory-fail basis only. No more than 2 credits of GEN 490U or GEN 492 may be applied toward the Genetics advanced course requirement.

GEN 495: Special Topics in Genetics
(1-0) Cr. 1-3. Repeatable, maximum of 3 credits. F.S.
Prereq: GEN 313; permission of instructor
Content varies from year to year. Genetics students may use no more than 9 credits of university-wide 490-499 credits toward the total of 120 credits required for graduation.

GEN 496: Attendance and Critique of Genetics Seminars
Cr. 1. Repeatable, maximum of 3 credits. F.S.
Prereq: GEN 313, junior or senior classification, permission of instructor
Attendance and critique of departmental seminars in BBMB, GDCB, or EEOB. Offered on a satisfactory-fail basis only. Genetics students may use no more than 9 credits of university-wide 490 - 499 credits toward the total of 120 credits required for graduation.

GEN 498: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

GEN 499: Genetics Research
Cr. 1-5. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: GEN 313, junior or senior classification, permission of instructor
Independent research in any area of genetics. Genetics students may use no more than 9 credits of university-wide 490-499 credits toward the total of 120 credits required for graduation.

GEN 499H: Genetics Research for Honors
Cr. 1-5. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: GEN 313, junior or senior classification, permission of instructor
Independent research in any area of genetics; for Honors students only. Genetics students may use no more than 9 credits of university-wide 490-499 credits toward the total of 120 credits required for graduation.

Global Resource Systems

The Global Resource Systems undergraduate major employs a truly interdisciplinary and systemic approach to understanding complex global resource issues. Students develop a core set of technical competencies in a resource area selected from the majors, minors and certificates offered by the College of Agriculture and Life Sciences. Students choose a world region in which to specialize, develop competency in a relevant world language, and participate in a significant cross-cultural immersion experience. They carry out a senior project related to their resource specialization within the context of the world region.

Multidisciplinary themes are developed in the context of the physical, biological and sociological factors affecting global resource systems. In this context, resource systems include agricultural (including crops, livestock and aquaculture), food, fuel, natural, environmental, biological, financial, governmental, institutional, human, knowledge, and other resources. Graduates of this program have transnational leadership skills and are successful integrators of various specializations on a team. They are skilled in applying a systemic perspective and developing solutions to complex global resource systems problems using innovativeness and creativity. Future professionals communicate effectively and

demonstrate environmental awareness, exhibit an ethical perspective, and display clear analysis of how cultural diversity impacts work both here and abroad. They also recognize opportunities for learning after graduation.

A degree in Global Resource Systems opens the door to employment opportunities in the many businesses and organizations that require globally competent employees.

Curriculum in Global Resource Systems

Administered by a supervisory committee in the College of Agriculture and Life Sciences. Students choose a region of the world to develop an expertise; they choose a language to learn and develop proficiency through the intermediate level; they choose and possess an area of technical expertise by completing an additional major, minor or certificate program offered through the College of Agriculture and Life Sciences; they complete a required internship in an international setting; and they select and complete a senior research project with faculty mentoring.

Total Degree Requirement: 129 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.

3 cr. from approved list	3

U.S. Diversity: 3 cr.

3 cr. from approved list	3

Communications Proficiency:

English composition (6 credits with a grade of C or higher; see courses below.)	
Speech fundamentals (3 credits with a grade of C or higher; see courses below.)	

Communication/Library: 13 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
SP CM 212	Fundamentals of Public Speaking	3
or AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
ENGL 302	Business Communication	3
or ENGL 309	Proposal and Report Writing	
or ENGL 314	Technical Communication	
LIB 160	Information Literacy	1
Total Credits		13

Humanities and Social Sciences: 6 cr.

ECON 101	Principles of Microeconomics	3
or ECON 102	Principles of Macroeconomics	
Plus three credit hours from approved humanities list		3
Total Credits		6

Ethics: 3 cr.

3 cr. from approved list	3

Life Sciences: 7 cr.

BIOL 211	Principles of Biology I	4
& 211L	and Principles of Biology Laboratory I	
or BIOL 212	Principles of Biology II	
& 212L	and Principles of Biology Laboratory II	
Plus 3 cr. from approved life sciences list at 300-level or higher		3

Mathematical Sciences: 6 cr.

MATH 140	College Algebra (or higher; except Math 195 or 196)	3
STAT 101	Principles of Statistics	3-4
or STAT 104	Introduction to Statistics	
Total Credits		6-7

Global Competency: 15-31 cr.

16 cr. of 100 and 200 level of a single WLC language; 15 cr. in global competency courses from an approved list with up to 3 cr. may be earned from a travel course.

Physical Sciences: 8 cr.

One of the following:		5
CHEM 163	College Chemistry	
& 163L	and Laboratory in College Chemistry	
or CHEM 177	General Chemistry I	
& 177L	and Laboratory in General Chemistry I	
One course from the following:		3
AGRON 182	Introduction to Soil Science	
AGRON 282	Soil Conservation and Land Use	
AGRON 206	Introduction to Weather and Climate	
GEOL 101	Environmental Geology: Earth in Crisis	
GEOL 160	Water Resources of the World	
Total Credits		8

Global Resource Systems: 23 cr.

GLOBE 110	Orientation	1
3 credits of GLOBE 211		3
GLOBE 211	Issues in Global Resource Systems (Each offering is 1 cr., must be repeated for 3 cr.)	
GLOBE 201	Global Resource Systems	3
GLOBE 320	Global Resource Systems Internship Preparation	1
GLOBE 303	Agricultural, Food and Natural Global Resource Systems	3
GLOBE 304	Socio-Economic Global Resource Systems	3
GLOBE 401	Senior Project	3
GLOBE 402	Responses to Global Resource System Challenges	3
One of the following:		3-6
GLOBE 321	Internship - Global	
GLOBE 322	Internship - United States	

Total Credits 23-26

Technical Concentration: 15-18 cr.

Satisfied by any of the majors, minors or certificates offered through the College of Agriculture and Life Sciences.

Electives:

Sufficient coursework to ensure a total of not less than 129 credits

Global Resource Systems, B.S.

Freshman

Fall	Credits	Spring	Credits
GLOBE 110	1	GLOBE 201	3
GLOBE 211	1	MATH 140	3
ECON 101	3	ENGL 250	3
ENGL 150	3	CHEM 163	4
LIB 160	1	CHEM 163L	1
BIOL 211	3	STAT 104	3
BIOL 211L	1		
Humanities	3		
	16		17

Sophomore

Fall	Credits	Spring	Credits
GLOBE 211	1	GLOBE 304	3
Language 101	4	Language 102	4
Global Politics or Global Culture	3	AGEDS 311 or SP CM 212	3
Technical Area	3	AGRON 182 or 206 or 282 or Geol 101 or 160	3
Elective	4	Technical Area	3
	15		16

Junior

Fall	Credits	Spring	Credits
GLOBE 303	3	GLOBE 320	1
Language 201	4	Language 202	4
GLOBE 211	1	Global History or Global Culture	3
ENGL 309	3	AGRON 342 (or Other CALS Approved Ethics)	3
Global Culture	3	Technical Area	3
US Diversity	3	General Elective	3
	17		17

Senior

Fall	Credits	Spring	Credits
GLOBE 321	3	GLOBE 402	3
GLOBE 401	3	Global Culture	3
International Perspectives	3	300 Level or Higher Life Science (From Approved List)	3
Global Economics or Global Culture	3	Technical Area	3
Technical Area	3	General Elective	3
General Elective	1		
	16		15

Courses primarily for undergraduates:

GLOBE 110: Orientation
(1-0) Cr. 1. F.
An introduction to Global Resource Systems (GRS) program. University and career acclimation, development of educational and professional skills, participation in GRS Learning Community. Assessed service-learning component.

GLOBE 120: Geography of Global Resource Systems
(3-0) Cr. 3. F.S.SS.
A survey of geographic concepts with a specific focus on the distribution of natural and human-generated resources and the demand for those resources on a global scale.
Meets International Perspectives Requirement.

GLOBE 201: Global Resource Systems
(3-0) Cr. 3. F.S.
A comparative analysis of global resources and the various natural and human systems affecting those resources. Assessed service-learning component.

GLOBE 211: Issues in Global Resource Systems
(1-0) Cr. 1. Repeatable, maximum of 3 credits. F.S.
Discussion of topics of current importance in global resource systems. Offered on a satisfactory-fail basis only. A maximum of 3 credits of 211 may be used towards degree requirements.

GLOBE 220: Globalization and Sustainability
(Cross-listed with ANTHR, ENV S, M E, MAT E, SOC, T SC). (3-0) Cr. 3. F.S.
An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.
Meets International Perspectives Requirement.

GLOBE 221: Apprenticeship
Cr. R. Repeatable. F.S.SS.
Prereq: Approval by the Global Resource Systems Faculty Coordinator
Practical work experience in approved domestic or international settings such as with a company, research laboratory, governmental agency or non-governmental organization. Offered on a satisfactory-fail basis only.

GLOBE 290: Independent Study
Cr. 1-2. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for first-year students and sophomores.

GLOBE 290H: Independent Study, Honors
Cr. 1-2. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for first-year students and sophomores.

GLOBE 303: Agricultural, Food and Natural Global Resource Systems
(3-0) Cr. 3. F.
Prereq: GLOBE 201, ECON 101 or ECON 102
In-depth analysis of the opportunities, constraints and consequences of agricultural, food and natural resource systems. Topics integrate global natural resources with agriculture and food systems, nutrition and health, sustainable development, and societal structures, including gender, migration and urbanization. Course content utilizes a systems approach.

GLOBE 304: Socio-Economic Global Resource Systems
(3-0) Cr. 3. S.
Prereq: GLOBE 201, ECON 101 or ECON 102
In-depth analysis of the opportunities, constraints and consequences of social, economic and political global resource systems. Topics integrate agriculture and food production, globalization, population, economic planning, energy, security, trade, and policy and their role in defining different world regions. Course content utilizes a systems approach.

GLOBE 320: Global Resource Systems Internship Preparation
(1-0) Cr. 1. S.
Prereq: Permission of instructor.
Students enrolled in this course intend to enroll in Globe 321 or 322 in the following term. Topics provide a pre-departure orientation, including logistical, academic, cultural, and personal requirements for completion of an experiential supervised work experience.

GLOBE 321: Internship - Global
Cr. 3-6. Repeatable. F.S.SS.
Prereq: GLOBE 320, Junior or Senior and enrollment in Global Resource Systems major; permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
A supervised learning experience including an analysis of an international location's resource system via immersion in a foreign culture lasting at least five weeks. The experience should focus on the region consistent with the student's degree track. Course expenses paid by student. A maximum of 12 credits of GLOBE 321 and 322 may be used for degree requirements.

GLOBE 322: Internship - United States
Cr. 3-6. Repeatable. F.S.SS.
Prereq: GLOBE 320, Junior or Senior and enrollment in Global Resource Systems major; permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
A supervised learning experience including an analysis of a domestic location's resource system via immersion in a different culture within the United States lasting at least five weeks. Designed for international students and for students who are not in a position to leave the United States. Course expenses paid by student. A maximum of 12 credits of Globe 321 and 322 may be used for degree requirements.

GLOBE 335: The Economics of Global Agricultural Food and Bio-energy
(Cross-listed with ECON). (3-0) Cr. 3.
Prereq: ECON 101
Applied economic analysis of the determinants of world agricultural production, marketing, and use in feed, food, fiber, biofuel, and other applications, and global food processing and consumption. Analysis of market case studies and various data on global agricultural production and transformation, land and resource use, demography, economic activity, nutrition and health trends.
Meets International Perspectives Requirement.

GLOBE 385: Economic Development
(Cross-listed with ECON). (3-0) Cr. 3.
Prereq: ECON 101, ECON 102
Current problems of developing countries, theories of economic development, agriculture, and economic development, measurement and prediction of economic performance of developing countries, alternative policies and reforms required for satisfying basic needs of Third World countries, interrelationships between industrialized countries and the developing countries, including foreign aid.
Meets International Perspectives Requirement.

GLOBE 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of faculty coordinator for the major.
Students must complete GLOBE 398 Cooperative Education Approval Form and register for GLOBE 398 before commencing each work period. Work periods for students in cooperative education related to Global Resource Systems. Offered on a satisfactory-fail basis only.

GLOBE 401: Senior Project
Cr. 3. F.S.SS.
Prereq: Senior classification in Global Resource Systems
Research project in collaboration with faculty that complements and furthers a student's experiences from Globe 321 and 322 while simultaneously bringing into focus entire four-year experience. Student will write a research report and make either an oral or poster presentation.

GLOBE 401H: Senior Project, Honors
Cr. 3. F.S.SS.
Prereq: Senior classification in Global Resource Systems
Research project in collaboration with faculty that complements and furthers a student's experiences from Globe 321 and 322 while simultaneously bringing into focus entire four-year experience. Student will write a research report and make either an oral or poster presentation.

GLOBE 402: Responses to Global Resource System Challenges
(3-0) Cr. 3. S.
Capstone analysis of critical global resource challenges facing both developed and developing countries. Students will use research skills to investigate specific global resource issues and use communications skills to work as a team to integrate their research, develop an interdisciplinary perspective, and evaluate potential solutions to resource challenges.

GLOBE 441: International Animal Agriculture
(Cross-listed with AN S). (3-0) Cr. 3. S.
Prereq: Two courses from AN S 223, AN S 225, AN S 226, AN S 229, AN S 235
An overview of animal agriculture with emphasis on animal agriculture in developing countries. Historical, economic, environmental; and political considerations will be assessed and evaluated. Issues related to gender, resilience and sustainability for different production systems will be investigated.
Meets International Perspectives Requirement.

GLOBE 446: International Issues and Challenges in Sustainable Development
(Cross-listed with AGRON, INTST). Cr. 3. F.S.
Prereq: 3-credit biology course, Sophomore or higher classification, permission of Instructor
Interdisciplinary study and analysis of agricultural systems, sustainable management, and impact on plants and animal biodiversity. International field experience in evaluating different agricultural systems and impact on biodiversity may be required. A program fee is charged to students for international study abroad.
Meets International Perspectives Requirement.

GLOBE 490: Independent Study
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for juniors and seniors. A maximum of 9 credits of all (university-wide) 490 courses may be used for degree requirements.

GLOBE 490A: Independent Study: General
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for juniors and seniors. A maximum of 9 credits of all (university-wide) 490 courses may be used for degree requirements.

GLOBE 490E: Independent Study: Entrepreneurship
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for juniors and seniors. A maximum of 9 credits of all (university-wide)490 courses may be used for degree requirements.

GLOBE 490H: Independent Study: Honors
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for juniors and seniors. A maximum of 9 credits of all (university-wide) 490 courses may be used for degree requirements.

GLOBE 490Z: Independent Study: Service Learning
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Independent study on topics of special interest to the student. Comprehensive report required. Intended primarily for juniors and seniors. Assessed service-learning component. A maximum of 9 credits of all (university-wide) 490 courses may be used for degree requirements.

GLOBE 494: Service Learning
Cr. arr. F.S.SS.
Prereq: Permission of instructor.
Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling a professional ethics and accomplishing student learning goals. Course expenses paid by student. Assessed service-learning component.

GLOBE 494A: Service Learning: International
Cr. arr. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission of instructor.
Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling a professional ethics and accomplishing student learning goals. Course expenses paid by student. Assessed service-learning component.

GLOBE 494B: Service Learning: Domestic
Cr. arr. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission of instructor.
Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling a professional ethics and accomplishing student learning goals. Course expenses paid by student. Assessed service-learning component.

GLOBE 495: Global Resource Systems Study Abroad Course Preparation
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor
Global resource systems topics will include the agricultural industries, climate, crops, culture, economics, food, geography, government, history, livestock, marketing, natural resources, public policies, soils, and preparation for travel to locations to be visited. Students enrolled in this course intend to register for Globe 494A, 496 or 497 the following term.

GLOBE 496: Global Resource Systems Study Abroad
Cr. 2-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
Extended field trips abroad to study global resource systems. Location and duration of trips will vary. Pre-trip sessions arranged through Globe 495. Trip expenses paid by student.
Meets International Perspectives Requirement.

GLOBE 497: Deans Global Ag and Food Leadership Program
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
An integrated agricultural and food production and policy program that allows students to assess, analyze and evaluate complex, country-specific situations and to develop their skills, knowledge and abilities via team-oriented projects that involve complex issues such as development of effective foreign food aid and agricultural and food production systems, drivers of world hunger, sustainable resource management and efficacy of policy, and the role of the USA and the United Nations and other development agencies in these systems. International location and duration of program will vary. Pre-trip sessions arranged through Globe 495. Trip expenses paid by students.
Meets International Perspectives Requirement.

GLOBE 499: Undergraduate Research
Cr. arr. F.S.SS.
Prereq: Permission of the instructor and approval by the Global Resource Systems Faculty Coordinator
Research projects in collaboration with faculty.

Horticulture

To meet the educational needs of a student population with interests ranging from the biology of plants to landscape design/installation to fruit and vegetable production to golf course construction and management, considerable flexibility is built into the horticulture curriculum. The diversity of interests and need for flexibility are reflected in the impressive array of horticulture courses.

The Department of Horticulture offers six options within the horticulture major:

1. Greenhouse Plant Production

2. Horticultural Food Crop Production and Management
3. Landscape Design, Installation, and Management
4. Public Horticulture
5. Horticulture Research
6. Turfgrass Management

Graduates possess the technical knowledge and skills to become professional horticulturists. They understand principles of life science, plant growth and development, and are familiar with cultural and management practices for a wide assortment of horticultural crops. They are able to work and communicate effectively with fellow horticultural professionals and other citizens who share an interest in horticulture. Graduates also understand the ethical and environmental dimensions of problems and issues facing horticultural professionals.

A degree in horticulture opens the door to employment opportunities with production nurseries, seed companies, interior landscaping firms, greenhouses, garden centers, conservatories, landscape design/installation firms, public gardens and arboreta, orchards and vineyards, food processing companies, vegetable farms, golf courses, sports fields, sod production companies, and lawn care businesses. Several allied plant-science industries also provide employment opportunities in the areas of sales, management, and communication. Opportunities exist for careers in research, teaching, extension, and business after obtaining advanced training in graduate school.

Minors

The Department of Horticulture offers two minors: 1) Horticulture and 2) Landscape Management. Both minors are earned by taking HORT 221 Principles of Horticulture Science plus 12 additional credits with a maximum of 3 credits at the 200-level and a minimum of 9 credits at the 300-level or above.

The Horticulture minor is a broad-based minor that does not focus within a specific area of horticulture. The 12 additional credits for this minor can be selected from the full list of Horticulture courses.

The Landscape Management minor focuses on landscape management including plant selection, landscape installation and management, and turfgrass management. The 12 additional credits for this minor can be selected from the following courses: HORT 240 Trees, Shrubs, and Woody Vines for Landscaping, HORT 281 Landscape Graphics, HORT 330 Herbaceous Ornamental Plants, HORT 341 Woody Plant Cultivars: Shade Trees, Ornamental Trees and Woody Shrubs, HORT 342 Landscape Plant Installation, Establishment, and Maintenance, HORT 351 Turfgrass Establishment and Management or HORT 444 Landscape Construction Management.

Curriculum in Horticulture

Students majoring in horticulture will select an option in which to specialize before reaching junior standing and will fulfill the requirements described below under Options.

The Department of Horticulture offers two minors: 1) Horticulture and 2) Landscape Management. The requirements appear under Undergraduate Minors.

Total Degree Requirement: 129 credits (cr.)
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

Biological Sciences: 18 cr.

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
And complete fourteen credit hours from the following:		14
AGRON 217	Weed Identification	
AGRON 282	Soil Conservation and Land Use	
AGRON 316	Crop Structure-Function Relationships	
AGRON 317	Principles of Weed Science	
AGRON 354	Soils and Plant Growth	
AGRON 354L	Soils and Plant Growth Laboratory	
BIOL 212	Principles of Biology II	
BIOL 212L	Principles of Biology Laboratory II	
BIOL 312	Ecology	
BIOL 313 & 313L	Principles of Genetics and Genetics Laboratory	
or GEN 320	Genetics, Agriculture and Biotechnology	
BIOL 314	Principles of Molecular Cell Biology	
BIOL 355	Plants and People	
BIOL 366	Plant Systematics	
BIOL 430	Principles of Plant Physiology	
BIOL 454	Plant Anatomy	
BIOL 474	Plant Ecology	
ENT 201	Introduction to Insects	
ENT 211	Insects and Society	
ENT 370	Insect Biology	
ENT 375	Plant Protection Using Natural Enemies	
ENT 376	Fundamentals of Entomology and Pest Management	
FOR 416	Forest Insects and Diseases	
FOR 416L	Forest Insects and Diseases Laboratory	

PL P 408	Principles of Plant Pathology	
Total Credits		18

Communications Proficiency (with a grade of C or better)

6 credits of English composition (see approved courses below)		
3 credits of speech fundamentals (see approved courses below)		

Communication/Library: 13 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGL 314	Technical Communication	3
or ENGL 302	Business Communication	
LIB 160	Information Literacy	1
One of the following:		3
SP CM 212	Fundamentals of Public Speaking	
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
COMST 214	Professional Communication	
Total Credits		13

Ethics: 3 cr.

3 cr. from approved list		3

Humanities and Social Sciences: 6 cr.

Approved Humanities course		3
Approved Social Science course		3
Total Credits		6

International Perspective: 3 cr.

3 cr. from approved list		3
Total Credits		3

U.S. Diversity: 3 cr.

3 cr. from approved list		3
Total Credits		3

Life Sciences: 6 cr.

BIOL 211	Principles of Biology I	3
Approved Life Sciences course		3
Total Credits		6

Mathematical Sciences: 6 cr.

Select one course from the following:		3
MATH 140	College Algebra	
MATH 150	Discrete Mathematics for Business and Social Sciences	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
AND select one of the following:		3
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
STAT 226	Introduction to Business Statistics I	
STAT 301	Intermediate Statistical Concepts and Methods	
STAT 401	Statistical Methods for Research Workers	
Total Credits		6

Physical Sciences: 11 cr.

Complete one of the following:		5
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	
or CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
AND complete one course from the following:		3-4
AGRON 259	Organic Compounds in Plants and Soils	
BBMB 221	Structure and Reactions in Biochemical Processes	
CHEM 178 & 178L	General Chemistry II and Laboratory in College Chemistry II	
CHEM 231 & 231L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	
CHEM 331 & 331L	Organic Chemistry I and Laboratory in Organic Chemistry I	
PHYS 101	Physics for the Nonscientist	
PHYS 111	General Physics	
PHYS 115	Physics for the Life Sciences	
AND complete one course from the following:		3-5
BBMB 221	Structure and Reactions in Biochemical Processes	
CHEM 231 & 231L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	
CHEM 331 & 331L	Organic Chemistry I and Laboratory in Organic Chemistry I	
Total Credits		11-14

Horticultural Sciences: Minimum of 30 cr.

HORT 110	Professional and Educational Development in Horticulture.	1
HORT 221	Principles of Horticulture Science	3

HORT 321	Horticulture Physiology	3
HORT 445	Horticulture Management and Administration	2
Select 21 cr. hours from courses within selected option.		21
Total Credits		Minimum of 30

Soil Sciences: 3 cr.

AGRON 182	Introduction to Soil Science	3
Total Credits		3

Electives

No more than 4 cr. of Hort 490 may count toward graduation.

Options

Greenhouse Plant Production

The following courses are required to meet the Horticulture requirement:

HORT 240	Trees, Shrubs, and Woody Vines for Landscaping	3
HORT 322	Plant Propagation	3
HORT 330	Herbaceous Ornamental Plants	3
HORT 331	Hydroponic Food Crop Production	3
HORT 332	Greenhouse Operation and Management	4
HORT 434	Fall Greenhouse Crop Production	3
HORT 435	Spring Greenhouse Crop Production	3

Other recommended courses are:

HORT 391	Horticultural Management Experience	
HORT 424	Sustainable and Environmental Horticulture Systems	
HORT 442	Nursery Production and Garden Center Management	

Required for option:

ACCT 284	Financial Accounting	3
And select 9 cr. hours from the following:		9
ACCT 215	Legal Environment of Business	
ACCT 285	Managerial Accounting	
ACCT 316	Business Law	
AGRON 206	Introduction to Weather and Climate	
COM S 103	Computer Applications	
ECON 101	Principles of Microeconomics	
ECON 102	Principles of Macroeconomics	
ECON 230	Farm Business Management	
ECON 234	Small Business Management	
ECON 334	Entrepreneurship in Agriculture	
ENV S 461I	Introduction to GIS	
MGMT 310	Entrepreneurship and Innovation	
MGMT 313	Feasibility Analysis and Business Planning	
MGMT 370	Management of Organizations	
MGMT 371	Organizational Behavior	
MKT 340	Principles of Marketing	
MKT 442	Sales Management	
MKT 446	Retailing	
MKT 447	Consumer Behavior	
TSM 270	Principles of Injury Prevention	

Horticultural Food Crop Production and Management

The following courses are required to meet the Horticulture requirement:

HORT 276	Understanding Grape and Wine Science	3
HORT 376	Fundamentals of Field Production of Horticultural Food Crops	3
HORT 461	Fruit Crop Production and Management	3
HORT 471	Vegetable Production and Management	2
HORT 471L	Vegetable Production and Management Lab	1

Other recommended courses:

HORT 322	Plant Propagation	
HORT 331	Hydroponic Food Crop Production	
HORT 332	Greenhouse Operation and Management	
HORT 338	Seed Science and Technology	
HORT 391	Horticultural Management Experience	
HORT 484	Organic Agricultural Theory and Practice	

Required for option:

ACCT 284	Financial Accounting	3
And select 9 cr. hours from the following:		9
ACCT 215	Legal Environment of Business	
ACCT 285	Managerial Accounting	
ACCT 316	Business Law	
COM S 103	Computer Applications	
ECON 101	Principles of Microeconomics	
ECON 102	Principles of Macroeconomics	
ECON 230	Farm Business Management	
ECON 234	Small Business Management	
ECON 334	Entrepreneurship in Agriculture	
ENV S 293	Environmental Planning	
ENV S 324	Energy and the Environment	
ENV S 382	Environmental Sociology	

ENV S 491	Environmental Law and Planning
FS HN 403	Food Laws and Regulations
FS HN 405	Food Quality Assurance
FS HN 471	Food Processing I
FS HN 472	Food Processing II
MGMT 310	Entrepreneurship and Innovation
MGMT 313	Feasibility Analysis and Business Planning
MGMT 370	Management of Organizations
MGMT 371	Organizational Behavior
MKT 340	Principles of Marketing
MKT 442	Sales Management
MKT 446	Retailing
MKT 447	Consumer Behavior
TSM 270	Principles of Injury Prevention
TSM 324	Soil and Water Conservation Management

Horticulture Research

The following courses are required for this option:

AGEDS 312	Science With Practice	3
HORT 322	Plant Propagation	3
Biological Sciences:		
BIOL 430	Principles of Plant Physiology	3
Other recommended courses:		
HORT 240	Trees, Shrubs, and Woody Vines for Landscaping	
HORT 330	Herbaceous Ornamental Plants	
HORT 331	Hydroponic Food Crop Production	
HORT 332	Greenhouse Operation and Management	
HORT 342	Landscape Plant Installation, Establishment, and Maintenance	
HORT 391	Horticultural Management Experience	
Mathematical Sciences Requirement:		8
MATH 165	Calculus I	
or MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
MATH 166	Calculus II	
or MATH 182	Calculus and Mathematical Modeling for the Life Sciences II	
Physical Sciences Requirement:		
BBMB 301	Survey of Biochemistry	
or BBMB 404	Biochemistry I	
CHEM 177	General Chemistry I	
CHEM 177L	Laboratory in General Chemistry I	
CHEM 178	General Chemistry II	
CHEM 178L	Laboratory in College Chemistry II	
CHEM 331	Organic Chemistry I	
CHEM 331L	Laboratory in Organic Chemistry I	
CHEM 332	Organic Chemistry II	
CHEM 332L	Laboratory in Organic Chemistry II	
PHYS 111 & PHYS 112	General Physics and General Physics	

And select 5 cr. hours from the following:

BBMB 404	Biochemistry I
BBMB 405	Biochemistry II
BBMB 411	Techniques in Biochemical Research
BIOL 313	Principles of Genetics
BIOL 313L	Genetics Laboratory
BIOL 314	Principles of Molecular Cell Biology
BIOL 315	Biological Evolution
CHEM 211	Quantitative and Environmental Analysis
CHEM 211L	Quantitative and Environmental Analysis Laboratory
CHEM 316	Instrumental Methods of Chemical Analysis
CHEM 316L	Instrumental Analysis Laboratory
CHEM 321L	Laboratory in Physical Chemistry
CHEM 322L	Laboratory in Physical Chemistry
CHEM 324	Introductory Quantum Mechanics
COM S 107	Applied Computer Programming
or COM S 20	Fundamentals of Computer Programming
GEN 409	Molecular Genetics
GEN 410	Analytical Genetics

Landscape Design, Installation and Management

The following courses are required to meet the Horticulture requirement:

HORT 240	Trees, Shrubs, and Woody Vines for Landscaping	3
HORT 281	Landscape Graphics	2
HORT 330	Herbaceous Ornamental Plants	3
HORT 341	Woody Plant Cultivars: Shade Trees, Ornamental Trees and Woody Shrubs	2
HORT 342	Landscape Plant Installation, Establishment, and Maintenance	3
HORT 351	Turfgrass Establishment and Management	3
HORT 380	Principles of Garden Composition	2
HORT 381	Beginning Garden Composition Studio	2
HORT 444	Landscape Construction Management	3
HORT 481	Advanced Garden Composition	2

Other recommended courses are:		
HORT 322	Plant Propagation	
HORT 332	Greenhouse Operation and Management	
HORT 391	Horticultural Management Experience	
HORT 442	Nursery Production and Garden Center Management	
Required for option:		
ACCT 284	Financial Accounting	3
And select 9 cr. hours from the following:		9
ACCT 215	Legal Environment of Business	
ACCT 285	Managerial Accounting	
ACCT 316	Business Law	
COM S 103	Computer Applications	
ECON 234	Small Business Management	
ECON 334	Entrepreneurship in Agriculture	
MGMT 310	Entrepreneurship and Innovation	
MGMT 313	Feasibility Analysis and Business Planning	
MGMT 370	Management of Organizations	
MGMT 371	Organizational Behavior	
MKT 340	Principles of Marketing	
MKT 343	Personal Sales	
MKT 442	Sales Management	
MKT 447	Consumer Behavior	
TSM 324	Soil and Water Conservation Management	

Public Horticulture

The following courses are required to meet the Horticulture requirement:

HORT 240	Trees, Shrubs, and Woody Vines for Landscaping	3
HORT 282	Educating Youth Through Horticulture	3
HORT 322	Plant Propagation	3
HORT 330	Herbaceous Ornamental Plants	3
Other recommended courses:		
HORT 281	Landscape Graphics	
HORT 332	Greenhouse Operation and Management	
HORT 341	Woody Plant Cultivars: Shade Trees, Ornamental Trees and Woody Shrubs	
HORT 342	Landscape Plant Installation, Establishment, and Maintenance	
HORT 351	Turfgrass Establishment and Management	
HORT 351L	Turfgrass Establishment and Management Laboratory	
HORT 376	Fundamentals of Field Production of Horticultural Food Crops	
HORT 380	Principles of Garden Composition	
HORT 381	Beginning Garden Composition Studio	
HORT 391	Horticultural Management Experience	
Required for option		
ACCT 284	Financial Accounting	3
And select 9 credit hours from the following:		9
ACCT 215	Legal Environment of Business	
ACCT 285	Managerial Accounting	
ACCT 316	Business Law	
AGEDS 310	Foundations of Agricultural Education Programs	
AGEDS 401	Planning Agriculture and Life Sciences Education Programs	
COMST 102	Introduction to Interpersonal Communication	
COMST 214	Professional Communication	
COMST 317	Small Group Communication	
ECON 101	Principles of Microeconomics	
ECON 234	Small Business Management	
ECON 334	Entrepreneurship in Agriculture	
ENGL 220	Descriptive English Grammar	
ENGL 303	Free-Lance Writing for Popular Magazines	
ENGL 305	Creative Writing: Nonfiction	
ENGL 309	Proposal and Report Writing	
ENGL 313	Rhetorical Website Design	
ENGL 415	Business and Technical Editing	
ENGL 416	Visual Aspects of Business and Technical Communication	
ENSCI 446	Integrating GPS and GIS for Natural Resource Management	
ENSCI 461I	Introduction to GIS	
FIN 301	Principles of Finance	
JL MC 201	Reporting and Writing for the Mass Media	
JL MC 310	Fundamentals of Photojournalism	
MGMT 370	Management of Organizations	
MGMT 371	Organizational Behavior	
MGMT 471	Personnel and Human Resource Management	
P R 220	Principles of Public Relations	
SP CM 312	Business and Professional Speaking	
SP CM 313	Communication in Classrooms and Workshops	

Turfgrass Management

The following courses are required to meet the Horticulture requirement:

HORT 240	Trees, Shrubs, and Woody Vines for Landscaping	3
HORT 351	Turfgrass Establishment and Management	3
HORT 351L	Turfgrass Establishment and Management Laboratory	1
HORT 451	Professional Turfgrass Management	2
HORT 452	Integrated Management of Diseases and Insect Pests of Turfgrasses	3
HORT 453	Sports Turf Management	3
HORT 454	Turf & Landscape Irrigation	3
HORT 551	Growth and Development of Perennial Grasses	2
Other recommended courses:		
HORT 330	Herbaceous Ornamental Plants	
HORT 322	Plant Propagation	
HORT 424	Sustainable and Environmental Horticulture Systems	
HORT 391	Horticultural Management Experience	
Required for option:		
ACCT 284	Financial Accounting	3
And select 9 cr. hours from the following:		9
ACCT 285	Managerial Accounting	
ACCT 316	Business Law	
AGRON 206	Introduction to Weather and Climate	
AGRON 360	Environmental Soil Science	
AGRON 459	Environmental Soil and Water Chemistry	
COM S 103	Computer Applications	
ECON 234	Small Business Management	
ECON 334	Entrepreneurship in Agriculture	
ENSCI 461I	Introduction to GIS	
ENV S 201	Introduction to Environmental Issues	
ENV S 324	Energy and the Environment	
HSP M 101	Introduction to the Hospitality Industry	
HSP M 289	Contemporary Club Management	
MGMT 370	Management of Organizations	
MGMT 371	Organizational Behavior	
TSM 270	Principles of Injury Prevention	
TSM 324	Soil and Water Conservation Management	

Horticulture, B.S. Greenhouse Plant Production Option

Freshman

Fall	Credits	Spring	Credits
CHEM 163	4	AGRON 182	3
CHEM 163L	1	BIOL 211	3
ENGL 150	3	BIOL 211L	1
HORT 110	1	ENGL 250	3
HORT 121	2	HORT 221	3
LIB 160	1	STAT 104	3
PSYCH or SOC or ECON	3		
	15		16

Sophomore

Fall	Credits	Spring	Credits
ACCT 284	3	Biol Science (see list)	3
Biol Science (see list)	3	Biol Science (see list)	3
Elective	2	Elective	3
HORT 240	3	HORT 332	4
Intl Perspectives	3	US Diversity	3
MATH 140	3		
	17		16

Junior

Fall	Credits	Spring	Credits
Biol Science (see list)	3	Biol Science (see list)	3
Select from the following:	3-4	HORT 322	3
CHEM 231		HORT 435	3
CHEM 231L		PHYS 101 OR 111 OR 115	3-5
OR		SP CM 212 or AGEDS 311	3
BBMB 221			
HORT 321	3		
HORT 434	3		
Hort Recommended (see list)	3		
	15-16		15-17

Senior

Fall	Credits	Spring	Credits
Elective	3	Elective	3
HORT 330	3	ENGL 302 or 314	3
HORT 331	3	Ethics	3
HORT 391	1	Humanities	3
HORT 445	2	Option Class (see list)	3
Hort Recommended (see list)	2	Option Class (see list)	3

Option Class	3
	17

Horticulture, B.S. - Horticulture Food Crop Production and Management Option

Freshman

Fall	Credits	Spring	Credits
CHEM 163	4	AGRON 182	3
CHEM 163L	1	BIOL 211	3
ENGL 150	3	BIOL 211L	1
HORT 110	1	ENGL 250	3
HORT 121	2	HORT 221	3
LIB 160	1	STAT 104	3
PSYCH OR SOC OR ECON	3		
	15		16

Sophomore

Fall	Credits	Spring	Credits
Biol Science (see list)	3	Biol Science (see list)	3
Biol Science (see list)	3	HORT 276	3
Elective	2	HORT 322	3
HORT 376	3	Humanities	3
Intl Perspectives	3	PHYS 101 or 111 or 115	3-5
Option Class (see list)	3		
	17		15-17

Junior

Fall	Credits	Spring	Credits
Select from the following:	3-4	ACCT 284	3
CHEM 231		Biol Science (see list)	3
CHEM 231L		Elective	3
OR		Hort Recommended (see list)	3
BBMB 221		HORT 471	2
HORT 321	3	HORT 471L	1
HORT 391	1	SP CM 212 or AGEDS 311	3
Hort Recommended (see list)	2		
MATH 140	3		
US Diversity	3		
	15-16		18

Senior

Fall	Credits	Spring	Credits
Biol Science (see list)	2-3	Elective	3
Elective	2	Ethics	3
ENGL 302 or 314	3	HORT 461	3
HORT 391	1	Hort Recommended (see list)	3
HORT 445	2	Option Class	3
Hort Recommended (see list)	3		
Option Class (see list)	3		
	16-17		15

Horticulture, B.S. - Landscape Design, Installation, and Management

Freshman

Fall	Credits	Spring	Credits
CHEM 163	4	AGRON 182	3
CHEM 163L	1	BIOL 211	3
ENGL 150	3	BIOL 211L	1
HORT 110	1	ENGL 250	3
HORT 121	2	HORT 221	3
LIB 160	1	STAT 104	3
PSYCH or SOC or ECON	3		
	15		16

Sophomore

Fall	Credits	Spring	Credits
ACCT 284	3	Biol Science (see list)	3
Biol Science (see list)	3	Biol Science (see list)	3
HORT 281	2	Elective	3
HORT 330	3	HORT 380	2
HORT 444	3	HORT 381	2
MATH 140	3	PHYS 101 OR 111 OR 115 OR AGRON 259	3-5
	17		16-18

Junior

Fall	Credits	Spring	Credits
Elective	3	Biol Science	3
HORT 240	3	Elective	3
HORT 321	3	Select from the following:	3-4
HORT 391	1	CHEM 231	
HORT 481	2	CHEM 231L	
SP CM 212 or AGEDS 311	3	OR	
		BBMB 221	
		HORT 341	2
		Intl Perspective	3
		US Diversity	3
	15		17-18

Senior

Fall	Credits	Spring	Credits
HORT 342	3	Biol Science (see list)	3
HORT 351	3	Elective	1
HORT 391	1	ENGL 302 or 314	3
HORT 445	2	Ethics	3
Humanities	3	Hort Recommended (see list)	3
Option Class	3	Option Class	3
Option Class	3		
	18		16

Horticulture, B.S. - Public Horticulture Option

Freshman

Fall	Credits	Spring	Credits
CHEM 163	4	AGRON 182	3
CHEM 163L	1	BIOL 211	3
ENGL 150	3	BIOL 211L	1
HORT 110	1	ENGL 250	3
HORT 121	2	HORT 221	3
LIB 160	1	STAT 104	3
SOC OR PSYCH OR ECON	3		
	15		16

Sophomore

Fall	Credits	Spring	Credits
ACCT 284	3	Biol Science (see list)	3
Biol Science (see list)	3	Biol Science (see list)	3
Elective	2	HORT 282	3
HORT 240	3	HORT 322	3
Intl Perspective	3	PHYS 101 OR 111 OR 115 OR AGRON 259	3-5
MATH 140	3		
	17		15-17

Junior

Fall	Credits	Spring	Credits
Elective	3	Biol Science (see list)	3
Elective	1	Select from the following:	3-4
HORT 321	3	CHEM 231	
HORT 330	3	CHEM 231L	
HORT 391	1	OR	
Option Class (see list)	3	BBMB 221	
SP CM 212 or AGEDS 311	3	Elective	1
		Hort Recommended (see list)	3
		Option Class (see list)	3
		US Diversity	3
	17		16-17

Senior

Fall	Credits	Spring	Credits
Biol Science (see list)	3	Elective	1
Elective	2	ENGL 302 or 314	3
HORT 391	1	Ethics	3
HORT 445	2	Hort Recommended (see list)	3
Hort Recommended (see list)	3	Hort Recommended (see list)	3
Hort Recommended (see list)	3	Humanities	3
Option Class (see list)	3		
	17		16

Horticulture, B.S. - Horticulture Research Option

Freshman

Fall	Credits	Spring	Credits
CHEM 177	4	AGRON 182	3
CHEM 177L	1	BIOL 211	3
Elective	1	BIOL 211L	1
ENGL 150	3	ENGL 250	3
HORT 110	1	HORT 221	3
HORT 121	2	STAT 104	3
LIB 160	1		
PSYCH OR SOC OR ECON	3		
	16		16

Sophomore

Fall	Credits	Spring	Credits
BIOL 212	3	Hort Recommended (see list)	3-4
BIOL 212L	1	Hort Recommended (see list)	3
CHEM 178	3	MATH 166 or 182	4
CHEM 178L	1	PHYS 111	5
Hort Recommended (see list)	3	US Diversity	3
Hort Recommended (see list)	3		

MATH 165 or 181	4		
	18		18-19

Junior

Fall	Credits	Spring	Credits
AGEDS 312	3	Biol Science (see list)	3
Biol Science (see list)	3	CHEM 331	3
HORT 321	3	CHEM 331L	1
HORT 391	1	HORT 322	3
Hort Recommended (see list)	3	Intl Perspectives	3
PHYS 112	5	Option Class	3-4
	18		16-17

Senior

Fall	Credits	Spring	Credits
BBMB 301 or 404	3	BIOL 430	3
CHEM 332	3	Elective	1
CHEM 332L	1	Ethics	3
ENGL 302 or 314	3	Hort Recommended (see list)	3
HORT 391	1	Humanities	3
HORT 445	2	Option Class	3
SP CM 212 or AGEDS 311	3		
	16		16

Horticulture, B.S. - Turfgrass Management Option

Freshman

Fall	Credits	Spring	Credits
CHEM 163	4	AGRON 182	3
CHEM 163L	1	BIOL 211	3
ENGL 150	3	BIOL 211L	1
HORT 110	1	ENGL 250	3
HORT 121	2	HORT 221	3
LIB 160	1	STAT 104	3
PSYCH OR SOC OR ECON	3		
	15		16

Sophomore

Fall	Credits	Spring	Credits
ACCT 284	3	Biol Science (see list)	3
Biol Science (see list)	3	HORT 451	2
HORT 240	3	HORT 452	3
HORT 351	3	Humanities	3
HORT 351L	1	PHYS 101 OR 111 OR 115	3-5
MATH 140	3	SP CM 212 or AGEDS 311	3
	16		17-19

Junior

Fall	Credits	Spring	Credits
Biol Science (see list)	3	Biol Science (see list)	3
HORT 321	3	Select from the following:	3-4
HORT 391	1	CHEM 231	
HORT 453	3	CHEM 231L	
Intl Perspective	3	OR	
US Diversity	3	BBMB 221	
		Elective	2
		HORT 354	3
		HORT 551	2
		Hort Recommended (see list)	3
	16		16-17

Senior

Fall	Credits	Spring	Credits
Biol Science (see list)	3	Elective	1
Elective	2	ENGL 302 or 314	3
HORT 391	1	Ethics	3
HORT 342	3	Hort Recommended (see list)	3
HORT 445	2	Option Class	3
HORT 454	3	Option Class	3
Option Class	3		
	17		16

Graduate Study

The graduate major in horticulture leads to the M.S. (thesis and non-thesis option) and Ph.D. Some faculty members of the department serve as major professors for students in interdepartmental graduate majors in plant biology; genetics and genomics; molecular, cellular, and developmental biology; ecology and evolutionary biology; sustainable agriculture; and environmental science.

Graduates possess a broad understanding of horticulture and the allied plant sciences. They are able to communicate effectively with members of the scientific community, industry groups, and other interested citizens. They are experienced in conducting research and communicating the results from that research. They are capable of addressing and solving complex problems that confront the many horticultural, agricultural, and plant science professions. They also understand the ethical, legal, social, and environmental issues associated with modern agricultural/horticultural practices.

Courses primarily for undergraduates:

HORT 110: Professional and Educational Development in Horticulture.
(1-0) Cr. 1. F.
Intended for first-year students and others new to the horticulture curriculum. Introduction to professional and educational development within horticulture. Focus is on university and career acclimation. Assessed service-learning component.

HORT 121: Home Horticulture
(2-0) Cr. 2. F.S.
Growing plants in and around the home including requirements for growing house plants; plant propagation; designing and maintaining flower, fruit, and vegetable gardens; lawn, tree, and shrub maintenance.

HORT 122: Hands-On Home Horticulture
(1-0) Cr. 1. F.S.
Demonstration and activities that illustrate principles of growing plants for the home garden. Topics include floral and landscape design, plant identification, propagation, selection, and management for indoor and outdoor gardens.

HORT 131: Floral Design
(0-2) Cr. 1. S.
Introduces basic geometric design of fresh arrangements, corsages, and holiday arrangements. Includes use of tools and supplies.

HORT 193: Topics in Horticulture
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193A: Topics in Horticulture: Greenhouse Crops
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193B: Topics in Horticulture: Nursery Crops
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193C: Topics in Horticulture: Turfgrass
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193D: Topics in Horticulture: Fruit Crops
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193E: Topics in Horticulture: Vegetable Crops
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193F: Topics in Horticulture: Cross-Commodity
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 193G: Topics in Horticulture: Landscape Horticulture
Cr. arr. Repeatable. F.S.SS.
Practical courses in the field of horticulture. A maximum of 6 credits of Hort 193 may be used toward the total of 128 credits required for graduation.

HORT 221: Principles of Horticulture Science
(2-2) Cr. 3. F.S.
Prereq: Biol 211 or concurrent enrollment
Biological principles of growing horticultural crops including anatomy, reproduction, light, temperature, water, nutrition, and growth and development. Laboratory exercises emphasize environmental factors and permit detailed observation of plant growth.

HORT 225: Spanish for Horticulture
(3-0) Cr. 3. S.
Introduction to basic conversation and communication skills in Spanish, and cross-cultural skills for working with Spanish speakers in the Horticulture industry, emphasizing the use of vocabulary and expressions common in the workplace.

HORT 240: Trees, Shrubs, and Woody Vines for Landscaping
(3-0) Cr. 3. F.
Identification of trees, shrubs, and woody vines. Factors influencing the horticultural use of woody plants. Field trips outside of regular class time may be required.

HORT 276: Understanding Grape and Wine Science
(Cross-listed with FS HN). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: High school biology and chemistry.
A scientific introduction to viticulture (grape-growing) and enology (wine-making). Topics include grape species and varieties, viticulture practices, fruit quality, geography, history, principles of fermentation and aging, wine classification, appreciation, evaluation, storage and service, regulations, wine as food. No wine tasting.

HORT 281: Landscape Graphics
(0-4) Cr. 2. F.
Introduction to computer and hand rendering techniques of landscape graphics. Students will gain proficiency in plan view and elevation graphics. Intensive studio and computer based instruction.

HORT 282: Educating Youth Through Horticulture
(2-3) Cr. 3. Alt. S., offered even-numbered years.
Planning, developing, and implementing science-based educational programs in a garden setting. Through hands-on experiences students will learn about horticulture, learning theory, and the application of science principles as they pertain to educating youth. Assessed service-learning component.

HORT 283: Pesticide Application Certification
(Cross-listed with AGRON, ENT, FOR). (2-0) Cr. 2. S.
Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized.

HORT 321: Horticulture Physiology
(3-0) Cr. 3. F.
Prereq: HORT 221 or BIOL 211
Principles of plant physiology relating to growth and development of horticultural plants including plant water relations, membrane transport, photosynthesis, photomorphogenesis, respiration, and phytohormones. Emphasis on plant's responses to environmental factors (temperature, water, and light) including cellular and whole-plant physiology under stressful environments.

HORT 322: Plant Propagation
(2-2) Cr. 3. S.
Prereq: HORT 221 or BIOL 211
Fundamental principles underlying sexual and asexual propagation of plants; practice in reproducing plants by use of seeds, cuttings, layering, grafting and budding and tissue culture.

HORT 330: Herbaceous Ornamental Plants
(2-2) Cr. 3. F.
Prereq: HORT 221 or by permission of instructor
Identification, botanical characteristics, origins, propagation, uses and general culture of herbaceous annual and perennial plants for Midwestern gardens and landscapes.

HORT 331: Hydroponic Food Crop Production
(2-2) Cr. 3. F.
Prereq: HORT 221 or AGRON 114 or 3 credits in biological sciences
Principles and practices of hydroponic systems, crop production and culture, aquaponic systems, and new food crops for hydroponic systems will be discussed. Laboratories will focus on demonstration and participation in practices and procedures used in hydroponic food crop production. Assessed service-learning component.

HORT 332: Greenhouse Operation and Management
(3-3) Cr. 4. S.
Prereq: Hort 221
Operation and management of greenhouses and other controlled environment agriculture structures. Methods of monitoring and manipulating environmental, cultural, and management factors such as light, temperature, fertility, substrate, etc., to maximize production efficiency. Emphasis placed on the production of ornamental and food crops. Greenhouse analysis project required.

HORT 338: Seed Science and Technology
(Cross-listed with AGRON). (2-3) Cr. 3. F.
Prereq: AGRON 181 (or equivalent) or HORT 221; BIOL 212
Seed production, maturation, dormancy, vigor, deterioration, and related aspects of enhancement, conditioning, storage, and quality evaluation. Aspects of the seed industry and regulation of seed marketing.

HORT 341: Woody Plant Cultivars: Shade Trees, Ornamental Trees and Woody Shrubs
(2-0) Cr. 2. S.
Prereq: Hort 240 or L A 221 or L A 222
Cultivars of the most prevalent and economically important woody landscape plants will be taught. The importance of cultivars to the nursery and landscaping professions and suggestions for their proper usage will be discussed.

HORT 342: Landscape Plant Installation, Establishment, and Maintenance
(2-3) Cr. 3. F.
Prereq: Hort 240 or L A 221 or L A 222
Principles and practices involved with establishment and maintenance of managed landscapes. Laboratory work involves site evaluation, installation techniques, postplant care, and maintenance of established landscape plants.

HORT 351: Turfgrass Establishment and Management
(Cross-listed with AGRON). (3-0) Cr. 3. F.
Prereq: HORT 221 or AGRON 181 (or equivalent) or BIOL 211
Principles and practices of turfgrass propagation, establishment, and management. Specialized practices relative to professional lawn care, golf courses, athletic fields, highway roadsides, and seed and sod production. The biology and control of turfgrass pests.

HORT 351L: Turfgrass Establishment and Management Laboratory
(Cross-listed with AGRON). (0-3) Cr. 1. F.
Prereq: Credit or enrollment in HORT 351
Those enrolled in the horticulture curriculum are required to take 351L in conjunction with 351 except by permission of the instructor.

HORT 354: Soils and Plant Growth
(Cross-listed with AGRON). (3-0) Cr. 3. F.S.
Prereq: AGRON 182 or equivalent and BIOL 101
Effects of chemical, physical, and biological properties of soils on plant growth, with emphasis on nutritive elements, pH, organic matter maintenance, and rooting development.

HORT 354L: Soils and Plant Growth Laboratory
(Cross-listed with AGRON). (0-3) Cr. 1. F.S.
Prereq: Agron or Hort major with credit or enrollment in AGRON 354
Laboratory exercises in soil testing that assess a soil's ability to support nutritive requirements for plant growth.

HORT 376: Fundamentals of Field Production of Horticultural Food Crops
(3-0) Cr. 3. F.
Prereq: Hort 221 or Agron 114
An introduction to field production of fruit and vegetable crops and the theoretical and practical knowledge required for successfully producing them. Topics will include basic principles and practices of fruit and vegetable production, site selection, soil techniques, irrigation management, equipment and tools, integrated pest management, season extension strategies, postharvest handling and food safety, marketing, and basic business planning for fruit and vegetable enterprises. Additionally, this course will prepare students for HORT 461 and HORT 471, that are advanced level courses focusing on fruit and vegetable production.

HORT 380: Principles of Garden Composition
(2-0) Cr. 2. S.
Functional and aesthetic aspects of landscape planning as a basis for design decisions; emphasis on spatial design and plant selection. Includes site analysis, development process, and design principles.

HORT 381: Beginning Garden Composition Studio
(0-4) Cr. 2. S.
Prereq: HORT 281 and HORT 240 or HORT 330, concurrent enrollment in HORT 380
Introduction to landscape design process. Intensive studio-based projects implementing principles of landscape design, concept development, and graphic communication.

HORT 391: Horticultural Management Experience
Cr. 1. Repeatable. F.S.SS.
Prereq: HORT 221 or permission of instructor
A structured work experience for the student to gain insight into management operations associated with production and management of horticultural crops. A report of 10 or more pages describing the student's experience is required. One credit is given for each term the student is enrolled in the course. A maximum of two credits may be used toward the horticultural sciences course requirements, and two additional credits may be used toward the 128 credits required for graduation.

HORT 398: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of department resource and career center coordinator
Students must register for this course before commencing each work period.

HORT 421: Introduction to Plant Breeding
(Cross-listed with AGRON). (3-0) Cr. 3. F.
Prereq: GEN 320 or BIOL 313
Breeding methods used in the genetic improvement of self-pollinated, cross-pollinated and asexually reproducing agronomic and horticultural crops. Applications of biotechnology techniques in the development of improved cultivars.

HORT 424: Sustainable and Environmental Horticulture Systems
(Dual-listed with HORT 524). (Cross-listed with ENV S). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Inquiry into ethical issues and environmental consequences of horticultural cropping systems, production practices and managed landscapes. Emphasis on systems that are resource efficient, environmentally sound, socially acceptable, and profitable.

HORT 434: Fall Greenhouse Crop Production
(2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: HORT 332
Principles and practices of flowering and ornamental greenhouse crop production. Emphasis is placed on production of flowering potted plants, cut flowers, and foliage crops produced in greenhouses and other controlled environments. An overnight class field trip outside scheduled class time is required.

HORT 435: Spring Greenhouse Crop Production
(2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HORT 330 and HORT 332
Principles and practices of containerized greenhouse production of crops for gardens and outdoor use. Emphasis is placed on the production of seedling plugs and rooted cuttings, annual and perennial bedding plants, and native plants. An overnight class field trip outside scheduled class time is required.

HORT 442: Nursery Production and Garden Center Management
(2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: HORT 221
Nursery layout, design, and cultural practices important for growing and shipping field and container-grown nursery crops. Overview of garden center design and retailing and marketing strategies. Field trip(s) outside scheduled class time may be required.

HORT 444: Landscape Construction Management
(2-3) Cr. 3. F.
Principles and practices of residential landscape construction. Encompasses project management, landscape estimating and overview of common landscape materials. Laboratory work involves field trips and project installation.

HORT 445: Horticulture Management and Administration
(2-0) Cr. 2. F.
Prereq: HORT 221 and junior or senior classification
In-depth presentation and discussion of skills and strategies needed to manage a horticultural enterprise. Topics include motivating employees, managing meetings, conducting performance appraisals, dealing with conflict, and managing an increasingly diverse work force.

HORT 451: Professional Turfgrass Management
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: HORT 351
Turfgrass science including the study of (1) specific information on soil chemistry and soil modification as they relate to the development and maintenance of turfgrass areas, (2) specialized management practices used in athletic field care, professional lawn care, and golf course industries, and (3) construction methods for golf courses and sports fields.

HORT 452: Integrated Management of Diseases and Insect Pests of Turfgrasses
(Dual-listed with HORT 552). (Cross-listed with ENT, PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HORT 351
Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

HORT 453: Sports Turf Management
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: HORT 351
Management techniques for today's specialized athletic fields. The horticultural and budgetary aspects of football, soccer, baseball, and softball fields will be presented. Field trips and laboratory exercises will develop a practical understanding of actual principles in field development, construction, and management.

HORT 454: Turf & Landscape Irrigation
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Irrigation systems and principles for turf and landscape environments. Topics include design, installation, equipment, management, and trouble shooting of irrigation systems for golf, athletic fields, residential lawns and landscapes. Participation in practical exercises and local field trips to irrigation sites is required.

HORT 461: Fruit Crop Production and Management
(2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HORT 221
Principles and practices of small fruit, tree fruit, and nut culture and production. Morphology, physiology of growth and development, plant establishment, pest management, pruning, training, harvesting, storage, and marketing of commercial temperate fruit and nut crops. Emphasis on sustainable practices. Participation in practical exercises and local field trips is required.

HORT 471: Vegetable Production and Management
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: HORT 221
Principles of vegetable production with emphasis on sustainable production practices, market outlets, business aspects, and risk management. Topics will include crop classification and rotation; planting methods; crop climatic conditions, physiological growth & development; soil, water, and pest management; cover cropping; season extension strategies; harvest and postharvest management and marketing. Course involves visits to growers fields to observe/experience their production enterprise.

HORT 471L: Vegetable Production and Management Lab
(0-3) Cr. 1. Alt. S., offered even-numbered years.
Prereq: Junior or Senior status and concurrent enrollment in Hort 471 is required.
Hands-on training in the area of vegetable crop production. Students will have an opportunity to grow a variety of vegetables in a heated greenhouse and also conduct greenhouse and lab experiments. The lab also involves visits to vegetable production sites in Iowa to observe/experience and learn from growers and other agricultural professionals.

HORT 475: Urban Forestry
(Cross-listed with FOR). (2-3) Cr. 3. F.
Prereq: Junior or senior classification, 3 credits in biology
Discussion of establishment and management of woody perennials in community-owned urban greenspaces, consideration of urban site and soil characteristics, plant physiology, plant culture, urban forest valuation, inventory methods, species selection, and urban forest maintenance (health care and pest management).

HORT 481: Advanced Garden Composition
(0-4) Cr. 2. F.
Prereq: HORT 240 and HORT 330 and HORT 380 and HORT 381
Priority given to Landscape Design Installation and Management option students. Development of residential landscapes using design principles and the design process. Projects encompass site analysis, concept development, preliminary design, final design, and graphic presentation techniques. Techniques will include hand and computer rendering.

HORT 484: Organic Agricultural Theory and Practice
(Dual-listed with HORT 584). (Cross-listed with AGRON). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 9 cr. in biological or physical sciences
Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives.

HORT 490: Independent Study
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490A: Independent Study: Greenhouse Crops
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490B: Independent Study: Nursery Crops
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490C: Independent Study: Turfgrass
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490D: Independent Study: Fruit Crops
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490E: Independent Study: Vegetable Crops
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490F: Independent Study: Cross-Commodity
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490G: Independent Study: Landscape Horticulture
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490H: Independent Study: Honors
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490I: Independent Study: International Study
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 490J: Independent Study: Entrepreneurship
Cr. arr. Repeatable.
Prereq: Junior or Senior classification in horticulture or permission of instructor
Investigation of topic holding special interest to the student. Comprehensive report required. Election of course and topic must be approved by department head. A maximum of 4 credits of Hort 490 and an additional 2 credits of 490 from outside Horticulture may be used toward the total of 129 credits required for graduation.

HORT 491: Seed Science Internship Experience
(Cross-listed with AGRON). Cr. 1-2. Repeatable, maximum of 1 times. F.S.SS.
Prereq: Agron 338, advanced approval and participation of employer and instructor
A professional work experience and creative project for seed science secondary majors. The project requires the prior approval and participation of the employer and instructor. The student must submit a written report.

HORT 493: Workshop in Horticulture
Cr. arr. Repeatable.
Off campus. Offered as demand warrants. Workshops in horticulture.

HORT 494: Service Learning
Cr. arr. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission of instructor
Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling professional ethics and accomplishing student learning goals. Course expenses paid by student. A maximum of 4 credits of 494 may be used toward the Horticulture credits required for graduation. Assessed service-learning component.

HORT 494A: Service Learning: International
Cr. arr. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission of instructor
Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling professional ethics and accomplishing student learning goals. Course expenses paid by student. A maximum of 4 credits of 494 may be used toward the Horticulture credits required for graduation. Assessed service-learning component.

HORT 494B: Service Learning: Domestic
Cr. arr. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission of instructor
Selected projects that result in outcomes benefiting a non-Iowa State University entity while instilling professional ethics and accomplishing student learning goals. Course expenses paid by student. A maximum of 4 credits of 494 may be used toward the Horticulture credits required for graduation. Assessed service-learning component.

HORT 495: Horticulture Travel Course Preparation
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of instructor
Limited enrollment. Students enrolled in this course also intend to register for Hort 496 the following term. Topics include preparation for safe international travel, the horticultural/agricultural industries, climate, crops, economics, geography, history, marketing, soils, culture, traditions, and horticultural/agricultural development of the country to be visited. Students enroll in this course the term immediately before travel to the foreign country.

HORT 496: Horticulture Travel Course
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
Limited enrollment. Study and tour of production methods in major horticultural regions of the world. Influence of climate, economics, geography, soils, landscapes, markets, cultures, and history of horticultural crops. Location and duration of tours will vary. Tour expenses paid by students.
Meets International Perspectives Requirement.

Courses primarily for graduate students, open to qualified undergraduates:

HORT 506: Crop Genetics
(Cross-listed with AGRON). Cr. 3. F.
Introduction to genetics of reproductive systems, recombination, segregation and linkage analysis, inbreeding, quantitative inheritance, fertility regulation, and polyploidy to prepare students for subsequent courses in crop improvement. Enrollment is restricted to off-campus MS in Plant Breeding students.

HORT 511: Integrated Management of Tropical Crops
(Cross-listed with ENT, PL P). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PL P 408 or PL P 416 or ENT 370 or ENT 376 or HORT 221
Applications of Integrated Crop Management principles (including plant pathology, entomology, and horticulture) to tropical cropping systems. Familiarization with a variety of tropical agroecosystems and Costa Rican culture is followed by 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects.
Meets International Perspectives Requirement.

HORT 524: Sustainable and Environmental Horticulture Systems
(Dual-listed with HORT 424). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Inquiry into ethical issues and environmental consequences of horticultural cropping systems, production practices and managed landscapes. Emphasis on systems that are resource efficient, environmentally sound, socially acceptable, and profitable.

HORT 530: Research Orientation
(1-3) Cr. 2. F.
Instruction in scientific methods and communication skills.

HORT 538: Seed Physiology and the Environment
(Cross-listed with AGRON). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: AGRON 316; CHEM 231 or CHEM 331
Physiological aspects of seed development, maturation, longevity, dormancy, and germination of agronomic and horticultural crops and their interactions with field and storage environments. Emphasis on current literature and advanced methodology.

HORT 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

HORT 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

HORT 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

HORT 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

HORT 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

HORT 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

HORT 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

HORT 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

HORT 543: Seed Physiology
(Cross-listed with STB). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
Brief introduction to plant physiology. Physiological aspects of seed development, maturation, longevity, dormancy and germination. Links between physiology and seed quality.

HORT 546: Strategies for Diversified Farming Systems
(Cross-listed with AGRON, SUSAG). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: SusAg 509
Project-focused engagement in food and farming systems using tools and perspectives drawn from multiple disciplines. Includes a field component.

HORT 551: Growth and Development of Perennial Grasses
(Cross-listed with AGRON). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: Junior or senior or graduate classification or permission of instructor
Selected topics on anatomy, morphology, and physiology relative to growth and development of perennial grasses. Emphasis on growth and development characteristics peculiar to grasses and variations of such characteristics under natural and managed conditions.

HORT 552: Integrated Management of Diseases and Insect Pests of Turfgrasses
(Dual-listed with HORT 452). (Cross-listed with ENT, PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HORT 351
Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

HORT 584: Organic Agricultural Theory and Practice
(Dual-listed with HORT 484). (Cross-listed with AGRON, SUSAG). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 9 cr. in biological or physical sciences
Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives.

HORT 590: Special Topics
Cr. arr. Repeatable.
Prereq: a major or minor in horticulture

HORT 593: Workshop in Horticulture
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593A: Workshop in Horticulture: Greenhouse Crops
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593B: Workshop in Horticulture: Nursery Crops
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593C: Workshop in Horticulture: Turfgrass
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593D: Workshop in Horticulture: Fruit Crops
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593E: Workshop in Horticulture: Vegetable Crops
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593F: Workshop in Horticulture: Cross-Commodity
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 593G: Workshop in Horticulture: Landscape Horticulture
Cr. arr. Repeatable.
Workshops in horticulture, with emphasis on off-campus instruction.

HORT 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

HORT 610: Graduate Seminar
Cr. 1. Repeatable. F.S.
Offered on a satisfactory-fail basis only.

HORT 690: Advanced Topics
Cr. arr. Repeatable.

HORT 696: Research Seminar
(Cross-listed with AGRON, BBMB, FOR, GDCB, PLBIO). Cr. 1. Repeatable.
Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

HORT 698: Horticulture Teaching Practicum
(1-0) Cr. 1. S.
Prereq: Graduate student classification
Discussions are intended to foster the development of graduate students as teaching assistants and future horticulture/plant science teachers. Topics include establishing a classroom presence, improving lectures, motivating students, dealing with difficult or disruptive students, and developing a teaching philosophy. Offered on a satisfactory-fail basis only.

HORT 699: Thesis and Dissertation Research
Cr. arr. Repeatable.

HORT 699A: Thesis and Dissertation Research: Greenhouse Crops
Cr. arr. Repeatable.

HORT 699B: Thesis and Dissertation Research: Nursery Crops
Cr. arr. Repeatable.

HORT 699C: Thesis and Dissertation Research: Turfgrass
Cr. arr. Repeatable.

HORT 699D: Thesis and Dissertation Research: Fruit Crops
Cr. arr. Repeatable.

HORT 699E: Thesis and Dissertation Research: Vegetable Crops
Cr. arr. Repeatable.

HORT 699F: Thesis and Dissertation Research: Cross-Commodity
Cr. arr. Repeatable.

HORT 699G: Thesis and Dissertation Research: Landscape Horticulture
Cr. arr. Repeatable.

HORT 699I: Thesis and Dissertation Research: Biotechnology
Cr. arr. Repeatable.

Industrial Technology

The Department of Agricultural and Biosystems Engineering offers a bachelor of science degree in Industrial Technology . It also offers an undergraduate certificate in occupational safety.

Industrial Technology graduates understand commonly-used manufacturing processes, lean manufacturing principles, continuous improvement, quality management, safety, regulatory issues affecting manufacturing, and the properties of manufacturing materials. They find careers within a variety of industries, businesses, and organizations focusing in manufacturing (e.g., quality control, production supervision, and process and facility planning) or occupational safety (e.g., development, management, and evaluation of safety programs and systems; and hazard identification and mitigation).

The certificate in occupational safety is designed to meet the needs of the students who will find themselves in management roles with responsibilities that include safety. The objective of this certificate program is to prepare technically-oriented managers to meet their professional safety responsibilities.

Students majoring in Industrial Technology choose between two options: Manufacturing; or Occupational Safety. Required Industrial Technology courses are taught under the course designator TSM (Technology Systems Management).

For more information about the Industrial Technology degree: http://www.abe.iastate.edu/undergraduate-students/industrial-technology/

For more information about the occupational safety certificate: http://www.abe.iastate.edu/home/certificate-in-occupational-safety/

Total Degree Requirement: 120 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

Communications Proficiency:
6 cr. of English composition with a C or better and 3 cr. of speech fundamentals with a C or better.

Communication/Library: 13 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
One of the following:		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
AGEDS 327	Advanced Communications for Agriculture and Life Sciences	
One of the following:		3

SP CM 212	Fundamentals of Public Speaking	
COMST 214	Professional Communication	
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
Total Credits		13

Mathematical, Physical, and Life Sciences: 25 cr.

STAT 104	Introduction to Statistics	3
MATH 145	Applied Trigonometry	3
MATH 151	Calculus for Business and Social Sciences	3
PHYS 111	General Physics	5
CHEM 163	College Chemistry	4
CHEM 163L	Laboratory in College Chemistry	1
BIOL 101	Introductory Biology	3
or BIOL 211	Principles of Biology I	
Second Biology course requirement by Option:		3
Manufacturing option		
3 credits from approved College of Agriculture and Life Sciences list		
Occupational Safety option		
BIOL 255	Fundamentals of Human Anatomy	
Total Credits		25

Business, Humanities, Ethics, and Social Sciences: 18 cr.

ACCT 284	Financial Accounting	3
ECON 101	Principles of Microeconomics	3
Ethics		3
TSM 370	Occupational Safety	
Humanities course from College of Agriculture and Life Sciences list		3
International Perspectives course from University list		3
U.S. Diversity course from University list		3
Total Credits		18

Technical Core: 30 cr.

TSM 110	Introduction to Technology	1
TSM 111	Experiencing Technology	1
TSM 115	Solving Technology Problems	3
TSM 116	Introduction to Design in Technology	3
TSM 201	Preparing for Workplace Seminar	1
TSM 210	Fundamentals of Technology	3
TSM 214	Managing Technology Projects	1
TSM 270	Principles of Injury Prevention	3
TSM 310	Total Quality Improvement	3
TSM 363	Electric Power and Electronics for Agriculture and Industry	4
TSM 397	Internship in Technology	R
TSM 399	Work Experience in Technology	2
TSM 415	Applied Project Management in Technology	2
TSM 416	Technology Capstone	3
Total Credits		30

No more than 4 cr. of TSM 397 may count toward graduation.

Manufacturing Option: 34 cr.

TSM 216	Advanced Technical Graphics, Interpretation, and CAD	2
A B E 271, A B E 272, or A B E 273		1
TSM 240	Introduction to Manufacturing Processes	3
TSM 337	Fluid Power Systems Technology	3
TSM 340	Advanced Automated Manufacturing Processes	3
TSM 440	Cellular Lean Manufacturing Systems	3
TSM 443	Statics and Strength of Materials for Technology	3
TSM 444	Facility Planning	3
TSM 465	Automation Systems	3
10 credits of free electives		10
Total Credits		34

Occupational Safety Option: 34 cr.

TSM 240	Introduction to Manufacturing Processes	3
TSM 371	Occupational Safety Management	2
TSM 372	Legal Aspects of Occupational Safety and Health	2
TSM 376	Fire Protection and Prevention	3
TSM 470	Industrial Hygiene: Physical, Chemical, and Biological Hazards	3
TSM 471	Safety Laboratory	1
TSM 477	Risk Analysis and Management	3
H S 105	First Aid and Emergency Care	2
PSYCH 250	Psychology of the Workplace	3
12 credits of free electives		12
Total Credits		34

Industrial Technology, B.S. - manufacturing option

First Year

Fall	Credits	Spring	Credits
TSM 110	1	TSM 111	1
TSM 116	3	TSM 115	3
ENGL 150	3	MATH 151	3
LIB 160	1	PHYS 111	5
MATH 145	3	ECON 101	3
CHEM 163	4		

CHEM 163L	1		
	16		15

Second Year

Fall	Credits	Spring	Credits
TSM 201	1	TSM 216	2
TSM 210	3	A B E 271, A B E 272, or A B E 273	1
TSM 214	1	STAT 104	3
TSM 240	3	BIOL 101 or BIOL 211	3
TSM 270	3	International Perspective - See list*	3
ENGL 250	3	SP CM 212, COMST 214, or AGEDS 311	3
	14		15

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
TSM 340	3	TSM 310	3	TSM 397	0
TSM 363	4	TSM 337	3		
ACCT 284	3	TSM 370 (Ethics requirement)	3		
US Diversity - See list*	3	Humanities - See list*	3		
ENGL 302, ENGL 309, ENGL 314, or AGEDS 327	3	Life Science - See list	3		
	16		15		0

Fourth Year

Fall	Credits	Spring	Credits
TSM 399	2	TSM 416	3
TSM 415	2	TSM 443	3
TSM 440	3	TSM 465	3
TSM 444	3	Elective	4
Elective	6		
	16		13

* See list - Speak with an academic adviser for options for each list.

Industrial Technology, B.S. - occupational safety option

First Year

Fall	Credits	Spring	Credits
TSM 110	1	TSM 111	1
TSM 116	3	TSM 115	3
ENGL 150	3	MATH 151	3
LIB 160	1	PHYS 111	5
MATH 145	3	ECON 101	3
CHEM 163	4		
CHEM 163L	1		
	16		15

Second Year

Fall	Credits	Spring	Credits
TSM 201	1	TSM 240	3
TSM 214	1	TSM 371	2
TSM 210	3	STAT 104	3
TSM 270	3	BIOL 155	3
H S 105	2	SP CM 212, COMST 214, or AGEDS 311	3
ENGL 250	3		
BIOL 101 or BIOL 211	3		
	16		14

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
TSM 363	4	TSM 310	3	TSM 397	0
TSM 376#	3	TSM 370	3		
PSYCH 250	3	ACCT 284	3		
TSM 477#	3	International Perspecitve*	3		
ENGL 302, ENGL 309, ENGL 314, or AGEDS 327	3	Electives	3		
	16		15		0

Fourth Year

Fall	Credits	Spring	Credits
TSM 372**	2	TSM 416	3

TSM 399	2 US Diversity*	3
TSM 415	2 Humanities*	3
TSM 470##	3 Elective	3
TSM 471##	1	
Elective	6	
	16	12

* See list - Speak with an academic adviser for options for each list.

** TSM 372 - odd years, Fall only (Fall 2013, Fall 2015, etc.)

\# TSM 376 - even years, Fall only (Fall 2014, Fall 2016, etc.)
TSM 477 - even years, Fall only (Fall 2014, Fall 2016, etc.)

\#\# TSM 470 - even years, Spring only (Spring 2014, Spring 2016, etc.)
TSM 471 - even years, Spring only (Spring 2014, Spring 2016, etc.)

Minor - Industrial Technology

The Department of Agricultural and Biosystems Engineering offers a minor in industrial technology which may be earned by completing a minimum of 18 credits of technology systems management courses, which includes:

TSM 115	Solving Technology Problems	3
TSM 210	Fundamentals of Technology	3
9 credits from:		9
TSM 216	Advanced Technical Graphics, Interpretation, and CAD	
TSM 240	Introduction to Manufacturing Processes	
TSM 270	Principles of Injury Prevention	
TSM 310	Total Quality Improvement	
TSM 337	Fluid Power Systems Technology	
TSM 340	Advanced Automated Manufacturing Processes	
TSM 363	Electric Power and Electronics for Agriculture and Industry	
TSM 370	Occupational Safety	
TSM 372	Legal Aspects of Occupational Safety and Health	
TSM 440	Cellular Lean Manufacturing Systems	
TSM 443	Statics and Strength of Materials for Technology	
TSM 444	Facility Planning	
TSM 465	Automation Systems	
TSM 470	Industrial Hygiene: Physical, Chemical, and Biological Hazards	
TSM 471	Safety Laboratory	
TSM 477	Risk Analysis and Management	
• At least six (6) credits of 300-level or higher TSM classes (from the courses listed above)		
• At least nine (9) credits that are not used to meet any other department, college, or university requirement.		
Total Credits		15

For the undergraduate curriculum in agricultural systems technology leading to the degree of bachelor of science or for the undergraduate curriculum in industrial technology leading to the degree of bachelor of science.

The department also offers an undergraduate curricula and courses in agricultural engineering, biological systems engineering.

Certificate in occupational safety

The Department of Agricultural and Biosystems Engineering offers a undergraduate certificate in occupational safety (http://www.abe.iastate.edu/undergraduate-students/industrial-technology/certificate-in-occupational-safety) which may be earned by completing a minimum of 20 credits of technology systems management courses, which includes:

TSM 270	Principles of Injury Prevention	3
TSM 370	Occupational Safety	3
TSM 371	Occupational Safety Management	2
TSM 372	Legal Aspects of Occupational Safety and Health	2
TSM 470	Industrial Hygiene: Physical, Chemical, and Biological Hazards	3
6 credits from a departmentally approved list		6
TSM 493D	Workshop in Technology: Occupational Safety (Note: This course needs to be the last course taken toward completion of the Occupational Safety Certificate)	1-4

Courses primarily for undergraduates:

TSM 110: Introduction to Technology
(1-0) Cr. 1. F.
Prereq: AST or I Tec majors only or permission of instructor
Team-oriented introduction to agricultural systems technology and industrial technology. Internships, careers, competencies, academic success strategies, transition to academic life.

TSM 111: Experiencing Technology
(0-2) Cr. 1. S.
Prereq: AST or I Tec majors only or permission of instructor
Laboratory-based, team-oriented experiences in a spectrum of topics common to the practice of technology. Internships, competencies, industry visits.

TSM 115: Solving Technology Problems

(2-2) Cr. 3. F.S.

Prereq: Credit or enrollment for credit in MATH 140 or higher

Solving technology problems and presenting solutions through data analysis and technical report writing. Problem solving cycle, unit conversion, unit factor method, SI units, significant digits, graphing, curve fitting and computer programming. Use of modern hardware and software tools for applied data-driven problem solving.

TSM 116: Introduction to Design in Technology

(2-2) Cr. 3. F.S.

Use of parametric solid modeling software to create three dimensional solid models and document parts and assemblies. Includes national and international standards for documentation, design projects, and teamwork. Rapid prototyping design creation, 3D printing, assemblies, rendering, and detailing technical drawings.

TSM 201: Preparing for Workplace Seminar

(Cross-listed with A B E). (1-0) Cr. 1. F.S.

Prereq: Prereq: Sophomore classification in AE, AST, BSE, or I TEC

8 week course. Professionalism in the context of the engineering/technical workplace. Development and demonstration of key workplace competencies: teamwork, initiative, communication, and engineering/technical knowledge. Resumes; Cover Letters; Behavioral Based Interviewing; Industry Speakers; Preparation for internships experiences.

TSM 210: Fundamentals of Technology

(3-0) Cr. 3. F.S.

Prereq: TSM 115 or equivalent; and MATH 140 or higher

Introduction to problem solving related to fundamental agricultural and/or industrial technology systems and mathematical tools needed for data analysis. Basic laws of energy, force, and mass applied to technology systems such as: mechanical power transmission; heating, ventilation and air conditioning; electrical circuits. Introduction to engineering economics: using the time value of money to make economic decisions.

TSM 214: Managing Technology Projects

(2-0) Cr. 1. F.S.

Prereq: TSM 201 or A B E 201; and sophomore classification in A E, AST, BSE, or ITEC.

8 week course. Introduction to project management principles. Use of project management in technology-based projects for academic, industry, and personal use.

TSM 216: Advanced Technical Graphics, Interpretation, and CAD

(1-2) Cr. 2. F.S.

Prereq: TSM 116

Advanced computer-aided-design topics incorporating 3D design and documentation used in manufacturing settings. Topics include: geometric dimensioning and tolerancing, weldments, sheet metal parts, advanced visualization, feature based design of parts and assemblies.

TSM 240: Introduction to Manufacturing Processes

(1-4) Cr. 3. F.S.

A study of selected materials and related processes used in manufacturing. Lecture and laboratory activities focus on materials, properties, and processes. This includes plastics and metals.

TSM 270: Principles of Injury Prevention

(3-0) Cr. 3. F.

Basic foundations of injury causation and prevention in home, motor vehicle, public, and work environments. Offered online only.

TSM 310: Total Quality Improvement

(3-0) Cr. 3. S.

Prereq: STAT 101 or STAT 104, junior classification

Introduction to the fundamental concepts of TQM - Deming style of management, statistical studies to understand the behavior of products, processes, or services, and how to define and document processes and customer focus. Introduction to continuous improvement tools and methods - emphasis on team work and problem solving skills.

TSM 322: Preservation of Grain Quality

(2-0) Cr. 2. S.

Prereq: MATH 140 or higher

Principles and management for grain quality preservation. Quality measurement. Drying and storage. Fans and airflow through grain. Handling methods.

TSM 322L: Preservation of Grain Quality Laboratory

(0-3) Cr. 1. S.

Prereq: Credit or enrollment for credit in TSM 322

Hands-on experiences in the principles and management for grain quality preservation. Quality measurement. Drying and storage. Fans and airflow through grain. Handling methods. System planning. Industry tour.

TSM 324: Soil and Water Conservation Management

(2-2) Cr. 3. S.

Prereq: MATH 140 or MATH 151

Introduction to engineering and conservation principles applied to the planning of erosion control systems, water control structures, water quality management, and drainage and irrigation systems.

TSM 325: Biorenewable Systems
(Cross-listed with A B E). (3-0) Cr. 3. F.
Prereq: ECON 101; CHEM 163 or higher; and MATH 140 or higher
Converting biorenewable resources into bioenergy and biobased products. Biorenewable concepts as they relate to drivers of change, feedstock production, processes, products, co-products, economics, and transportation/logistics.

TSM 327: Animal Production Systems
(3-0) Cr. 3. F.
Prereq: TSM 210
Confined animal feeding operations. Environmental controls for animal production. Response of animals to the environment. Heat and moisture balance in animal housing. Ventilation, water, feed handling, air pollution, odor and waste management systems.

TSM 330: Agricultural Machinery and Power Management
(2-3) Cr. 3. S.
Prereq: MATH 145 or MATH 151; and TSM 210
Selection, sizing, and operational principles of tractors and machinery systems. Cost analysis and computer techniques applied to planning and management of agricultural machine systems. Principles, operation, and application of agricultural machinery.

TSM 335: Tractor Power
(3-3) Cr. 4. F.
Prereq: TSM 210, MATH 145
Theory and construction of tractor engines, mechanical power trains and hydraulic systems. Introduction to traction, chassis mechanics, and hydraulic power.

TSM 337: Fluid Power Systems Technology
(2-2) Cr. 3. S.
Prereq: TSM 210
Fundamental fluid power principles. Fluid properties. Function and performance of components such as pumps, valves, actuators, hydrostatic transmission. Analysis of fluid power circuits and systems. Introduction to electrohydraulics. Course includes lab using fluid power trainers.

TSM 340: Advanced Automated Manufacturing Processes
(2-2) Cr. 3. F.
Prereq: TSM 216, TSM 240, MATH 151
NC programming operations for CNC mills and lathes. Transfer of parts descriptions into detailed process plans, tool selection, and NC codes. Computer assisted CAD/CAM NC programming for 2D/3D machining and machining of student programmed NC code in lab.

TSM 363: Electric Power and Electronics for Agriculture and Industry
(3-3) Cr. 4. F.
Prereq: TSM 210
Basic electricity. Electrical safety, wiring, 3-phase service, controls, and motors for agricultural and industrial applications. Planning building lighting and electrical systems. Electronics to sense, monitor, and control mechanical processes.

TSM 370: Occupational Safety
(3-0) Cr. 3. S.
Prereq: TSM 270, junior standing
Identifies safety and health risks in industrial work environments. Focus on how managers and supervisors meet their responsibilities for providing a safe workplace for their employees. Includes the identification and remediation of workplace hazards.

TSM 371: Occupational Safety Management
(2-0) Cr. 2. S.
Introduction to occupational safety and health administration and management. Focus on development and management of safety programs and obtaining employee involvement in occupational safety programs.

TSM 372: Legal Aspects of Occupational Safety and Health
(2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: TSM 371
A review of the common legal issues facing safety practitioners in the workplace. Includes OSHA, EPA and DOT regulations; workers' compensation, as well as common liability issues.

TSM 376: Fire Protection and Prevention
(3-0) Cr. 3. Alt. F., offered even-numbered years.
An overview of the current problems and technology in the fields of fire protection and fire prevention, with emphasis on industrial needs, focusing on the individual with industrial safety responsibilities.

TSM 393: Topics in Technology
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393A: Topics in Technology: Agriculture and Biosystems Management
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393B: Topics in Technology: Machine Systems
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393C: Topics in Technology: Manufacturing
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393D: Topics in Technology: Occupational Safety
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393E: Topics in Technology: Chemical Application Systems
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393F: Topics in Technology: Agricultural Safety and Health
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393G: Topics in Technology: Electronic Integration for Agriculture and Production Systems
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393I: Topics in Technology: Irrigation Systems Management
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 393J: Topics in Technology: Machinery Management Using Precision Agriculture Technology
Cr. 1-4. F.S.SS.
Offered as demand warrants. Web-based instruction.

TSM 397: Internship in Technology
Cr. R. Repeatable. F.S.SS.
Prereq: At least 45 credits of coursework, AST or I Tec major, and approval of internship coordinator
A supervised work experience in an approved learning setting with application to technology practices and principles. Reporting during work experience and self and employer evaluation required. Minimum GPA requirement.

TSM 399: Work Experience in Technology
Cr. 2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: TSM 397 in the preceding semester and approval of internship coordinator
Written reports and reflection on work experience. A maximum of 4 credits of TSM 399 maybe be used toward the total credits required for graduation.

TSM 408: Interdisciplinary Problem Solving
(3-0) Cr. 3.
Prereq: Junior or senior classification
Use of the Theory of Constraints as a way of approaching problem solving, win-win negotiation, project planning and effective delegation in the context of engineering/business systems. Team projects aimed at improving design outcomes.

TSM 409: Interdisciplinary Systems Effectiveness
(3-0) Cr. 3.
Prereq: Junior or senior classification
Focus on functions that determine the effectiveness of an entire organization. Generic Theory of Constraints solutions to production, distribution, and project management are compared to traditional solutions. Strategy for improvements discovered using simulations.

TSM 415: Applied Project Management in Technology
(2-0) Cr. 2. F.S.
Prereq: Senior classification with less than 32 credits remaining; TSM 214; and credit or enrollment for credit in TSM 310.
Implementation of project management principles using case studies and teamwork; problem definition in a technology context; development of charter for technology capstone project.

TSM 416: Technology Capstone
(1-4) Cr. 3. F.S.
Prereq: TSM 415 in previous semester
Application of project management tools to a technology capstone project; development and evaluation of potential project solutions using tools from the technology curriculum; problem resolution emphasizing communication, critical analysis, and planning techniques; presentation of project through oral presentation and written reports with input from client, faculty, and other stakeholders.

TSM 433: Precision Agriculture
(Dual-listed with TSM 533). (2-2) Cr. 3. F.
Prereq: MATH 140 or higher
Geographic information systems (GIS) and global positioning systems (GPS). Hardware systems for precision farming emphasized. Autosteering and automatic implement control systems. Collection and management of yield data. Sampling strategies for precision farming. Introduction to building fertilizer prescriptions and recommendations. Economic benefits of precision farming systems.

TSM 440: Cellular Lean Manufacturing Systems
(2-2) Cr. 3. F.
Prereq: TSM 310
Introduction to lean tools and techniques that reduce costs and improve business performance: JIT, VSM, SMED, Kaizen, Standard Work, Cycle Time Reduction, Takt Time, A3, etc. Emphasis on lean thinking and competency development through application: simulations, case studies, industry guests and mentors, teamwork and industry-related lean projects.

TSM 443: Statics and Strength of Materials for Technology
(2-2) Cr. 3. S.
Prereq: PHYS 111; and MATH 145 or MATH 151
Application of standard analytic and computer based techniques of solving problems related to force and moments. The properties of materials and how to select appropriate materials for a particular design is reviewed.

TSM 444: Facility Planning
(3-0) Cr. 3. F.
Prereq: TSM 216; TSM 240; and STAT 101 or STAT 104
Fundamental principles and practices in designing, evaluating, and organizing new or existing facilities. Emphasis on CAD-based facility design, production flow analysis, activity relationship analysis, materials handling, office layout, supporting services design, and facility cost analysis.

TSM 465: Automation Systems
(2-2) Cr. 3. S.
Prereq: TSM 363
Theory and applications of automation systems. Emphasizes features, capabilities, design and programming skills of Programmable Logic Controller (PLC) based industrial control systems. Introduction to industrial robots and sensors.

TSM 470: Industrial Hygiene: Physical, Chemical, and Biological Hazards
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 151 or higher
A qualitative and quantitative introduction to health effects of chemical, biological, and physical hazards in a workplace.

TSM 471: Safety Laboratory
(0-2) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: Credit or enrollment for credit in TSM 470
Introduction to equipment, methods, and strategies to measure, evaluate, control, and research hazards and risk in the workplaces.

TSM 477: Risk Analysis and Management
(Dual-listed with TSM 577). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 151; and STAT 101 or STAT 104
Risk analysis and management focuses on developing a risk oriented pattern of thinking that is appropriate for today's complex world. The tools that will be gained in this course will be helpful in recognizing, understanding, and analyzing hazards and risks in modern complex systems.

TSM 490: Independent Study
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490H: Independent Study: Honors
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490I: Independent Study: Manufacturing
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490J: Independent Study: Agriculture and Biosystems Management
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490M: Independent Study: Machine Systems
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 490O: Independent Study: Occupational Safety
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification, permission of instructor, and completion of an independent study contract and approval by department
A maximum of 4 credits of TSM 490 may be used toward the total credits required for graduation.

TSM 493: Workshop in Technology
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 493A: Workshop in Technology: Agriculture and Biosystems Management
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 493B: Workshop in Technology: Machine Systems
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 493C: Workshop in Technology: Manufacturing
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 493D: Workshop in Technology: Occupational Safety
Cr. 1-4. Repeatable.
Offered as demand warrants.

TSM 495: Agricultural and Biosystems Engineering Department Study Abroad Preparation or Follow-up
(Cross-listed with A B E). Cr. 1-2. Repeatable. F.S.SS.
Prereq: Permission of instructor
Preparation for, or follow-up of, study abroad experience (496). For preparation, course focuses on understanding the tour destination through readings, discussions, and research on topics such as the regional industries, climate, crops, culture, economics, food, geography, government, history, natural resources, and public policies. For follow-up, course focuses on presentations by students, report writing, and reflection. Students enrolled in this course intend to register for 496 the following term or have had taken 496 the previous term.
Meets International Perspectives Requirement.

TSM 496: Agricultural and Biosystems Engineering Department Study Abroad
(Cross-listed with A B E). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
Tour and study at international sites relevant to disciplines of industrial technology, biological systems engineering, agricultural systems technology, and agricultural engineering. Location and duration of tours will vary. Trip expenses paid by students. Pre-trip preparation and/or post-trip reflection and reports arranged through 495.
Meets International Perspectives Requirement.

Courses primarily for graduate students, open to qualified undergraduates:

TSM 533: Precision Agriculture
(Dual-listed with TSM 433). (2-2) Cr. 3. F.
Prereq: MATH 140 or higher
Geographic information systems (GIS) and global positioning systems (GPS). Hardware systems for precision farming emphasized. Autosteering and automatic implement control systems. Collection and management of yield data. Sampling strategies for precision farming. Introduction to building fertilizer prescriptions and recommendations. Economic benefits of precision farming systems.

TSM 540: Advanced Design and Manufacturing
(3-0) Cr. 3. S.
Prereq: Permission of instructor
Application of six sigma philosophy to advance product design and process control. Application of value steam mapping to the existing manufacturing system to develop future continuous improvement plans. Application of Taguchi Parameter design methodologies for optimizing the performance of manufacturing processes. Application of Taguchi Tolerance Design methodologies for product design.

TSM 575: Safety and Public Health Issues in Modern Society
(2-0) Cr. 2. Repeatable, maximum of 2 times.
Exploration and analysis of current safety and public health issues impacting society. The focus will be on topics that impact individuals in work, public, and home environments.

TSM 577: Risk Analysis and Management
(Dual-listed with TSM 477). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 151; and STAT 101 or STAT 104
Risk analysis and management focuses on developing a risk oriented pattern of thinking that is appropriate for today's complex world. The tools that will be gained in this course will be helpful in recognizing, understanding, and analyzing hazards and risks in modern complex systems.

TSM 590: Special Topics in Technology
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 590A: Special Topics in Technology: Agriculture and Biosystems Management
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 590B: Special Topics in Technology: Machine Systems
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 590C: Special Topics in Technology: Manufacturing
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 590D: Special Topics in Technology: Occupational Safety
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Graduate classification in industrial and agricultural technology, permission of instructor, and completion of an independent study contract approved by major professor

TSM 593: Workshop in Technology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

TSM 598: Technical Communications for a Master's Degree
(Cross-listed with A B E). Cr. 1. F.S.SS.
A technical paper draft based on the M.S. thesis or creative component is required of all master's students. This paper must be in a form that satisfies the requirements of some specific journal and be ready for submission. A technical presentation based on M.S. thesis or creative component is required of all master's students. This presentation must be in a form that satisfies the normal presentation requirements of a professional society. The presentation itself (oral or poster) may be made at a professional society meeting or at any international, regional, state, or university conference/event as long as the presentation content and form conforms to normal expectations. Offered on a satisfactory-fail basis only.

TSM 599: Creative Component
Cr. 1-3. Repeatable, maximum of 6 credits.
A discipline-related problem to be identified and completed under the direction of the program adviser. Three credits required for all nonthesis master's degree students.

Courses for graduate students:

TSM 601: Graduate Seminar
(Cross-listed with A B E). (1-0) Cr. 1. F.
Keys to starting a good MS thesis or PhD dissertation project. Learning how to begin formulating research questions. Review of literature, research hypotheses, objectives, methods, making figures and tables, and discussing results. Discussion of appropriate outlets including peer-reviewed journals, patents and intellectual property rights, responsible conduct, plagiarism, authorship, and reproducible research. Using peer review, conducting a peer review, and responding to feedback. Other topics may include on-campus library resources, data management, and time management.

TSM 652: Program and Learner Evaluation
(3-0) Cr. 3.
Prereq: STAT 401 or equivalent
Techniques for evaluating learners, facilities, programs, and staff utilizing theories for developing measurement instruments. Outcomes assessment is emphasized.

TSM 655: Academic Leadership in Technology and Engineering
(3-0) Cr. 3.
Prereq: Permission of instructor
A definition of the faculty role in technology and engineering disciplines, including strategies for dealing with programs, personnel, and constituencies are presented. Leadership skills involving team formation, team operation, and conflict resolution are addressed.

TSM 657: Curriculum Development in Technology and Engineering
(3-0) Cr. 3.
Prereq: Permission of instructor
Basic concepts, trends, practices, and factors influencing curriculum development, techniques, organization and procedures. Emphasis will be given to course development using the backward design process.

TSM 694: Teaching Practicum
(Cross-listed with A B E). Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and permission of instructor
Graduate student experience in the agricultural and biosystems engineering departmental teaching program.

TSM 697: Internship in Technology
Cr. R.
Prereq: permission of major professor and approval by department chair, graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

TSM 698: Technical Communications for a Doctoral Degree
(Cross-listed with A B E). Cr. 1. F.S.SS.
A technical paper draft based on the dissertation is required of all Ph.D. students. This paper must be in a form that satisfies the requirements of some specific journal and be ready for submission. A technical presentation based on the dissertation is required of all Ph.D. students. This presentation must be in a form that satisfies the normal presentation requirements of a professional society. The presentation itself (oral or poster) may be made at a professional society meeting or at any international, regional, state, or university conference/event as long as the presentation content and form conforms to normal expectations. Offered on a satisfactory-fail basis only.

TSM 699: Research
Cr. arr.

International Agriculture

Interdepartmental Undergraduate Program

The international agriculture program provides opportunities to develop knowledge and skills related to the factors that interact to impact agricultural and environmental issues, production, processes, distribution and utilization worldwide. The program puts emphasis on international experience through structured internships and study abroad. The international agriculture program is appropriate for students seeking positions that require knowledge and experience related to global agricultural issues and their impact on local, regional, national and international policies and practices. Students preparing for careers in the following areas will benefit from the international agriculture program; governmental and non-governmental development agencies, agribusinesses, educational institutions, and non-profit assistance agencies. Outcomes from participation in this program include developing an awareness for the role of international agriculture in the career development process, analyzing international agricultural issues and policies, acquiring skills for solving problems in international development and agribusiness and experiencing real situations and gaining perspectives about agriculture in a global setting.

Secondary Major

International agriculture is an undergraduate secondary major that may be taken only in conjunction with a primary major in an agriculture and life sciences curriculum. Students choosing international agriculture will strengthen their career placement with a business or agency involved in international activities. Technical knowledge of a primary major discipline will be strengthened by a global awareness of agriculture and life sciences. A secondary major in international agriculture will give students practical insight into the role of agriculture in a world of increasing food and fiber needs. It is ideal for those who wish to broaden their international perspective or prepare for international work in agriculture. The secondary major includes an emphasis on international internship or study abroad and/or foreign languages, and selection of appropriate courses (from an approved list) to meet the needs and interests of the student.

Courses for the secondary major include AGRON 342 World Food Issues: Past and Present; six credits of study abroad, travel, or language courses or any combination thereof; and six credits in selected international agriculture courses in the College of Agriculture and Life Sciences. Fifteen credits of the secondary major cannot be used to meet requirements of the major or any other college or university requirement.

Students interested in earning a secondary major in international agriculture must contact a program adviser. The early indication of an interest in international agriculture allows for effective integration of the secondary major course requirements with those of the primary major.

Minor

A minor in international agriculture is available to interested students regardless of their major. Students selecting the minor should have at least minimal familiarity with agriculture and life sciences and agricultural systems.

Courses for the minor include AGRON 342 World Food Issues: Past and Present; 3 to 6 credits of study abroad and/or foreign language and 3 to 6 credits in selected international agriculture courses in the College of Agriculture and Life Sciences. Nine credits of the 15 credit total for the minor can not be used for meeting requirements for the major.

For more information about a secondary major or minor in international agriculture, see descriptions in the designated departments or the supervisory committee.

For more information about courses for either a secondary major or a minor in international agriculture, see descriptions in the designated departments.

Curriculum in International Agriculture

Administered by an Interdepartmental Committee. International agriculture can be taken only as a secondary major in conjunction with a primary major in the College of Agriculture and Life Sciences. A minor is available to interested students regardless of their major.

15 cr. of this major cannot be used to meet requirements of the primary major or any other college or university requirements.

6 cr. from Internship in International Agriculture or Study Abroad or World Languages and Cultures; AGRON 342 World Food Issues: Past and Present; credits from approved International Agriculture Courses to total 15 cr.

Microbiology

Interdepartmental Undergraduate Major

Undergraduate study for the bachelor of science degree with a major in microbiology. In the Microbiology curriculum, principal emphasis is placed on understanding microorganisms and their interrelationships with other organisms in nature, the application of microbiology in medicine, agriculture and industry, and the study of fundamental life processes as exemplified by microorganisms. Areas of emphasis include: medical microbiology; environmental and industrial microbiology; and food microbiology.

Graduates of the Interdepartmental Undergraduate Microbiology Program will learn about the diversity and complexity of microbial life represented by procaryotes, eucaryotes and viruses. In addition to being able to explain fundamental principles of microbial growth, physiology, genetics, biochemistry, and ecology, students will be able to evaluate the impact that the microbial world has on human, animal and plant health, as well as on environmental quality, industry and biotechnology. Graduates are able to design and implement experimental approaches to address specific questions. In addition, graduates are able to communicate scientifically, using a variety of media.

Students graduating in microbiology find career opportunities in a wide variety of areas including: hospital and clinical laboratories; federal, state, and local government agencies; research and development; dairy and food processing industries; and the pharmaceutical and fermentation industries. Some fields of microbiology, especially advanced research, may require further training. Undergraduate work in the program is designed to provide sound preparation for graduate study, training for bachelors-level employment, and admission to professional programs such as medicine, veterinary medicine and dentistry.

Preveterinary preparation may be accomplished through the curriculum major in this program (see College of Veterinary Medicine, Admission Requirements).

Curriculum in Microbiology

www.micro.iastate.edu (http://www.micro.iastate.edu)

Administered by an interdepartmental committee.

Total Degree Requirement: 128 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Electives: 7-12
Communications Proficiency:

English composition - with a C or better		6
Speech fundamentals - with a C or better		3

Communication/Library:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
SP CM 212	Fundamentals of Public Speaking	3
One course from the following:		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 312	Biological Communication	
ENGL 314	Technical Communication	
LIB 160	Information Literacy	1
Total Credits		13

Humanities and Social Sciences:

Approved Humanities list	3
Approved Social Science list	3

Ethics: 3 cr.
3 cr. from approved list.

Mathematical Sciences:

One of the following:		7-8
MATH 145 & MATH 160	Applied Trigonometry and Survey of Calculus	
MATH 165 & MATH 166	Calculus I and Calculus II	
MATH 181 & MATH 182	Calculus and Mathematical Modeling for the Life Sciences I and Calculus and Mathematical Modeling for the Life Sciences II	
One of the following:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
Total Credits		10-12

Physical Sciences:

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
PHYS 111	General Physics	5

PHYS 112	General Physics	5
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
CHEM 332	Organic Chemistry II	3
One of the following:		3-6
BBMB 404 & BBMB 405	Biochemistry I and Biochemistry II	
or BBMB 301	Survey of Biochemistry	
Total Credits		28-31

Biological Sciences:

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 313	Principles of Genetics	3
BIOL 313L	Genetics Laboratory	1
BIOL 314	Principles of Molecular Cell Biology	3
Total Credits		15

Microbiology:

Core courses:

MICRO 110	Professional and Educational Preparation in Microbiology	1
MICRO 302	Biology of Microorganisms	3
MICRO 302L	Microbiology Laboratory	1
MICRO 310	Medical Microbiology	3
MICRO 310L	Medical Microbiology Laboratory	1
MICRO 320	Molecular and Cellular Bacteriology	4
MICRO 440	Laboratory in Microbial Physiology, Diversity, and Genetics	4
MICRO 450	Undergraduate Capstone Colloquium	2
MICRO 451	Senior Survey in Microbiology	R
One of the following:		3
MICRO 430	Procaryotic Diversity and Ecology	
MICRO 456	Principles of Mycology	
MICRO 477	Bacterial-Plant Interactions	
Nine credit hours from the following:		9
MICRO 374	Insects and Our Health	
MICRO 402	Microbial Genetics and Genomics	
MICRO 407	Microbiological Safety of Foods of Animal Origins	
MICRO 408	Virology	
MICRO 419	Foodborne Hazards	
MICRO 420	Food Microbiology	
MICRO 421	Food Microbiology Laboratory	
MICRO 456	Principles of Mycology	
MICRO 475	Immunology	
MICRO 475L	Immunology Laboratory	
MICRO 485	Soil and Environmental Microbiology	
MICRO 487	Microbial Ecology	
MICRO 490	Independent Study	
Microbiology elective - only 3 cr. lab courses allowed		
Total Credits		31

Microbiology, B.S.

First Year

Fall	Credits	Spring	Credits
ENGL 150 or 250	3	MICRO 302	3
MICRO 110	1	MICRO 302L	1
MICRO 101	3	BIOL 212	3
BIOL 211	3	BIOL 212L	1
BIOL 211L	1	CHEM 178	3
CHEM 177	4	STAT 104	3
CHEM 177L	1	Social Science choice	3
LIB 160	1		
	17		17

Second Year

Fall	Credits	Spring	Credits
MICRO 310	3	MICRO Environmental or Elective	3
MICRO 310L	1	BIOL 313	3
CHEM 331	3	BIOL 313L	1
CHEM 331L	1	CHEM 332	3
MATH 142 or Calc I (MATH 165 or 181)	3-4	Gen Calculus or Calc II (MATH 160 or 166 or 182)	4
ENGL 250	3	Humanities choice	3
	14-15		17

Third Year

Fall	Credits	Spring	Credits
MICRO Environmental or Elective	3	MICRO 320	4
PHYS 111	5	PHYS 112	5
BIOL 314	3	Advanced English	3
SP CM 212	3	International Perspectives	3
Gen Elective	3		
	17		15

Fourth Year

Fall	Credits	Spring	Credits
MICRO 440	4	MICRO elective	3
MICRO elective	3	MICRO 450	2
MICRO 451	0	BBMB 405	3
ETHICS choice	3	Social Science choice	3
BBMB 404	3	Gen Electives	5
US Diversity	3		
	16		16

Minor

The program offers a minor in microbiology which may be earned by accumulating a minimum of 15 credits of microbiology courses.

Graduate Study

The program offers work for the degrees master of science and doctor of philosophy in microbiology and for a minor for students majoring in other programs. The interdepartmental microbiology major is offered through faculty housed in twelve departments, including Agronomy; Animal Science; Biochemistry, Biophysics and Molecular Biology; Civil, Construction and Environmental Engineering; Entomology; Food Science and Human Nutrition; Genetics, Developmental and Cell Biology; Geological and Atmospheric Sciences; Plant Pathology and Microbiology; Veterinary Diagnostic and Production Animal Medicine; Veterinary Microbiology and Preventive Medicine; and Veterinary Pathology. Faculty coordinate graduate education and research in a wide range of topics fundamental to the discipline of microbiology. Specific information about individual faculty and their research areas is available at www.micrograd.iastate.edu. (http://www.micrograd.iastate.edu)

Prerequisites to graduate study include a sound undergraduate background in chemistry, mathematics and biology, including microbiology and genetics.

Graduates in the Microbiology Graduate program have a broad-based knowledge in the fundamentals of microbiology as well as advanced knowledge in specific areas as determined by their areas of research focus. Students completing the thesis have the technical, research, critical-thinking, problem-solving, and computer skills to design, implement, and conduct research using a variety of current techniques and equipment. They are also able to communicate research results effectively with scientific peer groups in both oral and written formats.

Courses primarily for undergraduates:

MICRO 101: Microbial World

(3-0) Cr. 3. F.

Prereq: High school biology or equivalent

Introduction to the importance of viruses, bacteria, fungi, archaea and parasites both to humans and to the biosphere. Topics include past and present microbial impact on humans and society, ecology and diversity of microbes, biotechnology and microbial impact on the biosphere.

MICRO 110: Professional and Educational Preparation in Microbiology

(1-0) Cr. 1. F.

An introduction to curriculum and research opportunities in microbiology at Iowa State. Topics include: easing the transition to life as a university student, development of specific goals, strengthening interpersonal communication, professional portfolio creation and resume building. Offered on a satisfactory-fail basis only.

MICRO 201: Introduction to Microbiology

(2-0) Cr. 2. F.S.

Prereq: One semester of college-level biology

Selected topics in microbiology with emphasis on the relationship of microorganisms to human and animal health, agricultural technology, and the environment. With written petition to the chair of the supervisory committee, students who obtain a grade of B or better may substitute 201 for Micro 302 in advanced courses.

MICRO 201L: Introductory Microbiology Laboratory

(0-3) Cr. 1. F.S.

Prereq: Credit or enrollment in MICRO 201 or MICRO 302

Basic microbiology laboratory techniques for non-microbiology majors. Credit for either Micro 201L or 302L, but not both, may be applied toward graduation.

MICRO 302: Biology of Microorganisms

(3-0) Cr. 3. F.S.SS.

Prereq: BIOL 211, credit or enrollment in BIOL 212; 1 semester of chemistry

Basic cell biology, physiology, metabolism, genetics and ecology of microorganisms, with an emphasis on prokaryotes and viruses, as well as the roles of microorganisms in the environment, disease, agriculture, and industry.

MICRO 302L: Microbiology Laboratory

(0-3) Cr. 1. F.S.

Prereq: Credit or enrollment in MICRO 302

Basic microbiology laboratory techniques for majors in microbiology, biological sciences and related fields. Credit for either Micro 201L or 302L, but not both, may be applied toward graduation.

MICRO 310: Medical Microbiology
(3-0) Cr. 3. F.
Prereq: MICRO 302 (or MICRO 201 if a B or better was obtained)
Study of infection by bacterial and viral pathogenic agents of humans with an overview of immune responses in controlling disease.

MICRO 310L: Medical Microbiology Laboratory
(0-3) Cr. 1. F.
Prereq: MICRO 201 or MICRO 302; MICRO 201L or MICRO 302L; credit or enrollment in MICRO 310
Microbiological tools and techniques to isolate, identify, and characterize medically significant microorganisms in relation to human diseases. Emphasis on the virulence factors of pathogenic organisms as compared to the normal flora.

MICRO 320: Molecular and Cellular Bacteriology
(4-0) Cr. 4. S.
Prereq: MICRO 302, BIOL 313, credit or enrollment in CHEM 332
A systems perspective of bacterial growth, survival, and cellular differentiation by integrating physiological and genetic principles. Emphasis is on prokaryotes although unicellular eukaryotes are also discussed. Topics include the structure, function, and assembly of cell components, molecular and genomic techniques, bioenergetics and metabolism, regulation of gene expression, genetic adaptation, stress tolerance, biofilms, and cell-cell interactions and communications.

MICRO 353: Introductory Parasitology
(Cross-listed with BIOL, V PTH). (3-0) Cr. 3. S.
Prereq: BIOL 212
Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites.

MICRO 374: Insects and Our Health
(Cross-listed with ENT). (3-0) Cr. 3. S.
Prereq: 3 credits in biological sciences
Identification, biology, and significance of insects and arthropods that affect the health of humans and animals, particularly those that are vectors of disease.
Meets International Perspectives Requirement.

MICRO 374L: Insects and Our Health Laboratory
(Cross-listed with ENT). (0-3) Cr. 1. Alt. S., offered even-numbered years.
Prereq: Credit or enrollment in ENT 374
Laboratory and field techniques for studying medical or public health entomology, including: collection, identification and maintenance of medically significant arthropods and experimental design and execution related to the biology of arthropods or arthropod-pathogen interactions.

MICRO 381: Environmental Systems I: Introduction to Environmental Systems
(Cross-listed with BIOL, ENSCI, ENV S). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

MICRO 402: Microbial Genetics and Genomics
(Dual-listed with MICRO 502). (Cross-listed with GEN). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MICRO 302, Biol 313
The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics.

MICRO 407: Microbiological Safety of Foods of Animal Origins
(Dual-listed with MICRO 507). (Cross-listed with FS HN). (3-0) Cr. 3. S.
Prereq: MICRO 420
Examination of the various factors in the production of foods of animal origin, from animal production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. The two modules of this course will be 1) the procedures and processes which can affect the overall microbiological safety of the food, and 2) the Hazard Analysis Critical Control Point (HACCP) system.

MICRO 408: Virology
(3-0) Cr. 3. F.
Prereq: BIOL 313 or BBMB 301. BIOL 314 recommended
The molecular virology and epidemiology of human, animal, plant and insect viruses.

MICRO 410: Insect-Virus Interactions: a Molecular Perspective
(Dual-listed with MICRO 510). (Cross-listed with ENT). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: Permission of an instructor.
Overview of insect-virus interactions including insect immunity to viruses, genetic enhancement of viral insecticides, transgenic mosquitoes, disruption of virus transmission, and the role of insect and virus genomics in combating viral disease of both human and agricultural importance.

MICRO 419: Foodborne Hazards
(Cross-listed with FS HN, TOX). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MICRO 201 or MICRO 302, a course in biochemistry
Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

MICRO 420: Food Microbiology
(Cross-listed with FS HN, TOX). (3-0) Cr. 3.
Prereq: MICRO 201 or MICRO 302
Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications.

MICRO 421: Food Microbiology Laboratory
(Cross-listed with FS HN). (0-6) Cr. 3.
Prereq: MICRO 201 or MICRO 302; MICRO 201L or MICRO 302L. Credit or enrollment in FS HN/MICRO 420
Standard techniques used for the microbiological examination of foods. Independent and group projects on student-generated questions in food microbiology. Emphasis on oral and written communication and group interaction.

MICRO 430: Procaryotic Diversity and Ecology
(Dual-listed with MICRO 530). (Cross-listed with BBMB). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MICRO 302, MICRO 302L
Survey of the diverse groups of procaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

MICRO 440: Laboratory in Microbial Physiology, Diversity, and Genetics
(Cross-listed with BBMB). (2-6) Cr. 4. F.
Prereq: MICRO 302, MICRO 302L, CHEM 332, BIOL 313L
Fundamental techniques and theory for studying the cellular mechanisms, genetic processes and diversity of microbial life. Experimental techniques will include isolation and physiological characterization of bacteria that inhabit different environments as well as an emphasis on genetic and molecular techniques to understand antibiotic resistance processes and mechanisms. Also included are techniques for phylogenetic characterization, measuring gene expression, and genetic manipulation of bacteria. Essential components for the effective communication of scientific results are also emphasized.

MICRO 450: Undergraduate Capstone Colloquium
(2-0) Cr. 2. S.
Prereq: SP CM 212 and senior standing in Microbiology
Required of all undergraduate majors in microbiology. Students demonstrate mastery of core courses in microbiology through discussion of current literature in microbiology and immunology, issues in scientific conduct, and bioethics in microbiology. Students present current papers in a journal club format and gain experience in writing and reviewing grant proposals.

MICRO 451: Senior Survey in Microbiology
Cr. R. F.
Prereq: Junior or Senior standing in Microbiology
Preparations for graduation. Topics include job search strategies, career information, mock interviews, graduate and professional school application processes and guidelines as well as outcomes assessment activities.

MICRO 456: Principles of Mycology
(Cross-listed with BIOL). (2-3) Cr. 3. F.
Prereq: 10 credits in biological sciences
Morphology, diversity, and ecology of fungi; their relation to agriculture, industry, and human health.

MICRO 475: Immunology
(Dual-listed with MICRO 575). (3-0) Cr. 3. S.
Prereq: MICRO 310
An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. Micro 475L optional. Credit for either Micro 475 or V MPM 520, but not both, may be applied to graduation.

MICRO 475L: Immunology Laboratory
(1-4) Cr. 1. S.
Prereq: Credit or enrollment in MICRO 310 or MICRO 475 or MICRO 575
Techniques in primary culture and tumor cell growth, measures of lymphocyte function, serological techniques and flow cytometry. Half semester course.

MICRO 477: Bacterial-Plant Interactions
(Dual-listed with MICRO 577). (Cross-listed with PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 3 credits in microbiology or plant pathology
Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves.

MICRO 485: Soil and Environmental Microbiology
(Dual-listed with MICRO 585). (Cross-listed with AGRON, ENSCI). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

MICRO 487: Microbial Ecology
(Dual-listed with MICRO 587). (Cross-listed with BIOL, ENSCI). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

MICRO 490: Independent Study
Cr. 1-5. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490A: Independent Study: Laboratory Research
Cr. arr. Repeatable. F.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490B: Independent Study: Literature Review
Cr. arr. Repeatable. F.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490C: Independent Study: Instructional Assistant
Cr. arr. Repeatable. F.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490G: Independent Study: General
Cr. arr. Repeatable. F.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490H: Independent Study, Honors
Cr. 1-5. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 495: Internship
Cr. 1-2. F.S.
Prereq: At least 6 credits of 300-level or above coursework in microbiology, approval of academic adviser
Participation in the Cooperative Extension Intern Program or an equivalent work experience. Written report of activities required. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

MICRO 502: Microbial Genetics and Genomics
(Dual-listed with MICRO 402). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MICRO 302, Biol 313
The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics.

MICRO 507: Microbiological Safety of Foods of Animal Origins
(Dual-listed with MICRO 407). (Cross-listed with FS HN). (3-0) Cr. 3. S.
Prereq: MICRO 420
Examination of the various factors in the production of foods of animal origin, from animal production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. The two modules of this course will be 1) the procedures and processes which can affect the overall microbiological safety of the food, and 2) the Hazard Analysis Critical Control Point (HACCP) system.

MICRO 510: Insect-Virus Interactions: a Molecular Perspective
(Dual-listed with MICRO 410). (Cross-listed with ENT). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: Permission of an instructor.
Overview of insect-virus interactions including insect immunity to viruses, genetic enhancement of viral insecticides, transgenic mosquitoes, disruption of virus transmission, and the role of insect and virus genomics in combating viral disease of both human and agricultural importance.

MICRO 525: Intestinal Microbiology
(Cross-listed with V MPM). Cr. 3. Alt. S., offered even-numbered years.
Prereq: Micro 302, BIOL 313
Overview of commensal microbiota in the health and well-being of vertebrates. Topics include diversity of intestinal structure, microbial diversity/function, innate immune development, community interactions and metabolic diseases associated with alterations of the intestinal microbiome.

MICRO 530: Procaryotic Diversity and Ecology
(Dual-listed with MICRO 430). (Cross-listed with BBMB). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MICRO 302, MICRO 302L
Survey of the diverse groups of procaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

MICRO 540: Livestock Immunogenetics
(Cross-listed with AN S, V MPM). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: AN S 561 or MICRO 575 or V MPM 520
Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance.

MICRO 551: Microbial Diversity and Phylogeny
(1-0) Cr. 1. F.
Prereq: MICRO 302, BIOL 313
Comparisons among the three kingdoms of life (Bacterica, Archaea, and Eukarya). Topics will include metabolism, adaptation, methods of phylogenetic analysis, and comparative genomics.

MICRO 552: Bacterial Molecular Genetics and Physiology
(1-0) Cr. 1. F.
Prereq: MICRO 302, BIOL 313
Review of genetics and selected physiological topics of model bacteria.

MICRO 553: Pathogenic Microorganisms
(1-0) Cr. 1. F.
Prereq: MICRO 302, BIOL 313
Review and contrast/comparison of common bacterial pathogens of plants and animals and their mechanisms of virulence, including toxins, protein secretion, host invasion and iron acquisition strategies. An overview of eukaryotic cell biology that is relevant to pathogenesis will also be included.

MICRO 554: Virology
(1-0) Cr. 1. S.
Prereq: MICRO 302, BIOL 313
Introduction to virus life cycles including entry, gene expression strategies, replication, and mechanisms to modify and overcome host defenses. The roles of specific viruses and sub-viral agents in animal and plant disease will also be included.

MICRO 555: Fungal Biology
(1-0) Cr. 1. S.
Prereq: GEN 313 or GEN 320 or equivalent.
Ecology, genetics, physiology and diversity of fungi, from yeasts to mushrooms, and their importance in human affairs.

MICRO 556: Ecology of Microorganisms
(1-0) Cr. 1. S.
Prereq: MICRO 302, BIOL 313
The study of microorganisms in their natural environments, with a focus on terrestrial and aquatic ecosystems, including eukaryotic hosts; interactions within biofilms and communities, including intercellular communication and symbioses; microbial adaptations to extreme environments; and metagemomic, genomic, molecular and microscopy techniques for the study of microbes in natural systems.

MICRO 575: Immunology
(Dual-listed with MICRO 475). (Cross-listed with V MPM). (3-0) Cr. 3. S.
Prereq: MICRO 310
An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. Micro 475L optional. Credit for either Micro 575 or V MPM 520, but not both, may be applied toward graduation.

MICRO 577: Bacterial-Plant Interactions
(Dual-listed with MICRO 477). (Cross-listed with PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 3 credits in microbiology or plant pathology
Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves.

MICRO 585: Soil and Environmental Microbiology
(Dual-listed with MICRO 485). (Cross-listed with AGRON, ENSCI). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

MICRO 586: Medical Bacteriology
(Cross-listed with V MPM). (4-0) Cr. 4. F.
Prereq: 310
Bacteria associated with diseases of vertebrates, including virulence factors and interaction of host responses.

MICRO 587: Microbial Ecology
(Dual-listed with MICRO 487). (Cross-listed with EEOB, ENSCI). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

MICRO 590: Special Topics
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

Courses for graduate students:

MICRO 604: Seminar
(1-0) Cr. 1. Repeatable. F.S.
Course will expose students to the breadth of subdisciplines within microbiology, offer opportunities for direct interaction between the students and the faculty members within the Interdepartmental Microbiology Graduate Program, and promote interactions among the students within the program. Offered on a satisfactory-fail basis only.

MICRO 608: Molecular Virology
(Cross-listed with PL P, V MPM). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or GDCB 511
Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis.

MICRO 615: Molecular Immunology
(Cross-listed with BBMB, V MPM). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function.

MICRO 625: Mechanisms of Bacterial Pathogenesis
(Cross-listed with V MPM). (4-0) Cr. 4. Alt. S., offered odd-numbered years.
Prereq: Credit in Biochemistry and Microbiology
Review of current concepts in specific areas of microbial pathogenesis including the genetic basis for bacterial disease, genetic regulation and control of virulence factors and their mechanisms of action, and host-pathogen interactions at the cellular and molecular levels. The application of microbial genetics to understanding pathogenesis will be included.

MICRO 626: Advanced Food Microbiology
(Cross-listed with FS HN, TOX). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials.

MICRO 627: Rapid Methods in Food Microbiology
(Cross-listed with FS HN, TOX). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Provides an overview of rapid microbial detection methods for use in foods. Topics include historical aspects of rapid microbial detection, basic categories of rapid tests (phenotypic, genotypic, whole cell, etc.), existing commercial test formats and kits, automation in testing, sample preparation and "next generation" testing formats now in development.

MICRO 685: Advanced Soil Biochemistry
(Cross-listed with AGRON, ENSCI). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: AGRON 585
Chemistry of soil organic matter and biochemical transformations brought about by microorganisms and enzymes in soils.

MICRO 690: Current Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

MICRO 690A: Current Topics: Microbiology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

MICRO 690B: Current Topics: Immunology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

MICRO 690C: Current Topics: Infectious Diseases
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

MICRO 692: Molecular Biology of Plant-Pathogen Interactions
(Cross-listed with PL P). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: PL P 506 or BBMB 405 or GEN 411 or MICRO 402 or strong background in molecular biology
Seminal and current research in molecular and physiological aspects of plant interactions with pathogens, including mechanisms of pathogenesis, host-pathogen recognition and host defense, with an emphasis on critical evaluation of primary literature. Students also complete a research proposal writing and peer review exercise.

MICRO 697: Graduate Research Rotation
Cr. arr. Repeatable. F.S.
Graduate research projects performed under the supervision of selected faculty members in the Interdepartmental Microbiology major.

MICRO 698: Seminar in Molecular, Cellular, and Developmental Biology
(Cross-listed with BBMB, GDCB, MCDB, V MPM). (2-0) Cr. 1-2. Repeatable. F.S.
Student and faculty presentations.

MICRO 699: Research
Cr. arr. Repeatable.

Nutritional Science (AGLS)

Nutritional science looks at the connection between diet and health. Students learn how diet can play a crucial role in the cause, treatment, and prevention of many diseases. There are degree program options within nutritional science. The pre-health professional and research option coursework prepares students for work in research laboratories, graduate study in nutrition or biological sciences, or entrance into health professional programs, such as medical, dental, physician assistant, and pharmacy schools. Students gain a strong science education along with human nutrition expertise. Additional options in family health, global health and policy, health coach, and nutrition and wellness prepare students for work positions in program planning and evaluation for community, public health, non-profit, and corporate wellness programs addressing the growing public interest in nutrition, wellness, and preventative health. Students learn about the role of nutrition and healthy eating for disease prevention and wellness. The food service option prepares students for school nutrition and food service management positions.

The department also offers a nutrition minor.

Administered by the Department of Food Science and Human Nutrition

- Pre-Health Professional and Research Option
- Family Health Option
- Food Service Option
- Global Health and Policy Option
- Health Coach Option
- Nutrition and Wellness Option

PRE-HEALTH PROFESSIONAL AND RESEARCH OPTION

Total Degree Requirement: 120 cr.
Students must fulfill International Perspectives and U.S. Diversity requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communications and Library: 13 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGL 314	Technical Communication	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		13

Humanities and Social Sciences: 6-12 cr.

Select Humanities courses from approved list		3
Select Social Science course from approved list		3
If H Sci student, select:		6
Additional Humanities course		
Additional Humanities or Social Science course		

Ethics and Environmental: 3-6 cr.

FS HN 342	World Food Issues: Past and Present	3
If AgLS student, select from:		2-3
ENV S 120	Introduction to Renewable Resources	
ENV S 201	Introduction to Environmental Issues	

Mathematical Sciences: 6-12 cr.

Select at least 3 credits from:		3-8
MATH 140	College Algebra	
MATH 143	Preparation for Calculus	
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 165 & MATH 166	Calculus I and Calculus II	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	

MATH 181 & MATH 182	Calculus and Mathematical Modeling for the Life Sciences I and Calculus and Mathematical Modeling for the Life Sciences II	
Select at least 3 credits from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
Total Credits		6-12

Physical Sciences: 17 cr.

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 178L	Laboratory in College Chemistry II	1
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
CHEM 332	Organic Chemistry II	3
CHEM 332L	Laboratory in Organic Chemistry II	1
Total Credits		17

Biological Sciences: 24-29 cr.

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 255	Fundamentals of Human Anatomy	3
BIOL 255L	Fundamentals of Human Anatomy Laboratory	1
Select at least 3 credits from:		3-4
BIOL 256 & 256L	Fundamentals of Human Physiology and Fundamentals of Human Physiology Laboratory	
BIOL 334	Metabolic Physiology of Mammals	
BIOL 335	Principles of Human and Other Animal Physiology	
BIOL 313	Principles of Genetics	3
Select at least 3 credits from:		3-6
BBMB 301	Survey of Biochemistry	
BBMB 316	Principles of Biochemistry	
BBMB 404 & BBMB 405	Biochemistry I and Biochemistry II	
MICRO 201 or MICRO 302	Introduction to Microbiology Biology of Microorganisms	2-3
MICRO 201L or MICRO 302L	Introductory Microbiology Laboratory Microbiology Laboratory	1
Total Credits		24-29

Food Science and Human Nutrition: 37 cr.

FS HN 110	Professional and Educational Preparation	1
FS HN 167	Introduction to Human Nutrition	3
FS HN 203	Contemporary Issues in Food Science and Human Nutrition	1
FS HN 265	Nutrition for Active and Healthy Lifestyles	3
FS HN 360	Advanced Human Nutrition and Metabolism	3
FS HN 361	Nutrition and Health Assessment	2
FS HN 362	Nutrition in Growth and Development	3
FS HN 467	Molecular Basis of Nutrition in Disease Prevention	3
FS HN 480	Professional Communication in Food Science and Human Nutrition	1
FS HN 492	Research Concepts in Human Nutrition	2
Select at least 15 additional credits from:		15
BIOL 314	Principles of Molecular Cell Biology	
FS HN 214 & FS HN 215	Scientific Study of Food and Advanced Food Preparation Laboratory (or FS HN 115 lab)	
FS HN 242	The US Food System	
FS HN 311	Food Chemistry	
FS HN 365	Obesity and Weight Management	
FS HN 367	Medical Terminology for Health Professionals	
FS HN 403	Food Laws and Regulations	
FS HN 419	Foodborne Hazards	
FS HN 420	Food Microbiology	
FS HN 461	Medical Nutrition and Disease I	
FS HN 463	Community Nutrition	
FS HN 464	Medical Nutrition and Disease II	
FS HN 466	Nutrition Counseling and Education Methods	
FS HN 490C	Independent Study: Nutrition	
FS HN 499	Undergraduate Research	
FS HN 575	Processed Foods	
NUTRS 501	Biochemical and Physiological Basis of Nutrition: Macronutrients and Micronutrients	
NUTRS 503	Biology of Adipose Tissue	
NUTRS 504	Nutrition and Epigenetic Regulation of Gene Expression	
NUTRS 562	Assessment of Nutritional Status	
PHYS 111 or PHYS 221	General Physics Introduction to Classical Physics I	
PHYS 112 or PHYS 222	General Physics Introduction to Classical Physics II	
Total Credits		37

Electives: 0-12 cr. Select from any university coursework to earn at least 120 total credits. Students planning to apply to health professional programs should review entrance requirements and select appropriate courses as electives.

Concurrent B.S. and M.S. Program: Well-qualified students in Nutritional Science, pre-health professional and research option, who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both a Bachelor of Science (B.S.) degree in Nutritional Science and a Master of Science (M.S.) degree in Nutritional Sciences. For more information, refer to www.fshn.hs.iastate.edu (http://www.fshn.hs.iastate.edu)

COMMON CORE FOR FAMILY HEALTH, FOOD SERVICE, GLOBAL HEALTH AND POLICY, HEALTH COACH, AND NUTRITION AND WELLNESS OPTIONS

Total Degree Requirement: 120 cr.

Students must fulfill International Perspectives and U.S. Diversity requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communications/Library: 10 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 16-18 cr.

Select Humanities course from approved list		3
PSYCH 101	Introduction to Psychology	3
or PSYCH 230	Developmental Psychology	
SOC 134	Introduction to Sociology	3
POL S 344	Public Policy	3
FS HN 342	World Food Issues: Past and Present (this course can also meet the IP requirement)	3
ENSCI 201	Introduction to Environmental Issues	2
If H Sci student, select additional Humanities course		3

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from:		3-4
MATH 140	College Algebra	
MATH 143	Preparation for Calculus	
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Select at least 3 credits from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
Total Credits		6-8

Physical Sciences: 5 cr.

CHEM 163	College Chemistry	4
or CHEM 177	General Chemistry I	
CHEM 163L	Laboratory in College Chemistry	1
or CHEM 177L	Laboratory in General Chemistry I	
Total Credits		5

Biological Sciences: 19 cr.

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 255	Fundamentals of Human Anatomy	3
BIOL 255L	Fundamentals of Human Anatomy Laboratory	1
BIOL 256	Fundamentals of Human Physiology	3
BIOL 256L	Fundamentals of Human Physiology Laboratory	1
MICRO 201	Introduction to Microbiology	2
MICRO 201L	Introductory Microbiology Laboratory	1
Total Credits		19

Food Systems: 5 cr.

FS HN 242	The US Food System	3
FS HN 342	World Food Issues (course shown above)	
FS HN 442	Issues in Food and Society	2
Total Credits		5

Food Science and Human Nutrition: 36 cr.

FS HN 101	Food and the Consumer	3
FS HN 110	Professional and Educational Preparation	1
FS HN 111	Fundamentals of Food Preparation	2
FS HN 115	Food Preparation Laboratory	1
FS HN 167	Introduction to Human Nutrition	3
FS HN 203	Contemporary Issues in Food Science and Human Nutrition	1
FS HN 264	Fundamentals of Nutritional Biochemistry and Metabolism	3
or BBMB 301	Survey of Biochemistry	
FS HN 265	Nutrition for Active and Healthy Lifestyles	3
FS HN 361	Nutrition and Health Assessment	2
FS HN 364	Nutrition and Prevention of Chronic Disease	3
FS HN 365	Obesity and Weight Management	3

FS HN 366	Communicating Nutrition Messages	3
FS HN 403	Food Laws and Regulations	2
FS HN 463	Community Nutrition	3
FS HN 480	Professional Communication in Food Science and Human Nutrition	1
FS HN 495	Practicum	2
Total Credits		36

FAMILY HEALTH OPTION: 18 credits

HD FS 102	Individual and Family Development, Health, and Well-being	3
Select two of the following:		6
HD FS 223	Child Development and Health	
HD FS 226	Development and Guidance in Middle Childhood	
HD FS 227	Adolescent and Emerging Adulthood	
HD FS 234	Adult Development	
HD FS 249	Parenting and Family Diversity Issues	
HD FS 270	Family Communications and Relationships	
Select three of the following:		9
HD FS 367	Abuse and Illness in Families	
HD FS 373	Death as a Part of Living	
HD FS 377	Aging and the Family	
HD FS 395	Children, Families, and Public Policy	
HD FS 449	Program Evaluation and Proposal Writing	
HD FS 463	Environments for the Aging	
HD FS 479	Family Interaction Dynamics	

FOOD SERVICE OPTION: 17 credits

HSP M 380	Quantity Food Production Management	3
HSP M 380L	Quantity Food Production and Service Management Experience	2
HSP M 391	Foodservice Systems Management I	3
HSP M 392	Foodservice Systems Management II	3
ECON 101	Principles of Microeconomics	3
ACCT 284	Financial Accounting	3

GLOBAL HEALTH AND POLICY OPTION: 18 credits

GLOBE 201	Global Resource Systems	3
GLOBE 303	Agricultural, Food and Natural Global Resource Systems	3
ECON 101	Principles of Microeconomics	3
MICRO 310	Medical Microbiology	3
POL S 340	Politics of Developing Areas	3
FS HN 560	Global Nutrition	3

HEALTH COACH OPTION: 18 credits

KIN 258	Physical Fitness and Conditioning	2
KIN 358	Physiology of Exercise	3
KIN 458	Principles of Fitness Assessment and Exercise Prescription	4
PSYCH 101	Introduction to Psychology	3
or PSYCH 230	Developmental Psychology	
PSYCH 422	Counseling Theories and Techniques	3
PSYCH 485	Health Psychology	3

NUTRITION AND WELLNESS OPTION: 10-18 credits of electives

At least 9 credits of electives must be 300-400 level courses. Select from any university coursework to earn at least 120 total credits.

Go to FS HN courses.

Nutritional Science, B.S.

Options: Family Health[1], Food Service[2], Global Health & Policy[3], Health Coach[4], Nutrition & Wellness[5]

First Year

Fall	Credits	Spring	Credits
FS HN 110	1	FS HN 101	3
FS HN 167	3	CHEM 163 or 177	4
MATH 140, 143, 160, 165, or 181	3-4	CHEM 163L or 177L	1
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
ENGL 150	3	Course based on option:	3
LIB 160	1	HD FS 102[1]	
		ECON 101[2,3]	
		PSYCH 101 or 230[4]	
		Elective[5]	
	15-16		15

Second Year

Fall	Credits	Spring	Credits
FS HN 111	2	FS HN 203	1
FS HN 115	1	FS HN 242	3
FS HN 264 (Or, BBMB 301, if organic chem. completed)	3	FS HN 265	3
BIOL 255	3	BIOL 256	3
BIOL 255L	1	BIOL 256L	1
ENGL 250	3	MICRO 201	2

Course based on option:	2-3	MICRO 201L	1
HD FS course from list[1]			
ACCT 284[2]			
GLOBE 201[3]			
KIN 258[4]			
Elective[5]			
	15-16		14

Third Year

Fall	Credits	Spring	Credits
FS HN 364	3	FS HN 342	3
PSYCH 101 or 230	3	FS HN 361	2
SP CM 212	3	FS HN 365	3
STAT 104 or 101	3-4	FS HN 366	3
Course based on option:	3-5	Humanities (H Sci) or ENV S (AgLS)	2-3
HD FS course from list[1]		Course based on option:	3
HSP M 380 and 380L[2]		HD FS course from list[1]	
GLOBE 303[3]		Elective[2]	
PSYCH 485[4]		POL S 340[3]	
Elective[5]		KIN 358[4]	
		300-400 level elective[5]	
	15-18		16-17

Fourth Year

Fall	Credits	Spring	Credits
FS HN 442	2	FS HN 403	2
FS HN 463	3	FS HN 495	2
Humanities[1,2,4,5]	3	POL S 344	3
Or, FS HN 567[3]		FS HN 480	1
SOC 134	3	Course based on option:	3
Course based on option:	3	HD FS course from list[1]	
HD FS course from list[1]		HSP M 392[2]	
HSP M 391[2]		Humanities[3]	
MICRO 310[3]		KIN 458[4]	
300-400 level elective[5]		300-400 level elective[5]	
PSYCH 422[4]		Electives (choose electives to total at least 120 credits)	2-4
300-400 level elective[5]			
	14		13-15

1-5 Courses for options: Family Health[1], Food Service[2], Global Health & Policy[3], Health Coach[4], Nutrition & Wellness[5]

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

Nutritional Science, B.S.

Option: Pre-health professional & research

Freshman

Fall	Credits	Spring	Credits
FS HN 110	1	FS HN 167	3
CHEM 177	4	CHEM 178	3
CHEM 177L	1	CHEM 178L	1
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
ENGL 150	3	MATH 140, 143, 160, 165, or 181	3-4
LIB 160	1		
Humanities	3		
	17		14-15

Sophomore

Fall	Credits	Spring	Credits
CHEM 331	3	CHEM 332	3
CHEM 331L	1	CHEM 332L	1
BIOL 313	3	BBMB 301 or 316, or BBMB 404 and 405 the next year	3
STAT 101 or 104	3-4	FS HN 265	3
ENGL 250	3	FS HN 203	1
SP CM 212	3	Social Science	3
	16-17		14

Junior

Fall	Credits	Spring	Credits
BIOL 255	3	BIOL 256 and 256L, or 334 or 335 Physiology	3-4
BIOL 255L	1	FS HN 361	2
FS HN 360	3	FS HN 362	3
MICRO 201 or 302	2-3	Humanities/Social Sci. (H Sci) or ENV S (AgLS)	3
MICRO 201L or 302L	1	Additional course from approved list**	3
Humanities course (H Sci) or elective*	3		
FS HN 342	3		
	16-17		14-15

Senior			
Fall	**Credits**	**Spring**	**Credits**
FS HN 480	1	ENGL 314	3
FS HN 492	2	FS HN 467	3
Additional course from approved list**	3	Additional course from approved list**	3
Additional course from approved list**	3	US Diversity (if not already taken) or elective*	3
Additional course from approved list**	3	Elecitve*	2-3
Elective*	3		
	15		14-15

* Choose elective courses to total equal to or greater than 120 credits.

** Select at least 15 additional credits from: BIOL 314; FS HN 214 with lab (FS HN 115 or 215); FS HN 242, 311, 365, 367, 403, 419, 420, 461, 463, 464, 466, 490C, 499, 575; NUTRS 501, 503, 504, 562; PHYS 111 or 221; PHYS 112 or 222.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

Seed Science

Secondary Major

Administered by the Departments of Agricultural and Biosystems Engineering, Agronomy, Horticulture, and Plant Pathology. Must be taken as a secondary major in conjunction with a primary major. The seed science program is designed for students with career interests in one or more aspects of the seed industry. Areas of study focus on seeds including production, conditioning, pathology, physiology, quality control, marketing, and seed plant designs.

Curriculum in Seed Science (Secondary Major)

Complete Communication and Library requirements of primary major and 3 cr. from the following:

ENGL 302	Business Communication	3
ENGL 309	Proposal and Report Writing	3
ENGL 314	Technical Communication	3
SP CM 312	Business and Professional Speaking	3

Biological Sciences: 10 cr.

BIOL 211	Principles of Biology I	4
& 211L	and Principles of Biology Laboratory I	
or BIOL 212	Principles of Biology II	
& 212L	and Principles of Biology Laboratory II	
AGRON 316	Crop Structure-Function Relationships	3
or HORT 321	Horticulture Physiology	
BIOL 313	Principles of Genetics	3
or GEN 320	Genetics, Agriculture and Biotechnology	

Physical Sciences: 12-14 cr.

CHEM 163	College Chemistry	5
& 163L	and Laboratory in College Chemistry	
or CHEM 177	General Chemistry I	
& 177L	and Laboratory in General Chemistry I	
One of the following:		
AGRON 259	Organic Compounds in Plants and Soils	3
BBMB 221	Structure and Reactions in Biochemical Processes	3
CHEM 231	Elementary Organic Chemistry	4
& 231L	and Laboratory in Elementary Organic Chemistry	
One of the following:		
CHEM 178	General Chemistry II	4
& 178L	and Laboratory in College Chemistry II	
PHYS 111	General Physics	5
PHYS 115	Physics for the Life Sciences	4

Mathematical Sciences 6-9 cr.

MATH 140	College Algebra	3
or MATH 150	Discrete Mathematics for Business and Social Sciences	
Statistics course		3
Demonstration of computer proficiency in Excel or course in Computer Science.		0-3

Agricultural Sciences: 21 cr.

AGRON 181	Introduction to Crop Science	3
or HORT 221	Principles of Horticulture Science	
AGRON 182	Introduction to Soil Science	3
AGRON 206	Introduction to Weather and Climate	3
AGRON 354	Soils and Plant Growth	3
TSM 322	Preservation of Grain Quality	3
& 322L	and Preservation of Grain Quality Laboratory	
or TSM 433	Precision Agriculture	
6 credits from AGRON, HORT, or TSM (3 credits at 300-400 level)		6

Economics and Business: 9 cr.

ECON 101	Principles of Microeconomics	3
ECON 235	Introduction to Agricultural Markets	3
One course from the following:		3
ACCT 284	Financial Accounting	
ECON 102	Principles of Macroeconomics	
ECON 230	Farm Business Management	

ECON 336	Agricultural Selling	
MGMT 370	Management of Organizations	
MKT 340	Principles of Marketing	

Seed Science: 16 cr.

AGRON 338	Seed Science and Technology	3
AGRON 421	Introduction to Plant Breeding	3
AGRON 311	Professional Internship in Agronomy (seed related)	1
AGRON 317	Principles of Weed Science	3
ENT 376	Fundamentals of Entomology and Pest Management	3
PL P 408	Principles of Plant Pathology	3

Humanities, Ethics & Social Sciences (met with primary major); remaining credits (student choice)

Because seed science is a secondary major, the courses taken by the student during the first year will vary, depending on the primary major (see typical program for the primary major).

Sustainable Agriculture

Interdepartmental Graduate Major

The Sustainable Agriculture interdepartmental major is offered through faculty in 21 departments – Agricultural and Biosystems Engineering; Agricultural Education and Studies; Agronomy; Animal Science; Anthropology; Civil, Construction and Environmental Engineering; Community and Regional Planning; Ecology, Evolution and Organismal Biology; Economics; Entomology; Food Science and Human Nutrition; Horticulture; Industrial and Manufacturing Systems Engineering; Journalism and Mass Communication; Landscape Architecture; Mechanical Engineering; Natural Resource Ecology and Management; Plant Pathology; Political Science; Sociology; and Veterinary Diagnostic and Production Animal Medicine. Faculty in these departments cooperate to offer courses and direct research leading to M.S. and Ph.D. degrees with a major in Sustainable Agriculture.

The Sustainable Agriculture major is designed to balance depth in disciplinary knowledge and perspectives with broader, systems-level thinking. It integrates technical and social sciences through a sequence of team-taught interdisciplinary core courses emphasizing higher-order critical thinking skills and active, collaborative approaches to learning. Students learn agroecological principles, study social relations underlying sustainable farming and food systems, and gain experience with practical techniques of sustainable agriculture.

Applicants applying to the MS program must have a bachelor's degree in one of the life, social, or engineering sciences, or a bachelor's degree plus equivalent experience in these areas. Applicants applying to the PhD program must have a master's degree and either an undergraduate or master's degree in one of the majors in the College of Agriculture and Life Sciences or its equivalent.

Graduates of the program will be able to design and manage agricultural systems that increase food security, enhance human communities, and protect environmental quality. Graduates of the program are qualified to work in a variety of settings, including university research, education, extension, agribusiness, governmental and non-governmental organizations, and farming.

Information on application procedures (https://susag.iastate.edu/admissions), curriculum requirements (https://susag.iastate.edu/academics), and faculty research areas (https://susag.iastate.edu/dir/faculty) is available on the Sustainable Agriculture website (https://susag.iastate.edu).

Courses primarily for graduate students, open to qualified undergraduates:

SUSAG 509: Agroecosystems Analysis
(Cross-listed with AGRON, SOC). (3-4) Cr. 4. F.
Prereq: Senior or above classification
Experiential, interdisciplinary examination of Midwestern agricultural and food systems, emphasizing field visits, with some classroom activities. Focus on understanding multiple elements, perspectives (agronomic, economic, ecological, social, etc), and scales of operation.

SUSAG 515: Integrated Crop and Livestock Production Systems
(Cross-listed with A B E, AGRON, AN S). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: SUSAG 509
Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms.

SUSAG 530: Ecologically Based Pest Management Strategies
(Cross-listed with AGRON, ENT, PL P). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes.

SUSAG 546: Strategies for Diversified Food and Farming Systems
(Cross-listed with AGRON, HORT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: SUSAG 509
Project-focused engagement in food and farming systems using tools and perspectives drawn from multiple disciplines. Includes a field component.

SUSAG 571: Agroforestry Systems
(Cross-listed with NREM). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 6 credits in biological science at 300-level or above
Concepts of sustainable land use, agroecological dynamics, and component interactions of agroforestry systems. Agroforestry systems in temperate and tropical regions. Design and evaluation techniques for agroforestry systems. Ecological, socioeconomic and political aspects of agroforestry.
Meets International Perspectives Requirement.

SUSAG 584: Organic Agricultural Theory and Practice
(Cross-listed with AGRON, HORT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 9 cr. in biological or physical sciences
Understanding of the historical origins and ecological theories underpinning the practices involved in organic agriculture. Interdisciplinary examination of crop and livestock production and socio-economic processes and policies in organic agriculture from researcher and producer perspectives.

SUSAG 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification, permission of instructor
For students wishing to conduct in-depth study of a particular topic in sustainable agriculture.

SUSAG 599: Creative Component
Cr. arr. F.S.SS.
Pre-enrollment contract required. For MS students pursuing the non-thesis degree option. Final product is a creative component.

Courses for graduate students:

SUSAG 600: Sustainable Agriculture Colloquium
(1-0) Cr. 1. Repeatable. F.S.
Weekly seminar for graduate students in the Sustainable Agriculture program.

SUSAG 610: Foundations of Sustainable Agriculture
(Cross-listed with A B E, AGRON, ANTHR, SOC). (3-0) Cr. 3. F.
Prereq: Graduate classification, permission of instructor
Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts.

SUSAG 699: Research
Cr. arr. Repeatable. F.S.SS.
MS and PhD thesis and dissertation research.

Food Science and Human Nutrition

The Department of Food Science and Human Nutrition is jointly administered by the College of Agriculture and Life Sciences and the College of Human Sciences. All curricula offered by the department are available to students in either college. These majors include:

- Culinary food science
- Dietetics
- Diet and exercise
- Food science
- Nutritional science

Visit the department web site at: www.fshn.hs.iastate.edu (http://www.fshn.hs.iastate.edu).

Undergraduate Study

Culinary Food Science

Culinary food science is an interdisciplinary degree combining a strong food science foundation with acquisition of culinary skills. The program includes chemistry, organic chemistry, biology, microbiology, and biochemistry as well as quantity food production, fine dining management, and food safety and sanitation. Internship experience in the food industry or culinary business is required. Culinary food science graduates are qualified to work as managers and specialists in food research, product development, culinary applications, and food marketing and sales. For more information: http://www.fshn.hs.iastate.edu/undergraduate-programs/culinary-science/

Dietetics

The Didactic Program in Dietetics (DPD) is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics. The dietetics undergraduate curriculum meets the academic requirements as the DPD. Additionally, the curriculum for concurrent Bachelor's and Master's degrees in diet and exercise meets the academic requirements of the DPD. Graduates of the program are eligible to apply for admission to accredited dietetics internships/supervised practice programs. Upon successful completion of the experience program, graduates are eligible to take the national examination administered by the Commission on Dietetic Registration to become a Registered Dietitian (RD) / Registered Dietitian Nutritionist (RDN) and to practice in the field of dietetics. There is a $30 fee for a statement of verification of completion of the DPD. For information about verification statements policies, see the dietetics program website: http://www.fshn.hs.iastate.edu/undergraduate-programs/dietetics/.

Students interested in pursuing the dietetics program enter the university designated as pre-dietetics students. During spring semester of the second year, interested students apply to the Didactic Program in Dietetics. Admission to the program is based on overall GPA (3.0 or above required), completion of required coursework, completion of application

and demonstrated interest in becoming a registered dietitian. Upon admission, students progress toward earning a Bachelor of Science degree in dietetics and receive a Verification Statement upon graduation, which is needed to enter an accredited dietetics internship. The dietetics program includes study in basic sciences, nutrition, and food science with applications to medical dietetics, nutrition counseling and education, and community nutrition. Foodservice management is also an important aspect of the program. Graduates work in clinical settings, consulting, food companies, food services, sports or athletic programs, corporate wellness programs, care facilities for patients from neonatal to geriatric, and community or school health programs.

Diet and Exercise

A program for concurrent Bachelor of Science and Master of Science (BS/MS) degrees in diet and exercise (http://www.fshn.hs.iastate.edu/undergraduate-programs/diet-exercise) is available. The program is jointly administered by the Department of Food Science and Human Nutrition (FS HN), within the College of Agriculture and Life Sciences and College of Human Sciences, and the Department of Kinesiology within the College of Human Sciences. Students interested in this program enroll as pre-diet and exercise students. In the fall of the third year, students apply for admission to the BS/MS program. Students not accepted into the program can continue toward completion of the BS degree in dietetics or kinesiology and health. Coursework has been designed to facilitate a 4-year graduation date for those students not accepted into the program and electing to complete a single undergraduate degree. Students accepted into the program will progress toward completion of BS/MS degrees in diet and exercise.

Food Science

Food science is a discipline in which the principles of biological and physical sciences are used to study the nature of foods, the causes of their deterioration, and the principles underlying the processing and preparation of food. It is the application of science and technology to the provision of a safe, wholesome, and nutritious food supply. Biotechnology and toxicology interrelate with food science in the area of food safety. In the food industry, food scientists work in research and development of products or processes, production supervision, quality control, marketing and sales, test kitchens and recipe development, product promotion and communication. Food scientists also work in government regulatory agencies and academic institutions.

Two options are available in food science: food science and technology and food science and industry. Both options are approved by the Institute of Food Technologists, the national professional organization of food science. Career options include quality control/assurance; production supervision; management and sales; research careers in the food industry, government, or academia; business; journalism; food product formulation and recipe development; food promotion and communication; and consumer services in government and industry.

Students who have an interest in graduate study or research are encouraged to select the food science and technology option. Students who wish to combine education in engineering with food science may select additional courses in chemical or agricultural engineering. Double majors are available and may require an additional year. For more information: http://www.fshn.hs.iastate.edu/undergraduate-programs/food-science/

Students in food science have the opportunity to pursue a Master of Business Administration (http://www.fshn.hs.iastate.edu/undergraduate-programs/food-science) (MBA) concurrently with the Bachelor of Science (BS) degree in food science. The program is designed so students can earn both the BS in food science and MBA in five years, to meet the needs of students who are interested in management careers in the food industry. Students apply for admission to the MBA program in the spring of the third year. The program for concurrent BS in food science/MBA degrees is a rigorous 5-year program, and admission is very selective.

Nutritional Science

Nutritional science looks at the connection between diet and health. Students learn how diet can play a crucial role in the cause, treatment, and prevention of many diseases. There are degree program options within nutritional science. The pre-health professional and research option coursework prepares students for work in research laboratories, graduate study in nutrition or biological sciences, or entrance into health professional programs, such as medical, dental, physician assistant, and pharmacy schools. Students gain a strong science education along with human nutrition expertise. Additional options in family health, global health and policy, health coach, and nutrition and wellness prepare students for work positions in program planning and evaluation for community, public health, non-profit, and corporate wellness programs addressing the growing public interest in nutrition, wellness, and preventative health. Students learn about the role of nutrition and healthy eating for disease prevention and wellness. The food service option prepares students for school nutrition and food service management positions. For more information: http://www.fshn.hs.iastate.edu/undergraduate-programs/nutritional-science/

Departmental Learning Outcomes

Students graduating with degrees in culinary science, dietetics, diet and exercise, food science, or nutritional science will be able to: 1) demonstrate a high level of technical competence in their chosen field, perform successfully in a graduate program, supervised practice program or entry-level professional position; 2) communicate effectively as professionals; 3) successfully solve complex problems on their own and as members of a team; 4) correctly interpret and critically evaluate research literature as well as data from professional practice; 5) critically evaluate information related to food science and nutrition issues appearing in the popular press; 6) prepare and deliver

effective presentations, orally and in writing, of technical information to professionals and to the general public; 7) thoughtfully discuss ethical, social, multicultural, and environmental dimensions of issues facing professionals in their chosen field. For more information: http://www.fshn.hs.iastate.edu/undergraduate-programs/outcomes/

Communication Proficiency is certified by a grade of C or better in 6 credits of coursework in composition (ENGL 150 Critical Thinking and Communication and ENGL 250 Written, Oral, Visual, and Electronic Composition or other communication-intensive courses) and a grade of C or better in 3 credits of coursework in oral communication.

Minors - Undergraduate

The department offers coursework for a variety of minors (http://www.fshn.hs.iastate.edu/undergraduate-programs/minors). Minors available include:

- culinary food science
- food safety (interdepartmental minor)
- food science
- nutrition
- food and society

All minors have the following requirements:

- At least 15 credits must be taken, including at least 6 credits taken at Iowa State University in courses numbered 300 or above.
- The minor must include at least 9 credits that are not used to meet any other college or university requirement.
- The same courses may not be applied to two different minors.

Prerequisites: Students must complete prerequisite requirements for courses included in the minor.

Graduate Study

The Food Science and Human Nutrition (FSHN) Department offers coursework for the degrees master of science and doctor of philosophy. Degree options include:

- food science and technology (http://www.fshn.hs.iastate.edu/graduate-program/food-science-technology) (MS and PhD)
- meat science (http://www.ans.iastate.edu/section/meat/?pg=degree) (MS and PhD; co-major in animal science)
- nutritional sciences (http://www.fshn.hs.iastate.edu/graduate-program/nutritional-sciences) (MS and PhD; interdepartmental graduate program)
- family and consumer sciences/dietetics (http://www.fshn.hs.iastate.edu/graduate-program/mfcs-dietetics) (MS only)
- diet and exercise (http://www.hs.iastate.edu/academics/majors-list/diet-and-exercise) (BS/MS)
- nutritional sciences (BS/MS)

Prerequisite to major work is a baccalaureate degree in food science, nutrition, other physical/biological sciences or engineering that is substantially equivalent to those at Iowa State University.

Students taking major work for the degree doctor of philosophy either in food science and technology or in nutritional sciences may choose minors from other fields including anthropology, biorenewable resources and technology, chemistry, biochemistry, economics, education, journalism, microbiology, psychology, physiology, statistics, toxicology, or other related fields.

The interdepartmental graduate program in nutritional sciences, administered through the Graduate College, under the auspices of the Chairs of FSHN and Animal Science, will provide the structure for coordinating and enhancing interdisciplinary nutrition research and graduate education. Graduate students will be able to select from three specializations: animal nutrition, human nutrition, or molecular/biochemical nutrition. The two main departments are FSHN and Animal Science, whereas other departments (such as Kinesiology; Biochemistry, Biophysics, and Molecular Biology; Agronomy; and Statistics) may also be involved.

The department participates in an online Master of Family and Consumer Sciences/Dietetics in conjunction with Colorado State University, Kansas State University, North Dakota State University, Oklahoma State University, South Dakota State University, University of Kansas Medical Center, and University of Nebraska through the Great Plains Interactive Distance Education Alliance. Students who are registered dietitians and are eligible for admission to the FSHN Master's degree program may be admitted.

The department offers work for concurrent B.S. and M.S. degree programs that allow students to obtain both the B.S. and M.S. degrees in 5 years. The programs are available to students majoring in nutritional science or pre-diet and exercise, and students progress toward M.S. degrees in nutritional sciences or diet and exercise, respectively. Students interested in these programs should contact the department for details. Application for admission to the Graduate College should be made during the junior year. Students begin research for the M.S. thesis or creative component during the summer after their junior year and are eligible for research assistantships.

Students graduating with advanced degrees in nutritional sciences and in food science and technology will demonstrate competency in their chosen discipline. Measurable outcomes will include the ability to: 1) design, conduct, and interpret research; 2) apply theoretical information to solve practical problems; 3) prepare and communicate discipline-

specific information in written and oral forms to scientific and lay audiences; 4) facilitate learning in the classroom; 5) submit a paper for publication in a peer-reviewed journal; and 6) secure professional-level positions in academia, industry, government, or health care.

Minors - Graduate

The department offers coursework for graduate minors in:

- food science/technology (http://www.fshn.hs.iastate.edu/graduate-program/food-science-technology/#minor-in-food-science-and-technology)
- nutritional sciences (http://www.fshn.hs.iastate.edu/graduate-program/nutritional-sciences/#minor-in-nutritional-sciences)

Food Science and Technology Graduate Minor students must complete the following:

- 9 to 12 credits. Students without a background in food chemistry, food engineering/processing, and/or food microbiology are required to take FSHN 511, 513, and/or 514, respectively, in which case the graduate minor will constitute up to 12 credits.
- 9 credits of graduate level food science coursework as approved by the POS committee.
- Maximum of 3 credits at the 400 level.

Nutritional Sciences Graduate Minor students must complete the following:

- 9 to 12 credits are required. Students who have not taken FSHN 360 or its equivalent (advanced nutrition with a biochemistry perquisite) will need to take FSHN 360, in which case the Nutrition Graduate minor will constitute 12 credits.
- 9 credits of graduate level nutrition courses as approved by the POS Committee.
- NUTRS 501

Certificate - Undergraduate

Health Coach (http://www.fshn.hs.iastate.edu/undergraduate-programs/health-coach-certificate)

The undergraduate health coach certificate provides a rigorous academic and theoretical background in three components of health (nutrition, exercise and motivational coaching) required to prepare workers for the challenges of being a health coach.

Certificates - Graduate

Food Safety and Defense (http://www.fshn.hs.iastate.edu/graduate-program/food-safety-defense)

The department offers an online 12-13 credit Graduate Certificate in Food Safety and Defense, in conjunction with the University of Nebraska, Lincoln, Kansas State University and the University of Missouri through the Great Plains Interactive Distance Education Alliance. Students may be admitted if qualified for admission to the food science master's degree program .

Dietetics Internship (http://www.dietetics.iastate.edu)

The Iowa State University Dietetics Internship (DI) began as an AP4 program in 1989. It meets the performance requirements for supervised practice programs for students who have completed the academic requirements of the Academy of Nutrition and Dietetics. The internship is administered through the Department of Food Science and Human Nutrition. Interns are admitted to Iowa State University as graduate students seeking a "Graduate Certificate in Dietetics Internship" which will be indicated on the final transcript. Successful completion of this program will result in the receipt of the DI Verification Statement which establishes eligibility to sit for the national standardized exam administered by the Commission on Dietetic Registration (CDR). Successful completion of the exam results in the Registered Dietitian (RD) / Registered Dietitian Nutritionist (RDN) credential. There is a nonrefundable application fee of $75.

Courses primarily for undergraduates:

FS HN 101: Food and the Consumer
(3-0) Cr. 3. F.S.
Prereq: High school biology and chemistry or 3 credits each of biology and chemistry
The food system from point of harvest to the consumption of the food by the consumer. Properties of food constituents. Protection of food against deterioration and microbial contamination. Introduction of foods into the marketplace. Processes for making various foods. Government regulations. Use of food additives. Current and controversial topics. Electronic communication from web emphasized for class reports, notes and assignments.

FS HN 102: Nutrition for Sport Performance
(1-0) Cr. 1. F.S.
Analysis of how the body uses nutrients for energy and how to select a balanced diet to meet specific athletic performance needs. Lecture and activities specific to students' interest.

FS HN 104: Introduction to Professional Skills in Culinary Science
(0-6) Cr. 1. S.
Introduction to culinary science. Students will develop fundamental culinary skills by arranged on-campus work experience (100 hours). Sessions with instructor arranged.

FS HN 110: Professional and Educational Preparation
(1-0) Cr. 1. F.S.
Introduction to professional and educational development within the food science and human nutrition disciplines. Focus is on university and career acclimation as well as enhancement of communication skills. Offered on a satisfactory-fail basis only.

FS HN 111: Fundamentals of Food Preparation
(2-0) Cr. 2. F.S.
Prereq: FS HN 101 or FS HN 167; high school chemistry or CHEM 160; concurrent enrollment in FSHN 115.
Principles involved in preparation of food products of standard quality. Influence of composition and techniques on properties of food products.

FS HN 115: Food Preparation Laboratory
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in FS HN 111 or FS HN 214
Practice standard methods of food preparation with emphasis on quality, nutrient retention, and safety.

FS HN 120: The Biochemistry of Beer
(Cross-listed with BBMB). (2-0) Cr. 2. F.
An introduction to the major classes of biomolecules, basic biochemical concepts, enzymology, metabolism and genetic engineering as they apply to the production and flavor of beer. All aspects of the biochemistry of beer will be covered, including the malting of barley, starch conversion, yeast fermentation and the chemical changes that occur during the aging of beer. Intended for non-majors. Natural science majors are limited to elective credit only.

FS HN 167: Introduction to Human Nutrition
(3-0) Cr. 3. F.S.SS.
Prereq: High school biology or 3 credits of biology
Understanding and implementing present day knowledge of nutrition. The role of nutrition in the health and well being of the individual and family.

FS HN 203: Contemporary Issues in Food Science and Human Nutrition
(1-0) Cr. 1. F.S.
Introduction to published research and discussion of current issues in food science and human nutrition. Emphasis on sources of credible information, ethics, and communication.

FS HN 214: Scientific Study of Food
(3-0) Cr. 3. F.S.
Prereq: FS HN 167 or FS HN 265; CHEM 231 or CHEM 331; plus concurrent enrollment in FS HN 115 or 215
Composition and structure of foods. Principles of preparation of standard quality food products. Behavior and interactions of food constituents.

FS HN 215: Advanced Food Preparation Laboratory
(0-6) Cr. 2. F.S.
Prereq: Credit or enrollment in FS HN 214
Practice standard methods of food preparation with emphasis on quality, nutrient retention, and safety. Development of culinary skills and advanced food preparation.

FS HN 242: The US Food System
(3-0) Cr. 3. S.
Exploration of the components of our food system including food production, food processing, and food access and the social, political and ethical influences on these components. Controversial topics related to how food is produced, processed, marketed and consumed will be discussed.

FS HN 264: Fundamentals of Nutritional Biochemistry and Metabolism
(3-0) Cr. 3. F.
Prereq: FS HN 167; CHEM 163, CHEM 163L; BIOL 211
Digestion, absorption, metabolism, and biochemical functions of nutrients. Biochemical aspects of nutrient deficiencies.

FS HN 265: Nutrition for Active and Healthy Lifestyles
(3-0) Cr. 3. S.
Prereq: FS HN 167, plus credit or enrollment in BBMB 301 or credit in FS HN 264
Fundamentals of nutrient metabolism and nutrient requirements. Role of macronutrient metabolism in physical performance and disease prevention. Effect of manipulation of macronutrient metabolism on physical performance and disease prevention. Applications of nutrient metabolism principles to dietary recommendations and planning.

FS HN 276: Understanding Grape and Wine Science
(Cross-listed with HORT). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: High school biology and chemistry.
A scientific introduction to viticulture (grape-growing) and enology (wine-making). Topics include grape species and varieties, viticulture practices, fruit quality, geography, history, principles of fermentation and aging, wine classification, appreciation, evaluation, storage and service, regulations, wine as food. No wine tasting.

FS HN 308: Dairy Products: Current Issues and Controversies
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Course will address milk chemistry, microbiology, handling, processing, regulations, organic production, and nutrition; dispel myths about dairy foods; improve critical thinking and communication skills. Students will participate in structured controversies and debate.

FS HN 311: Food Chemistry
(3-0) Cr. 3. F.
Prereq: CHEM 231 and CHEM 231L or CHEM 331 and CHEM 331L; credit or enrollment in BBMB 301
The structure, properties, and chemistry of food constituents and animal and plant commodities.

FS HN 311L: Food Chemistry Laboratory
(0-3) Cr. 1. F.
Prereq: Credit or concurrent enrollment in FSHN 311.
The laboratory practices of structure, properties, and chemistry of food constituents.

FS HN 314: Foundations of Culinary Science
(1-0) Cr. 1. S.
Prereq: FSHN 104 or concurrent enrollment in FSHN 104.
Introduction to the roles culinary scientists hold within industry including product development, research, and quality assurance. Discussions focused on professional and educational development, enhancement of communication skills, ethics and emerging issues and trends in culinary science.

FS HN 340: Foundations of Dietetic Practice
(1-0) Cr. 1. F.
Prereq: DIET or PDEX classification
Introduction to the profession of dietetics and responsibilities associated with dietetic professional practice. Emphasis on exploring career options in dietetics and preparation for a dietetic internship. Leadership and professional career development for the dietitian is addressed through self reflection, creation of materials for post-baccalaureate programs and job shadowing experience. Professional issues related to dietetic practice include Code of Ethics, legal credentialing and standards of professional practice, leadership and future trends in the profession. Offered on a satisfactory-fail basis only.

FS HN 342: World Food Issues: Past and Present
(Cross-listed with AGRON, ENV S, T SC). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

FS HN 351: Introduction to Food Engineering Concepts
(3-0) Cr. 3. S.
Prereq: A course in calculus and physics (PHYS 111 or PHYS 115)
Methodology for solving problems in food processing and introduction to food engineering concepts including food properties, material and energy balances, sources of energy, thermodynamics, fluid flow, heat transfer, and mass transfer.

FS HN 360: Advanced Human Nutrition and Metabolism
(3-0) Cr. 3. F.
Prereq: FS HN 265, 3 credits in biochemistry; 3 credits in physiology recommended
Physiological and biochemical basis for nutrient needs; assessment of nutrient deficiency and toxicity; examination of nutrient functions and regulation of metabolism; nutrient-gene interactions.

FS HN 361: Nutrition and Health Assessment
(1-3) Cr. 2. S.
Prereq: FS HN 265; 3 credits in statistics; 3 credits in physiology recommended
The assessment of nutritional status in healthy individuals. Laboratory experiences in food composition and assessment of dietary intake, body composition, and biochemical indices of nutritional status.

FS HN 362: Nutrition in Growth and Development
(3-0) Cr. 3. S.
Prereq: FS HN 360; credit or enrollment in a course in physiology
Nutrient needs throughout the life cycle. Interrelationships of genes, gene expression and nutrients with physiological outcomes during human development and aging.

FS HN 364: Nutrition and Prevention of Chronic Disease
(3-0) Cr. 3. F.
Prereq: BIOL 256, BIOL 256L or BIOL 306
Overview of nutrients, their functions, metabolism, food sources and optimal choices for the promotion of health and wellness. Nutrition strategies for the prevention of chronic disease, including cancer, diabetes and obesity, as they apply to individuals or the wider population will be discussed.

FS HN 365: Obesity and Weight Management
(3-0) Cr. 3. S.
Prereq: BIOL 256 and BIOL 256L, or BIOL 306
Multifactorial aspects of obesity, maintenance of healthy weight, and the relationship of weight status and chronic disease prevention. Traditional and novel nutrition and exercise theories as well as current popular diet and exercise trends will be discussed.

FS HN 366: Communicating Nutrition Messages
(3-0) Cr. 3. S.
Prereq: FS HN 264 or FS HN 265
Theory and application of adult learning and behavior change as it relates to the role of nutrition in health promotion and disease prevention. Discussion of nutrition education and interventions relative to various models. Factors to consider in developing the nutrition education/intervention practicum experience. Focus on communication strategies for providing nutrition messages to diverse community audiences using various forms of media and outreach (print, radio, TV, newspaper, consumer publications, websites, community venues). Development of nutrition messages using various forms of media for a target population.

FS HN 367: Medical Terminology for Health Professionals
(1-0) Cr. 1. F.S.SS.
An independent course focused on medical terminology, abbreviations, and simple clinical mathematical calculations. (offered online only).

FS HN 403: Food Laws and Regulations
(2-0) Cr. 2. S.SS.
Prereq: 3 credits in food science coursework at 200 level or above
History of food law in the US and the world. Relationship between policy, legislation and regulation. Introduction to primary US regulatory agencies and enforcement principles. Discussion of key laws related to food safety and nutrition. Overview of federal and independent research tools and sources of food law.

FS HN 405: Food Quality Assurance
(Dual-listed with FS HN 505). (2-3) Cr. 3.
Prereq: FS HN 214 or FS HN 311; STAT 101 or STAT 104
Basis of food quality control/assurance programs and establishment of decision-making processes using official (government and industry) instrumental, chemical, and sensory procedures. Statistical process and quality control procedures and their applications to various food systems. Development of hazard analysis procedures, specifications, grades, standards, and the procedures and processes which can affect the overall microbiological safety of the food. Successful completion of the course will result in certification in Preventive Controls for Human Food (FSMA).

FS HN 406: Sensory Evaluation of Food
(Dual-listed with FS HN 506). (2-3) Cr. 3. F.
Prereq: FS HN 214 or FS HN 311 or AN S 360; 3 credits in statistics
Sensory evaluation techniques used to evaluate the appearance, aroma, flavor, texture and acceptability of foods. Relationships between sensory and instrumental measurements of color and texture. Work independently and cooperatively (in a team) to identify sensory evaluation objectives, write hypotheses, design and conduct experiments, and analyze and interpret data.

FS HN 407: Microbiological Safety of Foods of Animal Origins
(Dual-listed with FS HN 507). (Cross-listed with MICRO). (3-0) Cr. 3. S.
Prereq: MICRO 420
Examination of the various factors in the production of foods of animal origin, from animal production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. The two modules of this course will be 1) the procedures and processes which can affect the overall microbiological safety of the food, and 2) the Hazard Analysis Critical Control Point (HACCP) system.

FS HN 408: Dairy Products Evaluation
(0-3) Cr. 1. S.
Prereq: Permission of instructor
Gain experience in identifying quality defects in dairy products including milk, cottage cheese, cheddar cheese, strawberry yogurt, butter, and vanilla ice cream. Intensive training for the National Collegiate Dairy Products Evaluation competition and for dairy product evaluation in the food industry.

FS HN 410: Food Analysis
(2-3) Cr. 3. F.
Prereq: FS HN 214 or FS HN 311 or CHEM 211
An introduction to the theory and application of chemical and instrumental methods for determining the constituents of food. Use of standard procedures for food analysis and food composition data bases.

FS HN 411: Food Ingredient Interactions and Formulations
(1-3) Cr. 2. F.S.
Prereq: FSHN 214 or FS HN 311 and FS HN 115, FS HN 215 or FS HN 311L.
Application of food science principles to ingredient substitutions in food products. Laboratory procedures for standard formulations and instrumental evaluation, with emphasis on problem-solving and critical thinking.

FS HN 412: Food Product Development
(Dual-listed with FS HN 512). (1-6) Cr. 3. F.S.
Prereq: FS HN 311 or FS HN 411
Principles of developing consumer packaged food products. Application of skills gained in food chemistry, formulation, microbiology, and processing. Some pilot plant experiences. Electronic communication from web emphasized for class reports, notes and assignments.

FS HN 419: Foodborne Hazards
(Cross-listed with MICRO, TOX). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MICRO 201 or MICRO 302, a course in biochemistry
Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

FS HN 420: Food Microbiology
(Cross-listed with MICRO, TOX). (3-0) Cr. 3.
Prereq: MICRO 201 or MICRO 302
Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications.

FS HN 421: Food Microbiology Laboratory
(Cross-listed with MICRO). (0-6) Cr. 3.
Prereq: MICRO 201 or MICRO 302; MICRO 201L or MICRO 302L. Credit or enrollment in FS HN/MICRO 420
Standard techniques used for the microbiological examination of foods. Independent and group projects on student-generated questions in food microbiology. Emphasis on oral and written communication and group interaction.

FS HN 440: Bioprocessing and Bioproducts
(Dual-listed with FS HN 540). (Cross-listed with C E). (3-0) Cr. 3. F.
Prereq: C E 326 or equivalent, MATH 160 or MATH 165, CHEM 167 or higher, BIOL 173 or BIOL 211 or higher, senior or graduate classification
Sustainability, cleaner production. Taxonomy, kinetics, metabolism, microbial cultivation, aerobic and anaerobic fermentation. Antibiotics, food supplements, fermented foods, vitamin production. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis.

FS HN 442: Issues in Food and Society
(2-0) Cr. 2. F.
Prereq: FS HN 242, FS HN 342
In-depth discussion, synthesis, and analysis of domestic and international food issues including: food systems from farm to fork, poverty and world hunger, overnutrition, population, agriculture and the environment, ethics, biotechnology, and policy.

FS HN 460: Global Nutrition
(Dual-listed with NUTRS 560 FS HN 560). (3-0) Cr. 3.
Prereq: FS HN 361 or equivalent; senior or graduate standing
An overview of global nutrition issues, including the sociocultural, biological, economic, and environmental context of nutrition related topics. The etiology, epidemiology, and program/policy responses to issues will be presented. Areas to be covered include childhood malnutrition, growth stunting, micronutrient deficiencies, parasites and nutrition, sanitation, and obesity and chronic disease incidence in developing countries. Participatory course, students will engage in a series of class activities, discussions, and presentations.

FS HN 461: Medical Nutrition and Disease I
(4-0) Cr. 4. F.
Prereq: FS HN 360, FS HN 361, FS HN 367; plus BIOL 256 and 256L or BIOL 306 or BIOL 335
(Dual-listed with NutrS 561) Pathophysiology of selected chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state.

FS HN 463: Community Nutrition
(3-0) Cr. 3. F.
Prereq: FS HN 265 or FS HN 360; FS HN 366 recommended
Dual-listed with NutrS 563. Survey of current public health nutrition problems among nutritionally vulnerable individuals and groups. Discussion of the multidimensional nature of those problems and of community programs addressing them. Grant writing as a means for funding community nutrition program development. Significant emphasis on written and oral communication at the lay and professional level. Field trip.
Meets U.S. Diversity Requirement

FS HN 464: Medical Nutrition and Disease II
(3-0) Cr. 3. S.
Prereq: FS HN 360, FS HN 461; plus BIOL 256 and BIOL 256L or BIOL 306 or BIOL 335
(Dual-listed with NutrS 564) Pathophysiology of selected acute and chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state.

FS HN 466: Nutrition Counseling and Education Methods
(Dual-listed with FS HN 566). (2-2) Cr. 3. F.
Prereq: FS HN 361 and FS HN 362
Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories.

FS HN 467: Molecular Basis of Nutrition in Disease Prevention
(3-0) Cr. 3. S.
Prereq: FS HN 360 or equivalent
Understanding the molecular basis for the role of diet in the development and prevention of common diseases such as diabetes, cancer, and vascular diseases. Translating this understanding into practical approaches for improving the health of individuals and populations.

FS HN 471: Food Processing I
(2-3) Cr. 3. F.
Prereq: FS HN 351 or A E 451 or CH E 357; MICRO 201 or 302; CHEM 163 or 177.
Principles and applications of food processing by application of heat (blanching, pasteurization, canning, extrusion, evaporation and distillation, extrusion and dehydration) and by removal of heat (refrigeration and freezing). Emphasis on solving problems in laboratory and recitation sessions.

FS HN 472: Food Processing II
(2-3) Cr. 3. S.
Prereq: FS HN 351 or A E 451 or CH E 357.
Principles and applications of food processing by biological 9fermentation, enzymes) and nontraditional (high pressure, irradiation, pulsed electric field) preservation methods. Includes packaging, waste water treatment, and sanitation. Emphasis on solving problems in laboratory and recitation sessions.

FS HN 480: Professional Communication in Food Science and Human Nutrition
(1-0) Cr. 1. F.S.
Prereq: FS HN 203, senior classification in the department
Presentation of current topics using written and oral communication to a lay audience. Emphasis on communication skills for the profession.

FS HN 489: Issues in Food Safety
(Cross-listed with AN S, HSP M, VDPAM). (1-0) Cr. 1. S.
Prereq: Credit or enrollment in FS HN 101 or FS HN 272 or HSP M 233; FS HN 419 or FS HN 420; FS HN 403
Capstone seminar for the food safety minor. Case discussions and independent projects about safety issues in the food system from a multidisciplinary perspective.

FS HN 490: Independent Study
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490A: Independent Study: Dietetics
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490B: Independent Study: Food Science
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490C: Independent Study: Nutrition
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490D: Independent Study: International Experience
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490E: Independent Study: Entrepreneurship
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490H: Independent Study: Honors
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 491: Supervised Work Experience
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 491A: Supervised Work Experience: Dietetics
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 491B: Supervised Work Experience: Food Science
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 491C: Supervised Work Experience: Nutrition
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 491D: Supervised Work Experience: Culinary Science
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 492: Research Concepts in Human Nutrition
(1-3) Cr. 2. F.
Prereq: senior classification or permission of instructor; FS HN 360
Students will develop and implement research projects with faculty supervision, based on knowledge gained from nutrition, biology and chemistry courses. Students will prepare a research proposal, conduct research and report results. Students will gain appreciation for independent research and experience creative and innovative aspects of nutrition research.

FS HN 493: Food Preparation Workshop
(1-3) Cr. 1-3.
Selected topics in food preparation including scientific principles, culture and culinary techniques. Variable format may include laboratory, recitation, and lecture. Offered on a satisfactory-fail basis only.

FS HN 495: Practicum
(1-3) Cr. 2. F.S.
Prereq: Senior classification in Nutritional Science-Nutrition and Wellness option or permission of instructor; FS HN 366; credit or enrollment in FS HN 463.
Students will develop, implement and assess a community-based project that engages groups in learning and practicing concepts related to nutrition and wellness. Assessed service learning component.

FS HN 496: Food Science and Human Nutrition Travel Course
(Dual-listed with FS HN 596). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled and 1 credit for pre-departure class, if offered.) Limited enrollment. Tour and study of food industry, culinary science, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

FS HN 496A: Food Science and Human Nutrition Travel Course: International travel
(Dual-listed with FS HN 596A). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.
Meets International Perspectives Requirement.

FS HN 496B: Food Science and Human Nutrition Travel Course: Domestic travel
(Dual-listed with FS HN 596B). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

FS HN 498: Cooperative Education
Cr. R. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Permission of department chair.
Required for students completing professional work periods in a cooperative education program. Students must register prior to commencing each work period. Offered on a satisfactory-fail basis only.

FS HN 499: Undergraduate Research
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of staff member with whom student proposes to work
Research under staff guidance. A maximum of 6 credits of FS HN 499 may be used toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

FS HN 505: Food Quality Assurance
(Dual-listed with FS HN 405). (2-3) Cr. 3.
Prereq: FS HN 214 or FS HN 311; STAT 101 or STAT 104
Basis of food quality control/assurance programs and establishment of decision-making processes using official (government and industry) instrumental, chemical, and sensory procedures. Statistical process and quality control procedures and their applications to various food systems. Development of hazard analysis procedures, specifications, grades, standards, and the procedures and processes which can affect the overall microbiological safety of the food. Successful completion of the course will result in certification in Preventive Controls for Human Food (FSMA).

FS HN 506: Sensory Evaluation of Food
(Dual-listed with FS HN 406). (2-3) Cr. 3. F.
Prereq: FS HN 214 or FS HN 311 or AN S 360; 3 credits in statistics
Sensory evaluation techniques used to evaluate the appearance, aroma, flavor, texture and acceptability of foods. Relationships between sensory and instrumental measurements of color and texture. Work independently and cooperatively (in a team) to identify sensory evaluation objectives, write hypotheses, design and conduct experiments, and analyze and interpret data.

FS HN 507: Microbiological Safety of Foods of Animal Origins
(Dual-listed with FS HN 407). (Cross-listed with MICRO). (3-0) Cr. 3. S.
Prereq: MICRO 420
Examination of the various factors in the production of foods of animal origin, from animal production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. The two modules of this course will be 1) the procedures and processes which can affect the overall microbiological safety of the food, and 2) the Hazard Analysis Critical Control Point (HACCP) system.

FS HN 511: Integrated Food Science
(3-0) Cr. 3. F.
Prereq: 3 credits in each of organic chemistry, physics, mathematics, and microbiology.
Critical review of the key principles of food science and applications in the chemistry, microbiology, and processing of food. Understanding of the impact of processing on the quality of foods with respect to composition, quality and safety.

FS HN 512: Food Product Development
(Dual-listed with FS HN 412). (1-6) Cr. 3. F.S.
Prereq: FS HN 311 or FS HN 411
Principles of developing consumer packaged food products. Application of skills gained in food chemistry, formulation, microbiology, and processing. Some pilot plant experiences. Electronic communication from web emphasized for class reports, notes and assignments.

FS HN 519: Food Toxicology
(Cross-listed with NUTRS, TOX). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A course in biochemistry
Basic principles of toxicology. Toxicants in the food supply: modes of action, toxicant defense systems, toxicant and nutrient interactions, risk assessment. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

FS HN 521: Microbiology of Food
(2-0) Cr. 2. S.SS.
Prereq: A course in microbiology with laboratory; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
This course deals with the identification, enumeration, and characterization of bacteria, yeasts, and mold associated with foods and food processing. Effects of physical and chemical agents on micro-organisms will be studied. Microbiological problems in food spoilage, food preservation, food fermentation, and food-borne disease will be discussed. Offered online only.

FS HN 522: Advanced Food Microbiology and Biotechnology
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Food microbiology, a course in biochemistry; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
This course will cover basic principles in biotechnology and applied food microbiology, including current topics of interest in food biotechnology. Students will be introduced to recombinant DNA techniques and how they are applied to genetically modify microorganisms, the use of nucleic acids as tools of rapid detection of microorganisms in foods, basic enzyme immobilization and down-stream processing techniques, and regulatory aspects of food biotechnology. Offered online only.

FS HN 523: A Multidisciplinary Overview of Food Safety and Security
(2-0) Cr. 2. F.SS.
Prereq: A course in biology or chemistry; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Multidisciplinary food safety and security perspectives provided by numerous subject matter experts. Topics include food safety policy, ag bioterrorism, border security, animal ID, food defense and site security, risk analysis, crisis communication, epidemiology, HACCP, and more. Offered online only.

FS HN 524: Food Microbiology
(3-0) Cr. 3. F.
Prereq: A course in microbiology with laboratory; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Food Microbiology looks at the nature, physiology, and interactions of microorganisms in foods. The course is an introduction to food-borne diseases, the effect of food processing systems on the microflora of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. Additionally, the course looks at food plant sanitation and criteria for establishing microbial standards for food products. Offered online only.

FS HN 525: Principles of HACCP
(2-0) Cr. 2. F.
Prereq: Undergraduate biology and chemistry courses;enrollment in GP-IDEA Food Safety and Defense Certificate or permission of instructor.
A comprehensive study of the Hazard Analysis and Critical Control Point System and its application in the food industry. Offered online only.

FS HN 526: Ethnic Foods: Food Safety, Food Protection and Defense
(2-0) Cr. 2. SS.
Prereq: Graduate standing; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Understanding of the various factors that impact safety of ethnic and imported ethnic foods; knowledge about the handling, preparation, processing and storage of ethnic and imported foods and food products; science-based characterization of representative ethnic foods. Offered online only.

FS HN 527: Microbiology of Fermented Foods
(2-0) Cr. 2. SS.
Prereq: Food microbiology; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Microbiology of fermented foods covers the physiology, biochemistry, and genetics of microorganisms important in food fermentations. The course looks at how microorganisms are used in fermentations and the effects of processing and manufacturing conditions on production of fermented foods. Offered online only.

FS HN 528: Food Protection and Defense-Essential Concepts
(2-0) Cr. 2. S.
Prereq: Enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
This course will provide students with an understanding of the principles required in a food defense program for a food manufacturing, warehousing or distribution center. The topics covered include: defining threats and aggressors; the Bioterrorism Act; food defense teams; vulnerability assessments; security programs; recall and traceability basics; security inspections; crisis management; emergency preparedness; and workplace violence. Offered online only.

FS HN 529: Foodborne Toxicants
(Cross-listed with TOX). (2-0) Cr. 2. F.
Prereq: A course in biochemistry; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Mechanisms of action, metabolism, sources, remediation/detoxification, risk assessment of major foodborne toxicants of current interest, design of HAACP plans for use in food industries targeting foodborne toxicants, discussion of toxicants from a food defense perspective. Offered online only.

FS HN 540: Bioprocessing and Bioproducts
(Dual-listed with FS HN 440). (Cross-listed with BRT, C E). (3-0) Cr. 3. F.
Prereq: C E 326 or equivalent, MATH 160 or MATH 165, CHEM 167 or higher, BIOL 173 or BIOL 211 or higher, senior or graduate classification
Sustainability, cleaner production. Taxonomy, kinetics, metabolism, microbial cultivation, aerobic and anaerobic fermentation. Antibiotics, food supplements, fermented foods, vitamin production. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis.

FS HN 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

FS HN 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

FS HN 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

FS HN 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

FS HN 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

FS HN 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

FS HN 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

FS HN 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

FS HN 554: Dietetic Internship I
(0-22) Cr. 5. S.SS.
For students enrolled in the Dietetic Internship program only. Supervised practice experience in operational management, medical nutrition therapy and community nutrition. Capstone research project: Technology in Health Promotion. Experiences and activities designed to meet accreditation standards.

FS HN 555: Dietetic Internship II
(0-18) Cr. 4. F.S.
Prereq: Concurrent enrollment or successful completion of FS HN 554
For students enrolled in the Dietetic Internship program only. Supervised practice experience in operational management, medical nutrition therapy and community nutrition. Capstone research project: Leadership Challenge. Experiences and activities designed to meet accreditation standards.

FS HN 556: Dietetic Internship III
(0-22) Cr. 5. F.SS.
Prereq: Concurrent enrollment or successful completion of FS HN 554 and FS HN 555
For students enrolled in the Dietetic Internship program only. Supervised practice experience in operational management, medical nutrition therapy and community nutrition. Capstone research project: Evidenced Analysis Based Clinical Presentation. Experiences and activities designed to meet accreditation standards.

FS HN 560: Global Nutrition
(Dual-listed with FS HN 460). (Cross-listed with NUTRS). (3-0) Cr. 3.
Prereq: FS HN 361 or equivalent; senior or graduate standing
An overview of global nutrition issues, including the sociocultural, biological, economic, and environmental context of nutrition related topics. The etiology, epidemiology, and program/policy responses to issues will be presented. Areas to be covered include childhood malnutrition, growth stunting, micronutrient deficiencies, parasites and nutrition, sanitation, and obesity and chronic disease incidence in developing countries. Participatory course, students will engage in a series of class activities, discussions, and presentations.

FS HN 566: Nutrition Counseling and Education Methods
(Dual-listed with FS HN 466). (Cross-listed with DIET). (2-2) Cr. 3. F.
Prereq: FS HN 361 and FS HN 362
Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories.

FS HN 575: Processed Foods
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: FS HN 214 or FS HN 311; a course in nutrition
This course will examine effect of industrial and domestic food processing on the nutrient content of food and risk of developing chronic disease.

FS HN 580: Orientation to Food Science and Nutrition Research
(1-0) Cr. 1. F.
Orientation to and discussion of research interests in food science and nutrition. Discussion of policy and ethical issues in the conduct of research. Intended for entering students in FS HN. Offered on a satisfactory-fail basis only.

FS HN 581: Seminar
(1-0) Cr. 1. S.
Discussion and practice of oral presentation of scientific data in a professional setting. Discussion of issues related to data presentation. Intended for graduate students in their first or second semester in FS HN.

FS HN 590: Special Topics
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

FS HN 590A: Special Topics: Nutrition
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

FS HN 590B: Special Topics: Food Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

FS HN 590C: Special Topics: Teaching
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

FS HN 596A: Food Science and Human Nutrition Travel Course: International travel
(Dual-listed with FS HN 496A). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.
Meets International Perspectives Requirement.

FS HN 596B: Food Science and Human Nutrition Travel Course: Domestic travel
(Dual-listed with FS HN 496B). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

FS HN 597: Nutritional Aspects of Oncology
(Cross-listed with DIET, NUTRS). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: B.S. in nutrition, dietetics, biology, or related discipline.
Understanding of basic cancer biology and methodology used to study nutrition and cancer relationships. Using current research as a basis, the role of nutrition in specific cancers will be explored. Students will learn about sources of information for cancer prevention programs, and how to apply this information to clinical patient management.

FS HN 599: Creative Component
Cr. arr.
Nonthesis option only.

Courses for graduate students:

FS HN 606: Advanced Food Analysis and Instrumentation
(3-3) Cr. 4. Alt. S., offered odd-numbered years.
Prereq: FS HN 311, or FS HN 410, or FS HN 511 or equivalent.
Instrumental methods for measuring chemical and physical properties of foods, food quality and functionality. Techniques for methods development, sample preparation, optimization of operating conditions, and data analysis needed to obtain accurate, reproducible results by means of instrumentation.

FS HN 611: Advanced Food Processing
(Cross-listed with BRT). (3-0) Cr. 3. F.
Prereq: FS HN 311, or FS HN 471/472 or equivalent, or FS HN 511.
Recent advances in the science and technology of food processing and preservation; examples include both thermal and non-thermal processes, including cold plasma, nanotechnology, food packaging, and extrusion. Advances in extraction and separation technologies, waste management, by-product utilization, biorenewables and sustainability in food processing industry will also be discussed. Students to research on select topics and present.

FS HN 612: Advanced Food Chemistry
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: FS HN 311, or FS HN 411, or FS HN 511, or BBMB 404, or equivalent.
Structure, chemical and physical properties of lipids, proteins and carbohydrates, and their food and industrial applications. Changes in functionalities during processing and storage.

FS HN 626: Advanced Food Microbiology
(Cross-listed with MICRO, TOX). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials.

FS HN 627: Rapid Methods in Food Microbiology
(Cross-listed with MICRO, TOX). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Provides an overview of rapid microbial detection methods for use in foods. Topics include historical aspects of rapid microbial detection, basic categories of rapid tests (phenotypic, genotypic, whole cell, etc.), existing commercial test formats and kits, automation in testing, sample preparation and "next generation" testing formats now in development.

FS HN 681: Seminar
(1-0) Cr. 1. F.S.SS.
Presentation of thesis or dissertation research. May be taken once for M.S. program and twice for the Ph.D. program.

FS HN 682: Seminar Reflection
Cr. R. Repeatable. F.S.
Active listening and critical thinking activities related to research seminars in food science and human nutrition. Required each semester for all FSHN graduate students. Electronic documentation.

FS HN 690: Special Problems
Cr. arr. Repeatable. F.S.SS.
Prereq: FS HN 502 or FS HN 503 or FS HN 504 or FS HN 553 or FS HN 554

FS HN 695: Grant Proposal Writing
(Cross-listed with NUTRS). (1-0) Cr. 1. F.
Prereq: 3 credits of graduate course work in food science and/or nutrition
Grant proposal preparation experiences including writing and critiquing of proposals and budget planning. Formation of grant writing teams in food science and/or nutrition. Offered on a satisfactory-fail basis only.

FS HN 699: Research in Food Science and Technology
Cr. arr. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

Natural Resource Ecology and Management

The department addresses a broad spectrum of natural resource and environmental issues in a holistic approach to learning, discovery and engagement. Our vision of natural resources is that informed protection and management of natural resources involves an integration of biological, economic, and social considerations. Such an integrated and comprehensive approach to the education of future generations of natural resource managers and scientists is needed in order to sustain viable landscapes, facilitate strong communities, and produce desired goods, services, and functions from our natural resources.

Our educational mission for the undergraduate and graduate programs is to provide those learning experiences and opportunities that will ensure students can learn to function effectively in their chosen fields.

Central to that effective functioning are the abilities to:

- Identify, explain and critically evaluate their own beliefs, values and actions in relation to professional and societal standards of ethics.
- Anticipate, analyze and evaluate natural resource issues and opportunities, explaining the ecological, economic, and social consequences of natural resource actions at various scales and over time.
- Actively seek the input and perspectives of diverse stakeholders regarding natural resource problems and issues.
- Assess, analyze, synthesize, and evaluate information fairly and objectively.
- Work effectively, both individually and with others, on complex, value-laden natural resource problems that require holistic problem solving approaches.
- Formulate and evaluate alternative solutions to complex problems and recommend and defend best alternatives.
- Communicate clearly and effectively with all audiences using appropriate oral, visual, electronic, and written techniques.
- Recognize and interpret resource problems and opportunities across spatial scales from local to global.
- Appreciate cultural diversity and understand the impact of the global distribution of people and wealth on natural resource use and valuation.
- Exercise leadership skills as professionals and engaged citizens.
- Demonstrate creativity and innovation in identifying and pursuing opportunities that produce environmental, social, or economic value.
- Exercise life-long learning skills developed before graduation.

Undergraduate Study

The Department of Natural Resource Ecology and Management offers work for the Bachelor of Science degree with majors in animal ecology or forestry. The department participates in interdisciplinary programs in biology, environmental studies, international studies, and pest management. By proper selection of free and restricted elective courses, students can obtain a minor or a second major in these programs or other disciplines.

Contact the department for information about minors from the Department of Natural Resource Ecology and Management.

The Department provides numerous scholarships; application information is available in the departmental Student Services Center.

Graduate Study

The Department of Natural Resource Ecology and Management offers work for the degrees Master of Science and Doctor of Philosophy with majors in fisheries biology, forestry, and wildlife ecology. A non-thesis masters degree is available for students desiring a general degree program without thesis research. Students may also major in interdepartmental graduate majors in biorenewable resources technology, ecology and evolutionary biology, environmental science, genetics, plant physiology, sustainable agriculture, or toxicology (see Index). All students are required to teach and conduct research as part of their training for the Ph.D. degree.

Fisheries Biology and Wildlife Ecology

Graduates have a broad understanding of the basic principles of animal biology, ecology and management, and relevant aspects of basic mathematics and natural sciences, computing applications, and personal and professional development. They are able to execute rigorous independent research, have developed problem-solving and critical-thinking skills, and can communicate effectively with scientific colleagues and the general public in both formal and informal settings.

Personnel of the U.S. Geological Survey's Iowa Cooperative Fish and Wildlife Research Unit contribute significantly to the graduate program of the department through teaching and research. Governmental agencies such as the U.S. Fish and Wildlife Service, Natural Resources Conservation Service and the Iowa Department of Natural Resources, and non-governmental agencies such as The Nature Conservancy and the Iowa Natural Heritage Foundation also contribute to the graduate program by funding research, providing in-kind support, and providing numerous formal and informal mentoring relationships.

No more than two dual-listed animal ecology courses may be applied for major graduate credit. Additional work is expected of students taking a dual-listed course for credit at the 500 level.

Forestry

The department offers programs leading to the degrees of Master of Science and Doctor of Philosophy with a major in forestry and minor work to students taking major work in other departments.

Graduates are skilled at defining a research problem in forestry, applying scientific principles and appropriate methods, and analyzing the results. They are capable of understanding the many facets of forest and wood science and are very knowledgeable in specific areas in forestry. They are able to deal with complex forestry problems, and where appropriate, they are capable of blending ecological, social, ethical, legal, and economic factors in the research process. They are very skilled at communicating, both in written and oral form, research results to professional and lay audiences. They are sensitive to cultural diversity and work effectively with peers, natural resource professionals, and the public.

The graduate program is open to, and suitable for, students who have majored in forestry or related natural resource fields. A non-thesis master's option is available.

The department participates in the Masters in Business Administration (M.B.A.), with specialization in the agriculture program administered by the College of Business, providing an opportunity to obtain an M.B.A. degree while taking advanced courses in forestry and maintaining contact with the profession of forestry.

Courses primarily for undergraduates:

A ECL 312: Ecology
(Cross-listed with BIOL, ENSCI). (3-3) Cr. 4. F.SS.
Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L
Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats.

A ECL 312I: Ecology
(Cross-listed with ENSCI, IA LL). Cr. 4. SS.
An introduction to the principles of ecology at the population, community and ecosystem level. Field studies of local lakes, wetlands and prairies are used to examine factors controlling distributions, interactions, and roles of plants and animals in native ecosystems.

A ECL 321: Fish Biology
(2-3) Cr. 3. S.
Prereq: A ECL 365
Biology, ecology, and evolution of fishes. Emphasis on structure, physiology, and behavior, including a focus on the conservation and management of fishes and their habitats. Laboratory focus on fish morphology, survey methods, identification, distribution, habits, and habitats of fishes.

A ECL 326I: Ornithology
(Cross-listed with IA LL). Cr. 4. SS.
The biology, ecology, and behavior of birds with emphasis on field studies of local avifauna. Group projects stress techniques of population analysis and methodology for population studies.

A ECL 333: Fisheries Techniques
(Cross-listed with NREM). (1-3) Cr. 2. F.
Prereq: BIOL 212
Introduction to techniques used in the collection and interpretation of fish population data in the field and in the lab. Course objectives include an understanding of population survey methodology and improving student critical thinking and teamwork skills. Laboratory focuses on field trips and hands-on sampling experience.

A ECL 365: Vertebrate Biology
(Cross-listed with BIOL). (3-2) Cr. 4. F.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L
Evolution, biology, and classification of fish, amphibians, reptiles, birds, and mammals. Emphasis on a comparative analysis of the structure and function of organ systems. Laboratory exercises concentrate on morphology and identification of orders of vertebrates.

A ECL 366: Natural History of Iowa Vertebrates
(2-3) Cr. 3. S.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L
Vertebrate fauna of Iowa, including fishes, amphibians, reptiles, birds, and mammals. Species identification, habitat requirements, community structure and assessment, conservation issues that include historical population changes and value of wild animals to the region's ecological and economic health.

A ECL 371: Ecological Methods
(Cross-listed with BIOL). (2-3) Cr. 3. S.
Prereq: A ECL 312; STAT 101 or STAT 104
Quantitative techniques used in management of natural resources with emphasis on inventory and manipulation of habitat and animal populations.

A ECL 401: Intro to Aquatic Animal Medicine
(Cross-listed with B M S). (1-2) Cr. 1. S.
8 week course. Introductory course with focus on fin fish production, health and medicine. Course content will help define future roles for veterinarians, producers, and service providers. Emphasis will be placed on anatomy, pathology, infectious diseases, nutrition, regulatory constraints in production, food safety, and current research. Field trip to aquaculture facility.

A ECL 404I: Behavioral Ecology
(Cross-listed with IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: Two semesters of biology
Animal coloniality, courtship, territoriality, predator defense, habitat selection, foraging, mating systems, and parental care will be examined in the field in order to evaluate various ecological and evolutionary theories of animal behavior.

A ECL 415: Ecology of Freshwater Invertebrates, Plants, and Algae
(Dual-listed with A ECL 515). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A ECL 312
Identification, biology, and ecological requirements of freshwater invertebrates, plants and algae. Additional emphases on community sampling methods and analysis, and use of organisms as tools for aquatic ecosystem health assessment.

A ECL 418: Stream Ecology
(Dual-listed with A ECL 518). (Cross-listed with ENSCI). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A ECL 486
Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

A ECL 419I: Vertebrate Ecology and Evolution
(Cross-listed with IA LL). Cr. 4. SS.
Field and laboratory study of representative vertebrates of northwestern Iowa. Observations and experimentation emphasize ecological histories by integrating concepts of functional morphology, behavioral ecology, and evolutionary biology.

A ECL 420I: Amphibians and Reptiles
(Cross-listed with IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: Two semesters of biology
Ecology, behavior, and conservation biology of amphibians and reptiles with emphasis on their anatomy and morphology; temperature and water regulation; locomotion; life history; reproduction; population and community ecology; and conservation.

A ECL 425: Aquatic Insects
(Dual-listed with A ECL 525). (Cross-listed with ENT). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312 or equivalent
Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

A ECL 440: Fishery Management
(Dual-listed with A ECL 540). (2-3) Cr. 3. F.
Prereq: A ECL 312, A ECL 321, STAT 101 or STAT 104; credit or enrollment in A ECL 486
Biological basis of fishery management, fishery problems, and management practices for freshwater, anadromous, and marine fisheries.

A ECL 442: Aquaculture
(Dual-listed with A ECL 542). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 211 and BIOL 212.
Concepts related to the culture of aquatic organisms including culture systems, water quality, nutrition, genetics, diseases, and marketing.

A ECL 451: Wildlife Ecology and Management
(2-3) Cr. 3. F.
Prereq: A ECL 371
Ecological theory and practice of wildlife management, including, population ecology, habitat management, and current issues in the field. Course involves a series of case studies addressing actual wildlife issues using field and quantitative methods.

A ECL 454: Principles of Wildlife Disease
(Dual-listed with A ECL 554). (3-0) Cr. 3. S.
Prereq: Junior standing and at least 10 credits in biological sciences at the 300+ level
Ecological and epidemiological aspects of diseases as they relate to wildlife populations. Topics to be covered include: major classes of disease; detection, description, monitoring, and management of disease; characteristics and interactions between disease agents and wildlife hosts; relationships among wildlife, domestic animal, and human health.

A ECL 455: International Wildlife Issues
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A ECL 365, A ECL 312 or graduate standing; NREM 120
Biological, political, social, and economic factors affecting the management of international wildlife resources.
Meets International Perspectives Requirement.

A ECL 457: Herpetology
(Cross-listed with BIOL). (2-0) Cr. 2. F.
Prereq: BIOL 351 or BIOL 365
Biology, ecology, and evolution of amphibians (salamanders, frogs, caecilians) and reptiles (lizards, snakes, tuatara, turtles, crocodilians). Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of amphibians and reptiles in ecosystems, and conservation. Laboratory focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

A ECL 457L: Herpetology Laboratory
(Cross-listed with BIOL). (0-3) Cr. 1. F.
Prereq: BIOL 351 or BIOL/A ECL 365; concurrent registration in BIOL 457 or A ECL 457
Laboratory to accompany Biology/Animal Ecology 457. Focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

A ECL 458: Ornithology
(Cross-listed with BIOL). (2-0) Cr. 2. S.
Prereq: A ECL 365 or BIOL 351
Biology, evolution, ecology and taxonomy of birds. Emphasis on structure, physiology, behavior, communication, navigation, reproduction, and conservation.

A ECL 458L: Ornithology Laboratory
(Cross-listed with BIOL). (0-3) Cr. 1. S.
Prereq: BIOL 351 or AECL/BIOL 365. Concurrent enrollment in AECL/BIOL 458 is required.
Laboratory complements lecture topics with emphasis on external anatomy, identification and distribution of Midwest birds, and field trips.

A ECL 459: Mammalogy
(Cross-listed with BIOL). (2-0) Cr. 2. S.
Prereq: BIOL 351 or A ECL 365
Biology, ecology, and evolution of mammals. Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of mammals in ecosystems, and conservation.

A ECL 459L: Mammalogy Laboratory
(Cross-listed with BIOL). (0-3) Cr. 1. S.
Prereq: BIOL 351 or BIOL/AECL 365; concurrent enrollment in AECL 459 or BIOL 459 required.
Laboratory focus on identification, survey methods, distribution, habits, and habitats of mammals. Several field trips.

A ECL 480: Studies in Marine Biology
Cr. 1-8. Repeatable. SS.
Courses taken at Gulf Coast Research Laboratory and other marine biological stations are transferred to Iowa State University under this number.

A ECL 486: Aquatic Ecology
(Dual-listed with A ECL 586). (Cross-listed with BIOL, ENSCI). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

A ECL 486L: Aquatic Ecology Laboratory
(Dual-listed with A ECL 586L). (Cross-listed with BIOL, ENSCI). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

A ECL 489: Population Ecology
(Dual-listed with A ECL 589). (Cross-listed with BIOL). (2-2) Cr. 3. F.
Prereq: BIOL 312, STAT 101 or STAT 104, a course in calculus, or graduate standing
Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation.

Courses primarily for graduate students, open to qualified undergraduates:

A ECL 515: Ecology of Freshwater Invertebrates, Plants, and Algae
(Dual-listed with A ECL 415). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A ECL 312
Identification, biology, and ecological requirements of freshwater invertebrates, plants and algae. Additional emphases on community sampling methods and analysis, and use of organisms as tools for aquatic ecosystem health assessment.

A ECL 516: Avian Ecology
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A ECL 365, A ECL 312, or graduate standing
Current topics and theories including avian breeding and foraging ecology, population biology, community structure, habitat selection, field methodologies, and data interpretation.

A ECL 518: Stream Ecology
(Dual-listed with A ECL 418). (Cross-listed with ENSCI). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A ECL 486
Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

A ECL 520: Fisheries Science
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A ECL 312, A ECL 321
Concepts, approaches, and techniques for assessment of recreational and commercial fisheries. Scope will range from individual fish to entire ecosystems, both freshwater and marine.

A ECL 523I: Fish Ecology
(Cross-listed with IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Basic principles of fish interaction with the biotic and abiotic environment. Field methods, taxonomy, and biology of fish with emphasis on the fish fauna of northwestern Iowa.

A ECL 525: Aquatic Insects
(Dual-listed with A ECL 425). (Cross-listed with ENT). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312 or equivalent
Morphology, ecology, diversity, and significance of aquatic insects, with emphasis on the collection, curation and identification of taxa in local streams and lakes.

A ECL 526I: Advanced Field Ornithology
(Cross-listed with IA LL). Cr. 2. SS.
Prereq: Concurrent registration in IA LL 326I
Field study of birds of the upper Midwest; extended field trip to Minnesota and Wisconsin; individual or group project.

A ECL 531: Conservation Biology
(Cross-listed with EEOB). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 312; BIOL 313 or graduate standing
Examination of conservation issues from a population and a community perspective. Population-level analysis will focus on the role of genetics, demography, and environment in determining population viability. Community perspectives will focus on topics such as habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology.

A ECL 531I: Conservation Biology
(Cross-listed with EEOB, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: IA LL 312I
Population-and community-level examination of factors influencing the viability of plant and animal populations from both demographic and genetic perspectives; assessment of biodiversity; design and management of preserves.

A ECL 535I: Restoration Ecology
(Cross-listed with EEOB, ENSCI, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: A course in ecology
Ecological principles for the restoration of native ecosystems; establishment (site preparation, selection of seed mixes, planting techniques) and management (fire, mowing, weed control) of native vegetation; evaluation of restorations. Emphasis on the restoration of prairie and wetland vegetation.

A ECL 540: Fishery Management
(Dual-listed with A ECL 440). (2-3) Cr. 3. F.
Prereq: A ECL 312, A ECL 321, STAT 101 or STAT 104; credit or enrollment in A ECL 486
Biological basis of fishery management, fishery problems, and management practices for freshwater, anadromous, and marine fisheries.

A ECL 542: Aquaculture
(Dual-listed with A ECL 442). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 211 and BIOL 212.
Concepts related to the culture of aquatic organisms including culture systems, water quality, nutrition, genetics, diseases, and marketing.

A ECL 551: Behavioral Ecology
(2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: a course in ecology or animal behavior
The study of how an animal's behavior affects its ability to survive and reproduce in its environment. Course topics, such as foraging behavior, sexual selection, parental care, etc., represent the interface of ecology, evolution, and behavior.

A ECL 554: Principles of Wildlife Disease
(Dual-listed with A ECL 454). (3-0) Cr. 3. S.
Prereq: Graduate classification
Ecological and epidemiological aspects of disease as they relate to wildlife populations. Topics to be covered include: major classes of disease; detection, description, monitoring, and management of disease; characteristics and interactions between disease agents and wildlife hosts; relationship among wildlife, domestic animal, and human health.

A ECL 570: Landscape Ecology
(Cross-listed with EEOB). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Permission of instructor; EEOB 588; a course in calculus
The study of ecological and evolutionary processes within a spatial context with emphasis on behavior, population, and community dynamics.

A ECL 573: Techniques for Biology Teaching
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 573A: Techniques for Biology Teaching : Animal Biology
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 573G: Techniques for Biology Teaching: Limnology
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 573I: Techniques for Biology Teaching: Insect Ecology
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 573W: Techniques for Biology Teaching: Project WET
(Cross-listed with EEOB, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

A ECL 586: Aquatic Ecology
(Dual-listed with A ECL 486). (Cross-listed with EEOB, ENSCI). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

A ECL 586L: Aquatic Ecology Laboratory
(Dual-listed with A ECL 486L). (Cross-listed with EEOB, ENSCI). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

A ECL 589: Population Ecology
(Dual-listed with A ECL 489). (Cross-listed with EEOB). (2-2) Cr. 3. F.
Prereq: BIOL 312, STAT 101 or STAT 104, a course in calculus, or graduate standing
Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation.

A ECL 590: Graduate Independent Study
(Cross-listed with ANTHR, EEOB, IA LL). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

A ECL 590I: Special Topics: Graduate Independent Study
(Cross-listed with ANTHR, EEOB, IA LL). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

A ECL 599: Creative Component
Cr. arr.
Prereq: Nonthesis M.S. option only

Courses for graduate students:

A ECL 611: Analysis of Populations
(Cross-listed with EEOB). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 312; STAT 401; a course in calculus
Quantitative techniques for analyzing vertebrate population data to estimate parameters such as density and survival. Emphasis on statistical inference and computing.

A ECL 698: Animal Ecology Teaching Practicum
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification in animal ecology and permission of instructor
Graduate student experience in the animal ecology teaching program. Offered on a satisfactory-fail basis only.

A ECL 699: Research
Cr. arr. Repeatable.

A ECL 699I: Research
(Cross-listed with ANTHR, EEOB, GDCB, IA LL). Cr. 1-4. Repeatable.

Courses primarily for undergraduates:

FOR 201: Forest Biology
(2-0) Cr. 2. F.
Prereq: Concurrent enrollment in FOR 202, FOR 203, FOR 204, FOR 205, and FOR 206
Discussion of ecological concepts, individual tree structure and growth, variation and diversity in tree populations. Physical environment of trees and forests, ecological processes in forest communities, and introduction to different regional forest communities.

FOR 202: Sustainable Materials: Wood Utilization
(2-0) Cr. 2. F.
Prereq: Concurrent enrollment in FOR 201, FOR 203, FOR 204, FOR 205, and FOR 206
Basis for use of wood as an industrial raw material for lumber, composites, pulp and paper, energy and chemicals. Implications of use of alternative renewable and non-renewable materials for societal infrastructure and consumer goods.

FOR 203: Resource Measurements/Evaluation
(2-0) Cr. 2. F.
Prereq: Concurrent enrollment in FOR 201, FOR 202, FOR 204, FOR 205, and FOR 206; MATH 140
Survey techniques involved in quantification, valuation, and evaluation of tree and stand growth and other variables in the forest environment (e.g., recreational use, wildlife habitat value, biomass, and solid wood).

FOR 204: Forest Ecosystem Decision-Making
(2-0) Cr. 2. F.
Prereq: Concurrent enrollment in FOR 201, FOR 202, FOR 203, FOR 205, and FOR 206
Methods of decision-making related to forest ecosystems including communications, teams and conflict resolution. Current issues relating to public, private, and urban forests; quantification of processes, services, and goods produced by the forest and expected by the public such as wildlife, water, range, recreation, wilderness, biodiversity, as well as wood and fiber products.

FOR 205: Integrated Forestry Laboratory
(0-8) Cr. 3. F.
Prereq: Concurrent enrollment in FOR 201, FOR 202, FOR 203, FOR 204, and FOR 206
Field and laboratory exercises integrating the evaluation and management of forest goods, services, and the processing of wood products.

FOR 206: Fall Forestry Camp
Cr. 4. F.
Prereq: Concurrent enrollment in FOR 201, FOR 202, FOR 203, FOR 204, and FOR 205
Three-week field camp to address topics and issues covered in 201, 202, 203, 204, and 205.

FOR 280: Wood Properties and Identification
(3-3) Cr. 4. S.
Properties of wood and how they relate to its successful use. Comparative anatomical characteristics, scientific nomenclature, and hand lens identification of commercially important North American woods.

FOR 283: Pesticide Application Certification
(Cross-listed with AGRON, ENT, HORT). (2-0) Cr. 2. S.
Core background and specialty topics in agricultural, and horticultural pesticide applicator certification. Students can select certification categories and have the opportunity to obtain pesticide applicator certification at the completion of the course. Commercial pesticide applicator certification is emphasized.

FOR 290: Special Problems
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290A: Special Problems: Leadership in Forestry Teams (LIFT) Learning Community
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290B: Special Problems: Forest Ecosystem Management
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290C: Special Problems: Natural Resource Conservation
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290D: Special Problems: Urban and Community Forestry
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 290E: Special Problems: Wood Science and Technology
Cr. 1-4. Repeatable.
Prereq: Freshman or Sophomore classification, permission of instructor

FOR 302: Silviculture
(2-3) Cr. 3. S.
Prereq: FOR 201
Manipulation of forest vegetation based on ecological principles for the production of goods and services.

FOR 356: Dendrology
(Cross-listed with BIOL). (2-4) Cr. 4. F.
Prereq: BIOL 211
Identification and ecology of North American woody plant species. Importance of woody plants in timber production and wildlife habitat. Natural disturbances, human impacts, management and restoration concerns for major North American forest regions will be addressed.

FOR 358: Forest Herbaceous Layer: Ecology and Identification.
(Cross-listed with NREM). (0.5-1) Cr. 1. S.
Prereq: BIOL 212
Survey of the major plant families, general, and representative species of the forest herbaceous layer. Functional ecology and restoration.

FOR 416: Forest Insects and Diseases
(Cross-listed with PL P). (3-0) Cr. 3. F.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent.
Nature of insects and pathogens of forest and shade trees; their role in the dynamics of natural and managed forest ecosystems; and the management of indigenous and exotic pests.

FOR 416L: Forest Insects and Diseases Laboratory
(Cross-listed with PL P). (0-3) Cr. 1. F.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent. Credit or enrollment in Pl P 416.
Laboratory experience working with insect and fungal pests of trees.

FOR 442: Dynamics of Forest Stands
(2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: NREM 301, FOR 302, STAT 101 or their equivalents
Change in forest species composition and structure at the stand and landscape scales resulting from site quality, tree growth, competition, succession, and disturbance. Methods for assessing tree growth and reconstructing past stand development. Applications to forest and savanna management.

FOR 451: Forest Resource Economics and Quantitative Methods
(3-3) Cr. 4. S.
Prereq: FOR 203, MATH 150
Application of economic principles to forest resource management considering both market and non-market goods and services. Methods of identifying and specifying problems in the management and use of forest resources. Application of mathematical and statistical models to the solution of managerial problems.

FOR 452: Ecosystem Management
(Dual-listed with FOR 552). (Cross-listed with NREM). (2-3) Cr. 3. S.
Prereq: Senior classification, and NREM 120 or its equivalent
Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints.

FOR 454: Forestry Practicum
(1-4) Cr. 3. S.
Prereq: 20 credits in student's major at 300 level or above
Integrated decision-making related to the conservation, management, and preservation of private and public forests, wildlands, urban/community forests, and/or the production and utilization of wood products. Student teams work with a client and develop management plans that incorporate ecological, social, economic, ethical, and institutional/political factors. Effective teamwork, written/oral/visual communication, and problem-solving stressed. Multiple trips to project site and client.

FOR 475: Urban Forestry
(Cross-listed with HORT). (2-3) Cr. 3. F.
Prereq: Junior or senior classification, 3 credits in biology
Discussion of establishment and management of woody perennials in community-owned urban greenspaces, consideration of urban site and soil characteristics, plant physiology, plant culture, urban forest valuation, inventory methods, species selection, and urban forest maintenance (health care and pest management).

FOR 480: Wood Anatomy and Fiber Analysis
(2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: FOR 280 or permission of instructor
Microscopic anatomy and ultrastructure of wood and other industrial lignocellulosic materials. Microscopy techniques for fiber analysis. Comparison of fiber properties.

FOR 481: Conversion of Lignocellulosic Materials
(2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: FOR 280 or equivalent
Chemical properties of lignocellulosic materials. Wood chemistry. Various conversion processes. Pulp and paper technology. Biobased products. Other fiber products. Cellulose derivatives. Term paper and/or student project required for graduate level.

FOR 485: Wood and Natural Fiber Composites
(2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: FOR 280 or TSM 240
Consolidation behavior of wood and other lignocellulosic materials. Principles of adhesion. Manufacturing processes for wood and lignocellulose composites such as plywood, oriented strand products, laminated lumber, particleboard, medium density fiberboard, and bast fiber products. Extrusion processing of natural fiber/plastic composites.

FOR 486: Drying Processes for Wood and Other Lignocellulosic Materials
(2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: FOR 280 or TSM 240
Principles of moisture relations in hygroscopic materials; adsorption, desorption, equilibrium moisture content. Transport processes in natural materials such as wood. Drying processes for wood and other lignocellulosic materials. Influence of moisture on dimensional stability and durability of wood and lignocelluosic composites.

FOR 487: Physical Properties of Wood
(3-3) Cr. 4. Alt. S., offered even-numbered years.
Prereq: FOR 280
Mechanical, thermal, electrical, and acoustical properties of wood. Lumber grading and stress rating, nondestructive evaluation of wood and wood composite products.

Courses primarily for graduate students, open to qualified undergraduates:

FOR 552: Ecosystem Management
(Dual-listed with FOR 452). (Cross-listed with NREM). (2-3) Cr. 3. S.
Prereq: Senior classification, and NREM 120 or its equivalent
Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints.

FOR 599: Creative Component
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599A: Creative Component: Forest Biology
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599B: Creative Component: Forest Biometry
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599C: Creative Component: Forest and Recreation Economics
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599D: Creative Component: Forest Management and Administration
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 599E: Creative Component: Wood Science
Cr. 1-12. Repeatable, maximum of 12 credits.

Courses for graduate students:

FOR 696: Research Seminar
(Cross-listed with AGRON, BBMB, GDCB, HORT, PLBIO). Cr. 1. Repeatable. Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

FOR 699: Research
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699A: Research: Forest Biology - Wood Science
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699B: Research: Forest Biometry
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699C: Research: Forest Economics
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699D: Research: Forest Management and Administration
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699E: Research: Wood Science
Cr. 1-12. Repeatable, maximum of 12 credits.

FOR 699F: Research: Plant Physiology
Cr. 1-12. Repeatable, maximum of 12 credits.

Courses primarily for undergraduates:

NREM 104: Practical Work Experience
Cr. R.
Three months of relevant work experience in natural resources, animal ecology, or forestry. Study at a summer biological station may be applicable. See adviser for specific requirements and approval process.

NREM 110: Orientation in Natural Resource Ecology and Management
Cr. 1. F.
Orientation to the University and to the Department of Natural Resource Ecology and Management. Discussion of departmental learning outcomes, strategies for academic success and academic planning. Offered on a satisfactory-fail basis only.

NREM 111: NREM Transitions Learning Community Seminar
(1-0) Cr. 1. Repeatable. F.S.
Enrollment limited to members of the NREM Transitions Learning Community. Designed to assist new transfer students and continuing sophomore students with their transition to the academic expectations and professional development aspects of the natural resource program. Offered on a satisfactory-fail basis only.

NREM 120: Introduction to Renewable Resources
(Cross-listed with AGRON, ENV S). (3-0) Cr. 3. F.S.
Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management.

NREM 130: Natural Resources and Agriculture
(Cross-listed with ENV S). (3-0) Cr. 3. S.
Survey of the ecology and management of fish, forest, and wildlife resources in areas of intensive agriculture, with emphasis on Iowa. Conservation and management practices for private agricultural lands. Designed for nonmajors.

NREM 181: Artistry in Wood
(1-0) Cr. 1. Alt. S., offered even-numbered years.
A survey of the artistry of wood as appreciated in spatial scale from microscopic anatomy to engineered wood structures. Anatomical and physical properties that render wood as a medium for artistic expression. The works of local artists, designers and engineers will be featured. The University Museums collection and Art on Campus will be explored.

NREM 207: Natural Resource Management under the North American Model of Conservation
(1-0) Cr. 1. F.
Introduction to North American model of conservation, current funding for natural resource management, role of hunting and angling in the North American model, critique and refinement of the model for the 21st century, and introduction to natural resource leadership, and outdoor skills and recreation. Offered on a satisfactory-fail basis only.

NREM 211: Careers in Natural Resources
Cr. 1. F.S.
Prereq: Sophomore classification
Career planning exploration in natural resources. Discussion of the job application process, including techniques for successful interviewing and development of an effective resume. Offered on a satisfactory-fail basis only.

NREM 270: Foundations in Natural Resource Policy and History
(Cross-listed with ENV S, L A). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
The development of natural resource conservation philosophy and policy from the Colonial Era to the present. North American wildlife, forestry, and environmental policy; national parks and other protected lands; federal and state agencies. Relationship to cultural contexts, including urban reform and American planning movement. Discussion of common pool resources, public and private lands.

NREM 301: Natural Resource Ecology and Soils
(Cross-listed with ENSCI). (3-3) Cr. 4. F.
Prereq: BIOL 211, BIOL 211L; FOR 201 or a second course in biology
Effects of environmental factors on ecosystem structure and function using forest, prairie and agricultural ecosystems as models. Special emphasis is given to soil-forming factors and the role of soil in nutrient and water cycling and ecosystem dynamics. Additional emphasis is given to human influences on natural ecosystems and the role of perennial plant communities in agricultural landscapes.

NREM 303: Internship
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of department mentor and sophomore standing
Placement with county conservation boards, camps, zoos, parks, etc., for experience as interpreters, rangers, and technicians.

NREM 303I: Undergraduate Internships
(Cross-listed with IA LL). Cr. 1-5. Repeatable. SS.
Prereq: Permission of instructor and sophomore standing
Placement with county conservation boards, camps, parks, etc. for experience as interpreters, rangers, and technicians.

NREM 305: Seminar
(2-0) Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Current topics in natural resources or related issues.

NREM 315: Genetics for Natural Resource Managers.
(3-0) Cr. 3. F.
Prereq: Prereq: Biol 211 and 212.
Introduction into how genetic techniques and technologies can aid the management of the earth's biotic resources. Topics include an overview of DNA structure, function and inheritance; tools and techniques for measuring genetic diversity; genetic management of wild and captive populations: DNA forensics as management tool. The goal of this course is to prepare managers/biologists to interpret genetic data as they relate to natural resource conservation.

NREM 330: Principles of Interpretation
(2-3) Cr. 3. S.
Prereq: 6 credits in biological sciences
History, objectives, forms, and techniques of interpretation in the settings of county, state, national parks, and zoos. Principles of effective communication as they apply to natural resource fields including wildlife management, forestry, and wildlife rehabilitation. Planning and use of effective communications and outreach campaigns to manage and conserve natural resources.

NREM 333: Fisheries Techniques
(Cross-listed with A ECL). (1-3) Cr. 2. F.
Prereq: BIOL 212
Introduction to techniques used in the collection and interpretation of fish population data in the field and in the lab. Course objectives include an understanding of population survey methodology and improving student critical thinking and teamwork skills. Laboratory focuses on field trips and hands-on sampling experience.

NREM 345: Natural Resource Photogrammetry and Geographic Information Systems
(Cross-listed with ENSCI). (2-3) Cr. 3. S.
Prereq: Junior classification
Measurement and interpretation of aerial photos in resource management. Introduction to Geographic Information Systems (GIS) using ArcGIS including digitizing, development and query of attribute tables, georeferencing, and use of multiple GIS layers in simple spatial analyses.

NREM 357: Midwestern Prairie Plants
(1-2) Cr. 1. F.
Offered 1st half semester only. Survey of the major plant families, genera, and representative species of Midwestern prairies with emphasis on plant identification. Prairie management for multiple species of plants and wildlife.

NREM 358: Forest Herbaceous Layer: Ecology and Identification.
(Cross-listed with FOR). (0.5-1) Cr. 1. S.
Prereq: BIOL 212
Survey of the major plant families, general, and representative species of the forest herbaceous layer. Functional ecology and restoration.

NREM 385: Natural Resource Policy
(Dual-listed with NREM 585). (3-0) Cr. 3. S.
Prereq: Junior classification
Development, theory and practice of natural resource policy. Integrative approach with topical policy studies in North American wildlife, forestry, and water. Policy formation, the role of science, introduction to federal law compliance. Readings, lectures, projects.

NREM 390: Fire Ecology and Management
(3-0) Cr. 3. F.
Characteristics and role of fire in forest ecosystems. Major topics covered include fuels, fire weather, fire behavior, fire danger rating systems, fire control, prescribed burning, and fire dynamics in major ecosystem types.

NREM 402: Watershed Hydrology
(Dual-listed with NREM 502). (Cross-listed with ENSCI, GEOL, MTEOR). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

NREM 407: Watershed Management
(Dual-listed with NREM 507). (Cross-listed with ENSCI, ENV S). (3-3) Cr. 4. S.
Prereq: A course in general biology
Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers.

NREM 408I: Aquatic Ecology
(Dual-listed with NREM 508I NREM 408I). (Cross-listed with IA LL). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

NREM 446: Integrating GPS and GIS for Natural Resource Management
(Dual-listed with NREM 546). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: 12 credits in student's major at 300 level or above, NREM 345 or equivalent experience with ArcGIS
Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation.

NREM 452: Ecosystem Management
(Dual-listed with NREM 552). (Cross-listed with FOR). (2-3) Cr. 3. S.
Prereq: Senior classification, and NREM 120 or its equivalent
Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints.

NREM 460: Controversies in Natural Resource Management
(Cross-listed with ENV S). (3-0) Cr. 3. F.S.
Prereq: NREM 120, and A ECL 312 or NREM 301, and Junior classification
Analysis of controversial natural resource issues using a case approach that considers uncertainty and adequacy of information and scientific understanding. Ecological, social, political, economic, and ethical implications of issues will be analyzed.

NREM 465: Landscape Change and Conservation
(Dual-listed with NREM 565). (Cross-listed with L A). (3-0) Cr. 3. F.
Prereq: L A 202
Exploration of issues in landscape ecology and conservation biology relevant to landscape change, design, and planning. Examination of foundational principles and their applications across a continuum of land uses, from wilderness to urban areas.

NREM 466: Ecosystem Service Management
(Dual-listed with NREM 566). (Cross-listed with ENSCI, ENT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

NREM 471: Agroforestry Systems; Local and Global Perspectives
(Dual-listed with NREM 571). (2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in biological science at 300 level or above
Concepts of sustainable land use, agroecological dynamics, and component interactions of agroforestry systems. Agroforestry systems in temperate and tropical regions. Design and evaluation techniques for agroforestry systems. Ecological, socioeconomic and political aspects of agroforestry.
Meets International Perspectives Requirement.

NREM 485: Undergraduate Seminar
Cr. 1. Repeatable, maximum of 2 times. F.S.
Prereq: Junior or Senior classification in Animal Ecology or Forestry majors (instructor may grant permission for students in other majors to register for course)
Weekly seminars on current research topics in natural resource ecology and management. Style and best practice in oral research communication. Skills and principles for evaluating research merit and quality of technical communication. Offered on a satisfactory-fail basis only.

NREM 489: Survey of Remote Sensing Technologies
(Dual-listed with NREM 589). (Cross-listed with E E, GEOL, MTEOR). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

NREM 489L: Satellite Remote Sensing Laboratory
(Dual-listed with NREM 589L). (Cross-listed with E E, GEOL, MTEOR). (0-3) Cr. 1. S.
Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589
Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

NREM 490: Independent Study
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Junior or senior classification, permission of instructor

NREM 490A: Independent Study: Animal Ecology
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Junior or senior classification, permission of instructor

NREM 490B: Independent Study: Forestry
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Junior or senior classification, permission of instructor

NREM 490E: Independent Study: Entrepreneurship
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Junior or senior classification, permission of instructor

NREM 490H: Independent Study: Honors Program
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Junior or senior classification, permission of instructor

NREM 490I: Iowa Lakeside Laboratory
(Cross-listed with ANTHR, IA LL). Cr. 1-6. Repeatable, maximum of 9 credits.
Prereq: 8 credits in biology and permission of instructor
Research opportunities for undergraduate students in the biological sciences. No more than 9 credits in Biol 490 may be counted toward graduation and of those, only 6 credits may be applied to the major.

NREM 496: Travel Course
(Dual-listed with NREM 596). Cr. 1-5. Repeatable, maximum of 3 times.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 496A: Travel Course: International
(Dual-listed with NREM 596A). Cr. 1-5. Repeatable, maximum of 3 times.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students. Meets International Perspectives Requirement.

NREM 496B: Travel Course: Domestic
(Dual-listed with NREM 596B). Cr. 1-5. Repeatable, maximum of 3 times.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 498: Cooperative Education
Cr. 1-3.
Prereq: Permission of departmental chair
Required of all cooperative education students. Students must register prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

NREM 502: Watershed Hydrology
(Dual-listed with NREM 402). (Cross-listed with ENSCI, GEOL, MTEOR). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

NREM 504: Forest Landscapes, Wildlife, and Silviculture
(2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Desired forest habitat conditions for fish and wildlife. Silvicultural approaches to protecting/improving such habitats. Focus on key forest elements related to animal species, groups and overall diversity. The lab focuses on team observations and discussions of diverse habitats including one weekend field trip.

NREM 505: Seminar
(2-0) Cr. 1-3. Repeatable, maximum of 3 times. F.S.
Prereq: Permission of instructor or graduate classification
Current topics in natural resources research and management.

NREM 507: Watershed Management
(Dual-listed with NREM 407). (Cross-listed with ENSCI). (3-3) Cr. 4. S.
Prereq: A course in general biology
Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers.

NREM 508I: Aquatic Ecology
(Cross-listed with ENSCI, IA LL). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

NREM 533: Erosion and Sediment Transport
(Cross-listed with A B E, ENSCI). (2-3) Cr. 3. F.
Prereq: C E 372 or GEOL/ENSCI/MTEOR 402, MATH 166 or equivalent
Soil erosion processes, soil loss equations and their application to conservation planning, sediment properties, initiation of sediment motion and over land flow, flow in alluvial channels and theory of sediment transport, channel stability, reservoir sedimentation, wind erosion, BMPs for controlling erosion.

NREM 535: Restoration Ecology
(Cross-listed with EEOB, ENSCI). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 366 or BIOL 474 or graduate standing
Theory and practice of restoring animal and plant diversity, structure and function of disturbed ecosystems. Restored freshwater wetlands, forests, prairies and reintroduced species populations will be used as case studies.

NREM 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

NREM 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

NREM 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

NREM 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

NREM 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

NREM 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

NREM 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

NREM 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

NREM 546: Integrating GPS and GIS for Natural Resource Management
(Dual-listed with NREM 446). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: 12 credits in student's major at 300 level or above, NREM 345 or equivalent experience with ArcGIS
Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation.

NREM 552: Ecosystem Management
(Dual-listed with NREM 452). (Cross-listed with FOR). (2-3) Cr. 3. S.
Prereq: Senior classification, and NREM 120 or its equivalent
Principles of planning, regulating, and decision-making associated with public and private lands, with consideration of forest, grassland, wetland, and freshwater aquatic ecosystems. Integrated natural resources management within ecological, social, economic and policy constraints.

NREM 565: Landscape Change and Conservation
(Dual-listed with NREM 465). (Cross-listed with L A). (3-0) Cr. 3. F.
Prereq: L A 202
Exploration of issues in landscape ecology and conservation biology relevant to landscape change, design, and planning. Examination of foundational principles and their applications across a continuum of land uses, from wilderness to urban areas.

NREM 566: Ecosystem Service Management
(Dual-listed with NREM 466). (Cross-listed with ENSCI, ENT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

NREM 570: Advanced Decision-making in Natural Resource Allocation
(2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: FOR 451 or two courses in economics
Analytical approach to economic aspects of forest resource management problems. Theory and application of economic decision-making criteria to traditional and modern forest resource management issues. Current problems in the allocation of forest resources.

NREM 571: Agroforestry Systems
(Dual-listed with NREM 471). (Cross-listed with SUSAG). (2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in biological science at 300 level or above
Concepts of sustainable land use, agroecological dynamics, and component interactions of agroforestry systems. Agroforestry systems in temperate and tropical regions. Design and evaluation techniques for agroforestry systems. Ecological, socioeconomic and political aspects of agroforestry.
Meets International Perspectives Requirement.

NREM 580: Research Orientation
(2-0) Cr. 2. F.
Prereq: 20 credits in biological sciences and a course in statistics
Research design, proposal preparation, and technical writing.

NREM 585: Natural Resource Policy
(Dual-listed with NREM 385). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Graduate classification or permission of instructor
Development, theory and practice of natural resource policy. Integrative approach with topical policy studies in North American wildlife, forestry, and water. Policy formation, the role of science, introduction to federal law compliance.

NREM 589: Survey of Remote Sensing Technologies
(Dual-listed with NREM 489). (Cross-listed with E E, GEOL, MTEOR). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

NREM 589L: Satellite Remote Sensing Laboratory
(Dual-listed with NREM 489L). (Cross-listed with E E, MTEOR). (0-3) Cr. 1. S.
Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589
Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

NREM 590: Special Topics
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Permission of instructor

NREM 590A: Special Topics: Animal Ecology
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Permission of instructor

NREM 590B: Special Topics: Forestry
Cr. 1-4. Repeatable, maximum of 4 credits.
Prereq: Permission of instructor

NREM 593: Workshop
Cr. 1-3. Repeatable.
Prereq: Graduate classification

NREM 596: Travel Course
(Dual-listed with NREM 496). Cr. 1-5. Repeatable, maximum of 3 times.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study ecological topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 596A: Travel Course: International
(Dual-listed with NREM 496A). Cr. 1-5. Repeatable, maximum of 3 times.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.
Meets International Perspectives Requirement.

NREM 596B: Travel Course: Domestic
(Dual-listed with NREM 496B). Cr. 1-5. Repeatable, maximum of 3 times.
Prereq: Permission of instructor
Limited enrollment. Extended field trips to study ecological and management topics in varied environments. Location and duration of trips will vary. Pre-trip sessions arranged. Trip expenses paid by students.

NREM 598: Natural Resource Ecology and Management Teaching Practicum
Cr. 1. F.S.SS.
Prereq: Graduate classification as M.S. candidate in a NREM major and permission of instructor.
Graduate student experience in teaching. Student must plan and present at least one unit of subject matter in a course or extension workshop. Teaching practicum must be documented by the student and approved by the student's POS committee. Offered on a satisfactory-fail basis only.

NREM 599: Creative Component
Cr. arr.

Courses for graduate students:

NREM 600: Seminar
Cr. 1. Repeatable. F.S.
Current topics in natural resources research and management.

NREM 698: Natural Resource Ecology and Management Teaching Practicum
Cr. 1. F.S.
Prereq: Graduate classification as a Ph.D. candidate in a NREM major and permission of instructor.
Graduate student experience in teaching. Student must plan and present substantive subject matter for a minimum of three weeks in lecture and/or laboratory formats, or a series of extension seminars/workshops. Teaching practicum must be documented by the student and approved by the student's POS committee. Offered on a satisfactory-fail basis only.

NREM 699: Research
Cr. 1-12. Repeatable, maximum of 12 credits.

Plant Pathology and Microbiology

Undergraduate Study

The department participates in the interdepartmental undergraduate Microbiology major. See /collegeofagricultureandlifesciences/microbiology/ for more information.

Graduate Study

The department offers studies for the degrees master of science and doctor of philosophy with a major in plant pathology, and minor work for students majoring in other departments or programs. A master of science nonthesis option is available. The department also participates in the interdepartmental majors in microbiology; toxicology; genetics; plant biology; molecular, cellular, and developmental biology; ecology and evolutionary biology; and sustainable agriculture.

Students entering graduate programs in the department need a sound background in the physical, biological, and mathematical sciences as well as adequate preparation in English.

Graduates have a broad understanding of the biology and management of plant pathogenic microorganisms and the interactions of pathogens with their host plants. They understand the relationship between plant pathology and allied disciplines and are able to communicate effectively with scientific colleagues and the general public in both formal and informal settings. Graduates are able to address complex plant disease problems facing agricultural and bioscience professionals, taking into account the related ethical, social, legal, and environmental issues. They are skilled in research procedures, communicating research results, and writing concise and persuasive grant proposals.

Courses primarily for undergraduates:

MICRO 101: Microbial World
(3-0) Cr. 3. F.
Prereq: High school biology or equivalent
Introduction to the importance of viruses, bacteria, fungi, archaea and parasites both to humans and to the biosphere. Topics include past and present microbial impact on humans and society, ecology and diversity of microbes, biotechnology and microbial impact on the biosphere.

MICRO 110: Professional and Educational Preparation in Microbiology
(1-0) Cr. 1. F.
An introduction to curriculum and research opportunities in microbiology at Iowa State. Topics include: easing the transition to life as a university student, development of specific goals, strengthening interpersonal communication, professional portfolio creation and resume building. Offered on a satisfactory-fail basis only.

MICRO 201: Introduction to Microbiology
(2-0) Cr. 2. F.S.
Prereq: One semester of college-level biology
Selected topics in microbiology with emphasis on the relationship of microorganisms to human and animal health, agricultural technology, and the environment. With written petition to the chair of the supervisory committee, students who obtain a grade of B or better may substitute 201 for Micro 302 in advanced courses.

MICRO 201L: Introductory Microbiology Laboratory
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in MICRO 201 or MICRO 302
Basic microbiology laboratory techniques for non-microbiology majors. Credit for either Micro 201L or 302L, but not both, may be applied toward graduation.

MICRO 302: Biology of Microorganisms
(3-0) Cr. 3. F.S.SS.
Prereq: BIOL 211, credit or enrollment in BIOL 212; 1 semester of chemistry
Basic cell biology, physiology, metabolism, genetics and ecology of microorganisms, with an emphasis on prokaryotes and viruses, as well as the roles of microorganisms in the environment, disease, agriculture, and industry.

MICRO 302L: Microbiology Laboratory
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in MICRO 302
Basic microbiology laboratory techniques for majors in microbiology, biological sciences and related fields. Credit for either Micro 201L or 302L, but not both, may be applied toward graduation.

MICRO 310: Medical Microbiology
(3-0) Cr. 3. F.
Prereq: MICRO 302 (or MICRO 201 if a B or better was obtained)
Study of infection by bacterial and viral pathogenic agents of humans with an overview of immune responses in controlling disease.

MICRO 310L: Medical Microbiology Laboratory
(0-3) Cr. 1. F.
Prereq: MICRO 201 or MICRO 302; MICRO 201L or MICRO 302L; credit or enrollment in MICRO 310
Microbiological tools and techniques to isolate, identify, and characterize medically significant microorganisms in relation to human diseases. Emphasis on the virulence factors of pathogenic organisms as compared to the normal flora.

MICRO 320: Molecular and Cellular Bacteriology
(4-0) Cr. 4. S.
Prereq: MICRO 302, BIOL 313, credit or enrollment in CHEM 332
A systems perspective of bacterial growth, survival, and cellular differentiation by integrating physiological and genetic principles. Emphasis is on prokaryotes although unicellular eukaryotes are also discussed. Topics include the structure, function, and assembly of cell components, molecular and genomic techniques, bioenergetics and metabolism, regulation of gene expression, genetic adaptation, stress tolerance, biofilms, and cell-cell interactions and communications.

MICRO 353: Introductory Parasitology
(Cross-listed with BIOL, V PTH). (3-0) Cr. 3. S.
Prereq: BIOL 212
Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites.

MICRO 374: Insects and Our Health
(Cross-listed with ENT). (3-0) Cr. 3. S.
Prereq: 3 credits in biological sciences
Identification, biology, and significance of insects and arthropods that affect the health of humans and animals, particularly those that are vectors of disease.
Meets International Perspectives Requirement.

MICRO 374L: Insects and Our Health Laboratory
(Cross-listed with ENT). (0-3) Cr. 1. Alt. S., offered even-numbered years.
Prereq: Credit or enrollment in ENT 374
Laboratory and field techniques for studying medical or public health entomology, including: collection, identification and maintenance of medically significant arthropods and experimental design and execution related to the biology of arthropods or arthropod-pathogen interactions.

MICRO 381: Environmental Systems I: Introduction to Environmental Systems
(Cross-listed with BIOL, ENSCI, ENV S). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

MICRO 402: Microbial Genetics and Genomics
(Dual-listed with MICRO 502). (Cross-listed with GEN). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MICRO 302, Biol 313
The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics.

MICRO 407: Microbiological Safety of Foods of Animal Origins
(Dual-listed with MICRO 507). (Cross-listed with FS HN). (3-0) Cr. 3. S.
Prereq: MICRO 420
Examination of the various factors in the production of foods of animal origin, from animal production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. The two modules of this course will be 1) the procedures and processes which can affect the overall microbiological safety of the food, and 2) the Hazard Analysis Critical Control Point (HACCP) system.

MICRO 408: Virology
(3-0) Cr. 3. F.
Prereq: BIOL 313 or BBMB 301. BIOL 314 recommended
The molecular virology and epidemiology of human, animal, plant and insect viruses.

MICRO 410: Insect-Virus Interactions: a Molecular Perspective
(Dual-listed with MICRO 510). (Cross-listed with ENT). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: Permission of an instructor.
Overview of insect-virus interactions including insect immunity to viruses, genetic enhancement of viral insecticides, transgenic mosquitoes, disruption of virus transmission, and the role of insect and virus genomics in combating viral disease of both human and agricultural importance.

MICRO 419: Foodborne Hazards
(Cross-listed with FS HN, TOX). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MICRO 201 or MICRO 302, a course in biochemistry
Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

MICRO 420: Food Microbiology
(Cross-listed with FS HN, TOX). (3-0) Cr. 3.
Prereq: MICRO 201 or MICRO 302
Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications.

MICRO 421: Food Microbiology Laboratory
(Cross-listed with FS HN). (0-6) Cr. 3.
Prereq: MICRO 201 or MICRO 302; MICRO 201L or MICRO 302L. Credit or enrollment in FS HN/MICRO 420
Standard techniques used for the microbiological examination of foods. Independent and group projects on student-generated questions in food microbiology. Emphasis on oral and written communication and group interaction.

MICRO 430: Procaryotic Diversity and Ecology
(Dual-listed with MICRO 530). (Cross-listed with BBMB). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MICRO 302, MICRO 302L
Survey of the diverse groups of procaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

MICRO 440: Laboratory in Microbial Physiology, Diversity, and Genetics
(Cross-listed with BBMB). (2-6) Cr. 4. F.
Prereq: MICRO 302, MICRO 302L, CHEM 332, BIOL 313L
Fundamental techniques and theory for studying the cellular mechanisms, genetic processes and diversity of microbial life. Experimental techniques will include isolation and physiological characterization of bacteria that inhabit different environments as well as an emphasis on genetic and molecular techniques to understand antibiotic resistance processes and mechanisms. Also included are techniques for phylogenetic characterization, measuring gene expression, and genetic manipulation of bacteria. Essential components for the effective communication of scientific results are also emphasized.

MICRO 450: Undergraduate Capstone Colloquium
(2-0) Cr. 2. S.
Prereq: SP CM 212 and senior standing in Microbiology
Required of all undergraduate majors in microbiology. Students demonstrate mastery of core courses in microbiology through discussion of current literature in microbiology and immunology, issues in scientific conduct, and bioethics in microbiology. Students present current papers in a journal club format and gain experience in writing and reviewing grant proposals.

MICRO 451: Senior Survey in Microbiology
Cr. R. F.
Prereq: Junior or Senior standing in Microbiology
Preparations for graduation. Topics include job search strategies, career information, mock interviews, graduate and professional school application processes and guidelines as well as outcomes assessment activities.

MICRO 456: Principles of Mycology
(Cross-listed with BIOL). (2-3) Cr. 3. F.
Prereq: 10 credits in biological sciences
Morphology, diversity, and ecology of fungi; their relation to agriculture, industry, and human health.

MICRO 475: Immunology
(Dual-listed with MICRO 575). (3-0) Cr. 3. S.
Prereq: MICRO 310
An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. Micro 475L optional. Credit for either Micro 475 or V MPM 520, but not both, may be applied to graduation.

MICRO 475L: Immunology Laboratory
(1-4) Cr. 1. S.
Prereq: Credit or enrollment in MICRO 310 or MICRO 475 or MICRO 575
Techniques in primary culture and tumor cell growth, measures of lymphocyte function, serological techniques and flow cytometry. Half semester course.

MICRO 477: Bacterial-Plant Interactions
(Dual-listed with MICRO 577). (Cross-listed with PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 3 credits in microbiology or plant pathology
Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves.

MICRO 485: Soil and Environmental Microbiology
(Dual-listed with MICRO 585). (Cross-listed with AGRON, ENSCI). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

MICRO 487: Microbial Ecology
(Dual-listed with MICRO 587). (Cross-listed with BIOL, ENSCI). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

MICRO 490: Independent Study
Cr. 1-5. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490A: Independent Study: Laboratory Research
Cr. arr. Repeatable. F.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490B: Independent Study: Literature Review
Cr. arr. Repeatable. F.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490C: Independent Study: Instructional Assistant
Cr. arr. Repeatable. F.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490G: Independent Study: General
Cr. arr. Repeatable. F.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 490H: Independent Study, Honors
Cr. 1-5. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: A minimum of 6 credits of 300-level or above coursework in microbiology, permission of instructor
A maximum of 6 credits of Micro 490 may be used toward the total of 128 credits required for graduation.

MICRO 495: Internship
Cr. 1-2. F.S.
Prereq: At least 6 credits of 300-level or above coursework in microbiology, approval of academic adviser
Participation in the Cooperative Extension Intern Program or an equivalent work experience. Written report of activities required. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

MICRO 502: Microbial Genetics and Genomics
(Dual-listed with MICRO 402). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MICRO 302, Biol 313
The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics.

MICRO 507: Microbiological Safety of Foods of Animal Origins
(Dual-listed with MICRO 407). (Cross-listed with FS HN). (3-0) Cr. 3. S.
Prereq: MICRO 420
Examination of the various factors in the production of foods of animal origin, from animal production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. The two modules of this course will be 1) the procedures and processes which can affect the overall microbiological safety of the food, and 2) the Hazard Analysis Critical Control Point (HACCP) system.

MICRO 510: Insect-Virus Interactions: a Molecular Perspective
(Dual-listed with MICRO 410). (Cross-listed with ENT). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: Permission of an instructor.
Overview of insect-virus interactions including insect immunity to viruses, genetic enhancement of viral insecticides, transgenic mosquitoes, disruption of virus transmission, and the role of insect and virus genomics in combating viral disease of both human and agricultural importance.

MICRO 525: Intestinal Microbiology
(Cross-listed with V MPM). Cr. 3. Alt. S., offered even-numbered years.
Prereq: Micro 302, BIOL 313
Overview of commensal microbiota in the health and well-being of vertebrates. Topics include diversity of intestinal structure, microbial diversity/function, innate immune development, community interactions and metabolic diseases associated with alterations of the intestinal microbiome.

MICRO 530: Procaryotic Diversity and Ecology
(Dual-listed with MICRO 430). (Cross-listed with BBMB). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MICRO 302, MICRO 302L
Survey of the diverse groups of procaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

MICRO 540: Livestock Immunogenetics
(Cross-listed with AN S, V MPM). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: AN S 561 or MICRO 575 or V MPM 520
Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance.

MICRO 551: Microbial Diversity and Phylogeny
(1-0) Cr. 1. F.
Prereq: MICRO 302, BIOL 313
Comparisons among the three kingdoms of life (Bacterica, Archaea, and Eukarya). Topics will include metabolism, adaptation, methods of phylogenetic analysis, and comparative genomics.

MICRO 552: Bacterial Molecular Genetics and Physiology
(1-0) Cr. 1. F.
Prereq: MICRO 302, BIOL 313
Review of genetics and selected physiological topics of model bacteria.

MICRO 553: Pathogenic Microorganisms
(1-0) Cr. 1. F.
Prereq: MICRO 302, BIOL 313
Review and contrast/comparison of common bacterial pathogens of plants and animals and their mechanisms of virulence, including toxins, protein secretion, host invasion and iron acquisition strategies. An overview of eukaryotic cell biology that is relevant to pathogenesis will also be included.

MICRO 554: Virology
(1-0) Cr. 1. S.
Prereq: MICRO 302, BIOL 313
Introduction to virus life cycles including entry, gene expression strategies, replication, and mechanisms to modify and overcome host defenses. The roles of specific viruses and sub-viral agents in animal and plant disease will also be included.

MICRO 555: Fungal Biology
(1-0) Cr. 1. S.
Prereq: GEN 313 or GEN 320 or equivalent.
Ecology, genetics, physiology and diversity of fungi, from yeasts to mushrooms, and their importance in human affairs.

MICRO 556: Ecology of Microorganisms
(1-0) Cr. 1. S.
Prereq: MICRO 302, BIOL 313
The study of microorganisms in their natural environments, with a focus on terrestrial and aquatic ecosystems, including eukaryotic hosts; interactions within biofilms and communities, including intercellular communication and symbioses; microbial adaptations to extreme environments; and metagemomic, genomic, molecular and microscopy techniques for the study of microbes in natural systems.

MICRO 575: Immunology
(Dual-listed with MICRO 475). (Cross-listed with V MPM). (3-0) Cr. 3. S.
Prereq: MICRO 310
An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. Micro 475L optional. Credit for either Micro 575 or V MPM 520, but not both, may be applied toward graduation.

MICRO 577: Bacterial-Plant Interactions
(Dual-listed with MICRO 477). (Cross-listed with PL P). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 3 credits in microbiology or plant pathology
Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves.

MICRO 585: Soil and Environmental Microbiology
(Dual-listed with MICRO 485). (Cross-listed with AGRON, ENSCI). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

MICRO 586: Medical Bacteriology
(Cross-listed with V MPM). (4-0) Cr. 4. F.
Prereq: 310
Bacteria associated with diseases of vertebrates, including virulence factors and interaction of host responses.

MICRO 587: Microbial Ecology
(Dual-listed with MICRO 487). (Cross-listed with EEOB, ENSCI). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

MICRO 590: Special Topics
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

Courses for graduate students:

MICRO 604: Seminar
(1-0) Cr. 1. Repeatable. F.S.
Course will expose students to the breadth of subdisciplines within microbiology, offer opportunities for direct interaction between the students and the faculty members within the Interdepartmental Microbiology Graduate Program, and promote interactions among the students within the program. Offered on a satisfactory-fail basis only.

MICRO 608: Molecular Virology
(Cross-listed with PL P, V MPM). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or GDCB 511
Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis.

MICRO 615: Molecular Immunology
(Cross-listed with BBMB, V MPM). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function.

MICRO 625: Mechanisms of Bacterial Pathogenesis
(Cross-listed with V MPM). (4-0) Cr. 4. Alt. S., offered odd-numbered years.
Prereq: Credit in Biochemistry and Microbiology
Review of current concepts in specific areas of microbial pathogenesis including the genetic basis for bacterial disease, genetic regulation and control of virulence factors and their mechanisms of action, and host-pathogen interactions at the cellular and molecular levels. The application of microbial genetics to understanding pathogenesis will be included.

MICRO 626: Advanced Food Microbiology
(Cross-listed with FS HN, TOX). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials.

MICRO 627: Rapid Methods in Food Microbiology
(Cross-listed with FS HN, TOX). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Provides an overview of rapid microbial detection methods for use in foods. Topics include historical aspects of rapid microbial detection, basic categories of rapid tests (phenotypic, genotypic, whole cell, etc.), existing commercial test formats and kits, automation in testing, sample preparation and "next generation" testing formats now in development.

MICRO 685: Advanced Soil Biochemistry
(Cross-listed with AGRON, ENSCI). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: AGRON 585
Chemistry of soil organic matter and biochemical transformations brought about by microorganisms and enzymes in soils.

MICRO 690: Current Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

MICRO 690A: Current Topics: Microbiology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

MICRO 690B: Current Topics: Immunology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

MICRO 690C: Current Topics: Infectious Diseases
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

MICRO 692: Molecular Biology of Plant-Pathogen Interactions
(Cross-listed with PL P). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: PL P 506 or BBMB 405 or GEN 411 or MICRO 402 or strong background in molecular biology
Seminal and current research in molecular and physiological aspects of plant interactions with pathogens, including mechanisms of pathogenesis, host-pathogen recognition and host defense, with an emphasis on critical evaluation of primary literature. Students also complete a research proposal writing and peer review exercise.

MICRO 697: Graduate Research Rotation
Cr. arr. Repeatable. F.S.
Graduate research projects performed under the supervision of selected faculty members in the Interdepartmental Microbiology major.

MICRO 698: Seminar in Molecular, Cellular, and Developmental Biology
(Cross-listed with BBMB, GDCB, MCDB, V MPM). (2-0) Cr. 1-2. Repeatable. F.S.
Student and faculty presentations.

MICRO 699: Research
Cr. arr. Repeatable.

Courses primarily for undergraduates:

PL P 408: Principles of Plant Pathology
(Dual-listed with PL P 508). (2-2) Cr. 3. F.S.
Prereq: 8 credits in life sciences, including BIOL 211 or 212.
Braun. Principles underlying the nature, diagnosis, and management of plant diseases. Laboratory complements lecture topics and provides experience in plant disease diagnosis.

PL P 416: Forest Insects and Diseases
(Cross-listed with FOR). (3-0) Cr. 3. F.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent.
Nature of insects and pathogens of forest and shade trees; their role in the dynamics of natural and managed forest ecosystems; and the management of indigenous and exotic pests.

PL P 416L: Forest Insects and Diseases Laboratory
(Cross-listed with FOR). (0-3) Cr. 1. F.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent. Credit or enrollment in Pl P 416.
Laboratory experience working with insect and fungal pests of trees.

PL P 452: Integrated Management of Diseases and Insect Pests of Turfgrasses
(Dual-listed with PL P 552). (Cross-listed with ENT, HORT). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HORT 351
Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

PL P 477: Bacterial-Plant Interactions
(Dual-listed with PL P 577). (Cross-listed with MICRO). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 3 credits in microbiology or plant pathology
Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves.

PL P 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, 7 credits in biological sciences, permission of instructor
A maximum of 6 credits of Pl P 490 may be used toward the total of 128 credits required for graduation.

PL P 490A: Independent Study: Plant Pathology
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, 7 credits in biological sciences, permission of instructor
A maximum of 6 credits of Pl P 490 may be used toward the total of 128 credits required for graduation.

PL P 490H: Independent Study: Honors
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior classification, 7 credits in biological sciences, permission of instructor
A maximum of 6 credits of Pl P 490 may be used toward the total of 128 credits required for graduation.

PL P 494: Seed Pathology
(Dual-listed with PL P 594). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: PL P 408
Significance of biotic and abiotic diseases that affect the production and utilization of seeds, during each phase of the seed life cycle: growing, harvesting, conditioning, storing, and planting seed. Mechanisms of seed infection and seed-to-seedling transmission are considered for fungi, bacteria, viruses/viroids, and nematodes. Aspects of epidemiology, management, and host-pathogen relationships are discussed. Emphases include the role of seed health testing in the global seed industry for quality control and phytosanitary certification, as well as the use of seed treatments to manage seedborne and soilborne pathogens and pests. Concurrent enrollment in Pl P 494L/594L (Seed Pathology Laboratory) is strongly encouraged (on-campus students only). Credit may not be obtained for both Pl P 494/594 and STB/Pl P 592.

PL P 494L: Seed Pathology Laboratory
(Dual-listed with PL P 594L). (0-3) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: PL P 408
Laboratory in seed pathology. Seed health testing methods; effects of seed treatments and seed conditioning on seedborne pathogens.

Courses primarily for graduate students, open to qualified undergraduates:

PL P 506: Plant-Pathogen Interactions
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: PL P 408 or PL P 416, BIOL 313
Baum, Whitham. Introduction to mechanisms of plant-parasite interaction. Genetics and molecular genetics of plant disease resistance and pathogenicity.

PL P 508: Principles of Plant Pathology
(Dual-listed with PL P 408). (2-2) Cr. 3. F.S.
Prereq: 8 credits in life sciences, including BIOL 211 or 212.
Braun. Principles underlying the nature, diagnosis, and management of plant diseases. Laboratory complements lecture topics and provides experience in plant disease diagnosis.

PL P 510: Plant Virology
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: BIOL 313 or BBMB 301. BIOL 314 recommended.
Taxonomy, molecular mechanisms, host-interactions, vector transmission, epidemiology, detection, control and exploitation of plant viruses. Course will consist of a mixture of lectures, and student-led presentations using primary literature.

PL P 511: Integrated Management of Tropical Crops
(Cross-listed with ENT, HORT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PL P 408 or PL P 416 or ENT 370 or ENT 376 or HORT 221
Applications of Integrated Crop Management principles (including plant pathology, entomology, and horticulture) to tropical cropping systems. Familiarization with a variety of tropical agroecosystems and Costa Rican culture is followed by 10-day tour of Costa Rican agriculture during spring break, then writeup of individual projects.
Meets International Perspectives Requirement.

PL P 512: Lifestyles of plant pathogenic fungi and oomycetes.
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Pl P 408 or MICRO 456 or equivalent.
Exploration of the major groups of plant pathogenic fungi and oomycetes, focusing on the diseases they cause as well as pathogen ecology, diagnosis, crop resistance, and fungicide resistance.

PL P 530: Ecologically Based Pest Management Strategies
(Cross-listed with AGRON, ENT, SUSAG). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Durable, least-toxic strategies for managing weeds, pathogens, and insect pests, with emphasis on underlying ecological processes.

PL P 543: Ecology and Epidemiology of Plant Diseases
(2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: PL P 408 or PL P 416
Nutter. Theory and practice related to the ecology and epidemiology of plant disease epidemics. Interactions among host and pathogen populations as affected by the environment are quantified with respect to time and space. Analysis of ecological and host and pathogen genetic factors that alter the course of plant disease epidemics. Risk assessment theory, disease forecasting, and modeling the impact of biotic plant stresses on yield and quality are also emphasized.

PL P 552: Integrated Management of Diseases and Insect Pests of Turfgrasses
(Dual-listed with PL P 452). (Cross-listed with ENT, HORT). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HORT 351
Identification and biology of important diseases and insect pests of turfgrasses. Development of integrated pest management programs in various turfgrass environments.

PL P 574: Plant Nematology
(2-0) Cr. 2. Alt. SS., offered odd-numbered years.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent
Morphology, anatomy, identification, management, and life cycles of common plant-parasitic nematodes; host parasite interactions; recent advances in plant nematology.

PL P 574L: Laboratory Techniques in Plant Nematology
(0-3) Cr. 1. Alt. SS., offered odd-numbered years.
Prereq: 8 credits in biological sciences, including BIOL 211 or equivalent. Must also be registered for Pl P 574.
Practical skills of sample collection, processing, extraction, and identification of plant-parasitic nematodes from soil and roots; other techniques will be discussed.

PL P 577: Bacterial-Plant Interactions
(Dual-listed with PL P 477). (Cross-listed with MICRO). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 3 credits in microbiology or plant pathology
Overview of plant-associated bacteria including their ecology, diversity, and the physiological and molecular mechanisms involved with their interactions with plants. The course covers bacterial plant pathogens and pathogenesis, nitrogen fixation and plant symbioses, biological control and plant growth promotion, bacterial disease diagnosis and management, and approaches to the study of microbial communities in the rhizosphere and on leaves.

PL P 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 10 credits in biological sciences, permission of instructor

PL P 592: Seed Health Management
(Cross-listed with STB). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: Admission to the Graduate Program in Seed Technology and Business/Consent of instructor
Munkvold. Occurrence and management of diseases during seed production, harvest, conditioning, storage, and planting. Emphasis on epidemiology, disease management in the field, seed treatment, effects of conditioning on seed health, and seed health testing. Credit may not be obtained for both Pl P/STB 592 and Pl P 594.

PL P 594: Seed Pathology
(Dual-listed with PL P 494). (2-0) Cr. 2. Alt. F., offered odd-numbered years.
Prereq: PL P 408
Significance of biotic and abiotic diseases that affect the production and utilization of seeds, during each phase of the seed life cycle: growing, harvesting, conditioning, storing, and planting seed. Mechanisms of seed infection and seed-to-seedling transmission are considered for fungi, bacteria, viruses/viroids, and nematodes. Aspects of epidemiology, management, and host-pathogen relationships are discussed. Emphases include the role of seed health testing in the global seed industry for quality control and phytosanitary certification, as well as the use of seed treatments to manage seedborne and soilborne pathogens and pests. Concurrent enrollment in Pl P 494L/594L (Seed Pathology Laboratory) is strongly encouraged (on-campus students only). Credit may not be obtained for both Pl P 494/594 and STB/Pl P 592.

PL P 594L: Seed Pathology Laboratory
(Dual-listed with PL P 494L). (0-3) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: PL P 408
Laboratory in seed pathology. Seed health testing methods; effects of seed treatments and seed conditioning on seedborne pathogens.

Courses for graduate students:

PL P 608: Molecular Virology
(Cross-listed with MICRO, V MPM). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or GDCB 511
Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis.

PL P 628: Improving Professional Presentation Skills
(2-0) Cr. 2. F.
Prereq: Graduate student status.
Skill building to improve oral presentation fundamentals for graduate students in biological sciences. Principles and guidance in both personal speaking style and maximizing impact of presentation software. In-depth lectures and class discussions on all aspects of presentation skills. Video and anonymous peer review of individual speeches.

PL P 691: Field Plant Pathology
(0-6) Cr. 2. Repeatable. Alt. SS., offered even-numbered years.
Prereq: PL P 408 or PL P 416
Diagnosis of plant diseases, plant disease assessment methods, and the integration of disease management into commercial crop production practices. Objectives are to familiarize students with common diseases of Midwest crops and landscape plants, and to provide experience in disease diagnosis. Field trips include commercial operations, agricultural research facilities, and ornamental plantings.

PL P 692: Molecular Biology of Plant-Pathogen Interactions
(Cross-listed with MICRO). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: PL P 506 or BBMB 405 or GEN 411 or MICRO 402 or strong background in molecular biology
Seminal and current research in molecular and physiological aspects of plant interactions with pathogens, including mechanisms of pathogenesis, host-pathogen recognition and host defense, with an emphasis on critical evaluation of primary literature. Students also complete a research proposal writing and peer review exercise.

PL P 694: Colloquium in Plant Pathology
(2-0) Cr. 2. Repeatable. S.
Prereq: PL P 408 or PL P 416, permission of instructor
Advanced topics in plant pathology, including biological control, cultural control, resistance gene deployment, genetic engineering for disease resistance, chemical control, integrated pest management, emerging diseases, fungal genetics, insect vector biology, professional communications, etc.

PL P 698: Seminar
Cr. 1. Repeatable. F.S.

PL P 699: Thesis and Dissertation Research
Cr. arr. Repeatable.
F.S.SS.

College of Business

David Spalding, Dean
Danny J. Johnson, Associate Dean
Russ Laczniak, Associate Dean
Scott Grawe, Associate Dean

www.business.iastate.edu (http://www.business.iastate.edu)

Objectives of the Curriculum in Business

The instructional objective of the College of Business is to provide a high quality professional education in business. Such an education should provide the student with: (1) an appreciation of the evolution of the profession and an awareness of the ethical, global, technological, economic, political and social forces shaping its future; (2) an understanding of the major functional areas of business with the opportunity for specialization for a career in business; (3) an ability to recognize and appreciate the affect of diversity in the work place; (4) an opportunity for advanced study.

A comprehensive education in business includes a broad foundation in the liberal arts, courses in the major functional areas of business activity, proficiency in analytical methods, and the ability to identify problems and arrive at logical solutions. In addition, a professional education is designed to inspire students to assume business and community leadership.

The curriculum in business is accredited by AACSB International, the Association to Advance Collegiate Schools of Business.

Organization of Curriculum

The undergraduate curriculum in business is divided into three areas: a general education program, a pre-professional business program, and a professional business program. The general education program provides a broad spectrum of liberal arts coursework. The pre-professional business requirements provide a foundation in pre-business coursework. The professional program includes two parts: (1) the business core which provides a common body of knowledge in all the functional areas in business, and (2) a major area of study. The eight majors offered for the degree bachelor of science (B.S.) are accounting, business economics, entrepreneurship, finance, management, management information systems, marketing, and supply chain management. The college also offers a secondary major in international business. Elective courses are part of the curriculum.

Required High School Preparation

Students entering the pre-business curriculum must present evidence of the following high school preparation:

a. Four (4) years of English/Language Arts, emphasizing writing, speaking, and reading as well as an understanding and appreciation of literature.

b. Three (3) years of mathematics, including one year each of algebra, geometry, and advanced algebra.

c. Three (3) years of science, including one year each of courses from two of the following fields: biology, chemistry, and physics;

d. Two (2) years of social studies.

Curriculum Changes

Iowa State University students who want to change their curriculum to the College of Business must attend a curriculum change meeting. See Changing Curriculum or Major for more details on this process. Students on Academic Probation will not be allowed to change curriculum to the

College of Business during enrollment period three. See Making Schedule Changes.

Admission Standards to Professional Programs

All new entering students and curriculum change students are enrolled in the pre-business curriculum. To enter the professional program in the College of Business, students must complete any required ENGL 099 Strategies for Nonnative Speakers of English courses, any required ENGL 101 English for Native Speakers of Other Languages courses, ENGL 150 Critical Thinking and Communication, and the following foundation courses or their approved substitutions:

MATH 150	Discrete Mathematics for Business and Social Sciences	3
COM S 113	Introduction to Spreadsheets and Databases	3
ECON 101	Principles of Microeconomics	3
ECON 102	Principles of Macroeconomics	3
STAT 226	Introduction to Business Statistics I	3
ACCT 284	Financial Accounting	3
BUSAD 102	Business Learning Team Orientation	1
or BUSAD 103	Orientation	
BUSAD 250	Introduction to Business	3

In addition, all students must achieve an Iowa State University cumulative grade point of 2.5 or a grade-point average of 2.5 in the foundation courses listed above. Admission into the professional program is a prerequisite for pre-business students to gain admission into upper-level business classes.

Students who meet the following requirements qualify for early admission to the professional program. First Semester Freshman: ACT score of 30 or higher, or ranked in the top 5% of high school class, or National Merit/Achievement Finalist, or member of the Freshman Honors Program. All other Students: minimum ISU cumulative GPA of 3.50 in at least 12 credits or full member of the University Honors Program.

If using the foundation courses for admission to the Professional Program, both transfer grades and Iowa State University grades are used to compute the grade point average. If foundation courses initially taken at Iowa State University need to be repeated, they must be repeated at Iowa State University. With the exception of ACCT 285 Managerial Accounting, pre-business students do not have access to business core classes. To facilitate registration, qualified students may be conditionally admitted during the semester in which they complete the admission requirements.

Admission requirements are subject to change. Applications and the current requirements for admission to the College of Business are available on the Web at https://apps.bus.iastate.edu/ProfessionalProgram/.

Academic Standards and Graduation Requirements

Policies for students enrolled in the College of Business may be obtained at http://www.business.iastate.edu/undergraduate/ or from the Undergraduate Programs Office in the College of Business.

Students are responsible for knowing and adhering to these College of Business policies as well as the university regulations found in this catalog. The following policies are in effect for students graduating from a professional curriculum in business with a B.S. degree under the 2016-2017 catalog:

1. A minimum of 122 semester credits are required.
2. At least 50 percent of the required business credits must be earned at Iowa State. All 300 level and higher business credits must be earned at a four-year college.
3. A minimum of 12 credits of the last 32 credits earned in residence must be applied to the business core and/or the major.
4. The major departments reserve the right to determine the appropriate section of the degree program to which transfer credits will be assigned.
5. Students must achieve communication proficiency by earning a grade of C or better in two of the three required English courses.
6. A student must earn a grade of C or higher in a minimum of 30 credits applied to the business core and the major.
7. A student must earn at least 42 credits of 300 level and higher coursework from a four-year institution.
8. Business majors may not take business courses Pass-Not Pass (P/NP).
9. General education courses may not be taken P/NP.
10. No more than 9 elective credits may be taken P/NP.
11. The last 32 credits applied for graduation must be taken at ISU. A waiver for Study Abroad and Internship/Co-ops may be granted.

Advising System

Each student in the College of Business has an assigned academic adviser who helps facilitate student progress toward graduation while supporting the academic standards of the College. Students enter as Pre-Business majors and are guided toward their entrance to the Professional Program (business major) with assistance from professional advisers who continue to work with them through graduation.

Advisers, as part of the Undergraduate Programs Office staff, provide academic services to Business students including development of

academic plans, study abroad planning, accessing pertinent University services and resources, and meeting their overall educational objectives.

The College encourages students to attend an orientation program prior to their entry, where information is shared and evaluated to help set the student out on the academic path appropriate to their goals, preparation, interests, and capabilities.

Honors

Entering freshmen who meet one of the following criteria, and have a minimum English ACT of 24, will be invited to apply for membership in the Freshman Honors Program: earned an ACT composite of 30, or ranked in the top 5% of their high school classes; or selected as a National Merit or National Achievement finalist.

Enrolled students who have completed 12 graded credits at Iowa State University and earned a 3.50 GPA can be admitted as a full member of the Honors Program. To qualify for full membership, students must have declared a major, developed a program of study, and have a minimum of 48 credits remaining before graduation. Designated advisers will assist honors students in developing an appropriate program of study.

Internships

Credit and non-credit internships in business may be approved for College of Business students in all majors including pre-business. Credit hours and requirements vary. Arrangements must be made in the college prior to the beginning of the internship. An internship adviser from the Business Career Services Office will assist students in making these arrangements.

Multiple Majors

Undergraduates pursuing a degree in the College of Business may complete additional majors in the College of Business. Those desiring additional majors outside the college should refer to the catalog section of the appropriate college and department for the additional major requirements. A multiple major in business economics and agricultural business or economics is not permitted. A major in business economics with a minor in economics is not permitted.

Undergraduates with a primary major outside the College of Business who want a second major in business must meet the admission requirements for the professional program as well as complete the following requirements: Foundation, Supporting Courses, Business Core, and major requirements. (Refer to the current Curriculum Guide).

All students pursuing multiple majors or multiple degrees within the College of Business are required to have a minimum of 15 credits of coursework in each major that is not used in the other majors.

Students are limited to three business majors/degrees within the College of Business, or a total of three business major/minors within the college. This limit is on business majors/degrees/minors only, and does not apply to multiple majors/degrees/minors taken outside the College of Business.

Second Majors and Minors

International Business Secondary Major

A student in the College of Business may earn a secondary major in International Business. The requirements for this major include 12 credits of international business courses, one year of the same university-level foreign language (minimum 6 credits) and an approved international experience (minimum 3 months). Students who pursue this secondary major will be required to complete the requirements for a primary major in Business. Fifteen of the 18 credits required for the International Business major may not be used for the primary major.

Minor in International Business

Students with a major in the College of Business may earn a minor in International Business by completing 15 credits of approved course work and an approved study abroad experience of 12 weeks, or one year of foreign language study and completion of an approved study tour course offered by the College of Business. The minor must include at least 6 credits numbered 300 or above taken at Iowa State University with a grade of C or higher. Students with declared majors have priority over students with declared minors in courses with space constraints.

Minor for Business Students

Students with a major in the College of Business may qualify for a minor specialization in one of the college's departments by taking at least 15 credit hours in the minor specialization, nine hours of which may not be used to satisfy any other department, college, or university requirement. The minor must include at least 6 credits in courses numbered 300 or above taken at Iowa State University with a grade of C or higher. Students with declared majors have priority over students with declared minors in courses with space constraints.

Students are limited to three business majors/degrees within the College of Business, or a total of three business major/minors within the college. This limit is on business majors/degrees/minors only, and does not apply to multiple majors/degrees/minors taken outside the College of Business.

Minor for Non-Business Students

The College of Business offers a structured minor in general business to students outside the College. The minor requires a minimum of 15 credits, not including pre-requisite courses. Requirements for the minor are:

ACCT 284	Financial Accounting	3
ACCT 285	Managerial Accounting	3
or ACCT 215	Legal Environment of Business	

or BUSAD 250	Introduction to Business	
Three courses chosen from the following:		9
FIN 301	Principles of Finance	
MGMT 370	Management of Organizations	
MIS 301	Management Information Systems	
MKT 340	Principles of Marketing	
SCM 301	Supply Chain Management	

The minor must include at least 6 credits in courses numbered 300 or above taken at Iowa State University. A "C" average or higher is required in all courses used to satisfy the minor requirements. All requirements for the minor must be taken for a grade. Students with a major outside the College of Business are eligible for a general business minor only—not a specialization in a business department.

Non-Business students may not take more than 9 cr. of 300 or 400 level Business courses.

Entrepreneurial Studies Cross-Disciplinary Minor

The College of Business participates in a cross-disciplinary minor in Entrepreneurial Studies. This minor is available to any undergraduate student. Requirements for the minor include, MGMT 310 Entrepreneurship and Innovation (3 credits), either MGMT 313 Feasibility Analysis and Business Planning or MGMT 410 Social Entrepreneurship (3 credits), two business-oriented electives from an approved list (6 credits), and an experiential learning component (3 credits). The approved list of courses is available in the Undergraduate Programs Office in the College of Business at http://www.business.iastate.edu/undergraduate/minors/entrepreneurship.

Non-degree Seeking Students

Students who wish to take courses in the College of Business, but are not seeking an undergraduate degree, should apply to the college as non-degree seeking students. Non-degree seeking students are eligible to take up to 9 credits in 300-level and above business courses without meeting the college's admission requirements.

Upper Division Courses for Students Outside the College

Students from outside the College of Business are eligible to take up to 9 credits of 300-level and above business courses without meeting the college's admission requirements to the professional program, as long as they meet course prerequisites.

Graduate Study

Five programs are offered at the master's level: a master of business administration (MBA), a master of accounting (MAcc), a master of business analytics (MoBA), a master of finance (MFin), and a master of science in information systems (MSIS). These programs are intended to meet distinct sets of educational objectives.

The master of business administration (MBA) is the professional management education program for those pursuing careers in business. The goal of the MBA program is to educate future business leaders preparing them for the challenges of tomorrow by giving them the vision, knowledge, skills, and confidence to make the best decisions for all involved stakeholders. The MBA program consists of a 48-credit curriculum leading to a non-thesis, non-creative component master of business administration. Students may pursue a specialization in accounting, finance, information systems, marketing, or supply chain management. The College of Business also offers a business administration minor to students with majors outside the college.

A concurrent BS/MBA is available to eligible engineering undergraduate students majoring in aerospace, agricultural, biosystems, chemical, civil, computer, electrical, industrial, mechanical, or software engineering. A concurrent BS/MBA is available to eligible undergraduate students majoring in agronomy, agricultural systems technology, animal science, chemistry, food science, and industrial technology. A concurrent DVM/MBA degree is available to eligible Veterinary Medicine students.

Double degree programs are offered with apparel, merchandising, and design (MBA/MSAMD) architecture (MArch/MBA), community and regional planning (MBA/MCRP), finance (MBA/MFin), information systems (MBA/MSIS), and statistics (MBA/MS Statistics). There is also a finance and economics double degree (MFin/MSEcon).

The master of accounting (MAcc) is designed to meet the needs of accountants in public or private accounting, focusing on interpreting and analyzing accounting information for decision-making. Additionally, the MAcc program is designed to help interested candidates meet the 150-hour education requirement for CPA certification in Iowa. The 30 hour program requires 15 hours of graduate accounting courses, an international topics course, and 12 hours of non-accounting graduate credits, including a communications course.

The master of business analytics (MoBA) is an interdisciplinary program that addresses the challenges of dealing with data analytics and business intelligence in the "Big Data" environment. The goal is to develop managers who will master analytics in ways that lead to increased profits for their company. This blended program offers both online and face-to-face education in a comprehensive approach that draws from Business, Computer Science, Electrical and Computer Engineering, Statistics, and Industrial and Manufacturing Systems Engineering. It provides a foundation in data analytics project management, statistical and predictive modeling, consumer sentiment analysis, knowledge discovery, analytical reporting, segmentation analysis and data visualization. The program requires 30 credits of

graduate level courses over a 21 month period. Students start the program with a one-week on-campus initiation class. Students then revisit campus once during the middle and once at the end of the program, while taking online classes during the rest of the time.

A certificate in business analytics is also available for working professionals. The certificate requires a minimum of 12 graduate level approved credits, which may be taken either on-line or face-to-face.

The master of finance (MFin) is designed to provide students with in-depth coverage of financial topics and a strong quantitative skill set. Students will learn financial analysis, valuation, modeling, and risk management techniques. The 40-credit program requires 22 core credits, of which 7 are in economics. 18 credits of electives are required, of which 9 must be in finance.

The master of science in information systems (MSIS) is designed to provide students with strong technical skills and a broad background in business needed to effectively develop and manage information systems projects. Using the latest software, students will apply information systems theory and concepts to modern information systems development. Program requirements range from 30-42 credits depending upon the student's background. The MSIS curriculum includes business foundation courses, information systems core courses and electives, and a research requirement (creative component).

The College of Business participates in the following graduate level interdepartmental programs: Information Assurance, Human Computer Interaction, Seed Technology and Business, and Transportation.

Ph.D in Business and Technology

The College of Business offers graduate work leading to the Doctor of Philosophy degree in business and technology, with one of five specializations—entrepreneurship (ENTSP), information systems (IS), management (MGMT), marketing (MKT), or supply chain management (SCM). Departments in the college (Management, Marketing, and Supply Chain and Information Systems), and the departments of Statistics, Economics, Psychology, and Sociology cooperate in providing coursework toward this degree. The program prepares individuals for academic careers in research, teaching, and public service at institutions of higher learning in the United States and other countries. The PhD program consists of a 44 credit course curriculum followed by a 12 credit thesis or dissertation. Students do not need to have an undergraduate degree or master's degree in business in order to qualify for enrollment in the PhD program. However, students without a graduate degree in business will be required to complete 18 credit hours of business foundation courses. For more details or application information contact the Graduate Programs office in the College of Business.

Departments of the College

- Accounting
- Finance
- Management
- Marketing
- Supply Chain and Information Systems

Curriculum in Business

The college offers programs of study leading to the degree bachelor of science with a major in accounting, business economics, entrepreneurship, finance, management, management information systems, marketing, or supply chain management. The college also offers a secondary major in international business. Total credits required: 122

See also: A 4-year (8 semester) plan of study for each business degree.

Business Curriculum

Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communication:
Proficiency met with grade of C or better in 2 of 3 English courses

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGL 302	Business Communication	3
SP CM 212	Fundamentals of Public Speaking	3
LIB 160	Information Literacy	1

Humanities/Social Science: 9 cr.
9 cr. from approved humanities/social science list.

Global Perspectives: 6 cr.
6 cr. from approved global perspectives list.

Natural Science: 3 cr.
3 cr. from approved natural sciences list.

Foundation:

BUSAD 102	Business Learning Team Orientation	1
or BUSAD 103	Orientation	
BUSAD 250	Introduction to Business	3
MATH 150	Discrete Mathematics for Business and Social Sciences	3
COM S 113	Introduction to Spreadsheets and Databases	3
ECON 101	Principles of Microeconomics	3
ECON 102	Principles of Macroeconomics	3
STAT 226	Introduction to Business Statistics I	3

ACCT 284	Financial Accounting	3

Supporting Courses:

BUSAD 203	Business Careers and Employment Preparation	1
MATH 151	Calculus for Business and Social Sciences	3
ACCT 215	Legal Environment of Business	3
ACCT 301	The Accounting Cycle (For ACCT majors only)	1
MIS 207	Fundamentals of Computer Programming (For MIS majors only)	3
STAT 326	Introduction to Business Statistics II (For ACCT, BUSEC, and FIN majors only)	3
PHIL 230	Moral Theory and Practice	3

Business Core: 21 cr.

ACCT 285	Managerial Accounting	3
FIN 301	Principles of Finance	3
MGMT 370	Management of Organizations	3
MIS 301	Management Information Systems	3
MGMT 372	Responsible Management and Leadership in Business	3
MKT 340	Principles of Marketing	3
SCM 301	Supply Chain Management	3
MGMT 478	Strategic Management *	3
Total Credits		24

*All above core courses must be complete before Mgmt 478.

Electives:

1. Acct, Fin, and Bus Econ majors will also take STAT 326 Introduction to Business Statistics II as part of the supporting courses. Bus Econ majors will take MATH 160 Survey of Calculus and ECON 207 Applied Economic Optimization instead of MATH 150 Discrete Mathematics for Business and Social Sciences and MATH 151 Calculus for Business and Social Sciences. Acct majors will take ACCT 301 The Accounting Cycle concurrent with ACCT 285 Managerial Accounting as part of the Supporting Courses. MIS majors will take MIS 207 Fundamentals of Computer Programming as part of the Supporting Courses.
2. Students not adequately prepared in mathematics may have to take remedial courses in addition to courses listed above. Remedial mathematics courses may not be used to satisfy credit requirements for graduation in the business curricula.
3. Students may satisfy the Global Perspectives requirement either by taking six credit hours from the University International Perspectives list or three credit hours from the International Perspectives list and three credit hours from the College of Business Global Perspectives list. Approved list of courses is available at http://www.business.iastate.edu/undergraduate/majors or from the Undergraduate Programs Office in the College of Business.
4. Courses used for the International Perspectives and U.S. Diversity requirements may also be used to fulfill other curriculum requirements or electives and therefore credits are not included in the sum needed.

Professional Programs

The curriculum in accounting is accredited by AACSB International and the Association to Advance Collegiate Schools of Business.

Accounting major: 23 cr.

ACCT 383	Intermediate Managerial Accounting	3
ACCT 384	Accounting Information Systems	3
ACCT 386	Intermediate Accounting I	3
ACCT 387	Intermediate Accounting II	3
ACCT 485	Principles of Federal Income Tax	3
ACCT 497	Introduction to Auditing	3
ACCT 498	Capstone in Accounting	2
One additional course from department approved list		3
Total Credits		23

Business Economics major: 19 cr.

ECON 301	Intermediate Microeconomics	4
ECON 353	Money, Banking, and Financial Institutions	3
ECON 431	Managerial Economics	3
ECON 492	Graduating Senior Survey	R
Select three additional economics courses from the department approved list		9
Total Credits		19

Entrepreneurship Major: 18 cr.

MGMT 310	Entrepreneurship and Innovation	3
MGMT 313	Feasibility Analysis and Business Planning	3
MGMT 320X	Corporate Entrepreneurship, Innovation and Technology Management	
Select one capstone:		3
ENTSP 480	Applied Entrepreneurship: Executing New Ventures and Projects	
ENTSP 485	Trends and Theories of Entrepreneurship	
Select two addtional courses from department approved list		6
Total Credits		18

Finance major: 21 cr.

FIN 310	Corporate Finance *	3
FIN 320	Investments	3

Select four FIN courses from the Finance Department approved list (at least two muct be 400-level).	12
Select one ACCT course from the Finance Department approved list.:	3
Total Credits	21

*STAT 326 Introduction to Business Statistics II is highly recommended to be taken as a prerequisite.

Management major: 18 cr.

MGMT 310	Entrepreneurship and Innovation	3
MGMT 371	Organizational Behavior	3
MGMT 414	International Management	3
Select three management elective courses from the department approved list. Students may select courses from one of two tracks, Organizational Leadership or Entrepreneurship.		9
Total Credits		18

Management Information Systems major: 18 cr.

MIS 307	Intermediate Business Programming	3
MIS 310	Information Systems Analysis	3
MIS 320	Database Management Systems	3
MIS 340	Project Management	3
Select two courses from Department list that complete an Elective Cluster.		6
Elective Clusters are Application Development, Business Analytics, IT Infrastructure and Security, and Supply Chain Management.		
Total Credits		18

Marketing major: 18 cr.

MKT 444	Marketing Research	3
MKT 447	Consumer Behavior	3
MKT 443	Strategic Marketing Management	3
Select three additional marketing courses from the department approved list.		9
Total Credits		18

Supply Chain Management major: 18 cr.

SCM 424	Process Management, Analysis, and Improvement	3
SCM 453	Supply Chain Planning and Control	3
SCM 460	Decision Tools for Logistics and Operations Management	3
SCM 461	Principles of Transportation	3
SCM 486	Principles of Purchasing and Supply Management	3
Select one SCM elective course from departmental approved list.		3
Total Credits		18

Bachelor of Science

The bachelor of science (B.S.) degree offers a high quality professional education in business. It prepares students for professional careers in specialized functions of business and government. Candidates for this degree must satisfy the requirements established by the College of Business and also the requirements for individual majors specified by the departments of the College. All candidates for the B.S. degree are required to complete one of the following majors: accounting, business economics, entrepreneurship, finance, management, management information systems, marketing, or supply chain management.

Majors

Accounting
Business Economics
Entrepreneurship
Finance
International Business (second major only)
Management
Management Information Systems
Marketing
Supply Chain Management

Accounting

For undergraduate curriculum in business, major in accounting.

The Department of Accounting offers a major in accounting. Students will complete the general education requirements (including business foundation courses), business core requirements for the bachelor of science (BS) degree, and 23 additional credits in the major.

The curriculum in accounting is accredited by AACSB International, the Association to Advance Collegiate Schools of Business.

The primary purpose of accounting is to provide useful information to both internal users (management) and external users such as investors, creditors, government, and the general public. Accounting is an integral part of the management of business and public organizations. Accountants, therefore, participate in planning, evaluating, controlling, and reporting the activities of the firm. Accounting information is needed by external users in order to make investment decisions, to grant or withhold credit, and in the case of government, to collect revenue and gather statistical information. In order to provide useful information, accountants collect, analyze, synthesize, and report data in an understandable manner.

The instructional objective of the Accounting Program is to provide a well-rounded professional education in accounting. Such an education should provide the student with:

1. a mastery of basic accounting concepts

2. an ability to think critically and creatively about accounting problems
3. an ability to communicate effectively and work with others as a member of a team
4. an awareness and sensitivity for dealing with ethical concerns.

The major in accounting is designed to give students a conceptual foundation as well as to provide a wide range of basic skills and analytical tools for use in reporting for both public and private concerns. Students who complete the accounting major are well prepared to accept positions in industry, government, and the public accounting profession.

The requirements for the accounting major are met by successful completion of the following courses:

ACCT 383	Intermediate Managerial Accounting	3
ACCT 384	Accounting Information Systems	3
ACCT 386	Intermediate Accounting I	3
ACCT 387	Intermediate Accounting II	3
ACCT 485	Principles of Federal Income Tax	3
ACCT 497	Introduction to Auditing	3
ACCT 498	Capstone in Accounting	2
Three credit hours of electives chosen from the following:		3
ACCT 483	Advanced Managerial Accounting	
ACCT 484	Advanced Accounting Information Systems	
ACCT 487	Volunteer Income Tax Assistance	
ACCT 488	Governmental and Non-profit Institution Accounting	
ACCT 495	Advanced Accounting Problems	
ACCT 496	International Accounting	

See the CPA note below for the 150-hour education requirement for CPA certification in Iowa.

In addition, it is highly recommended that an accounting major include ACCT 316 Business Law. The Department of Accounting should be consulted for information on alternative plans of study.

The department also offers a minor for College of Business students with a different major. They are required to take 16 credits from a list of approved courses, of which 9 credits need to stand alone.

CPA Note: The accounting major requires 24 credits of accounting beyond ACCT 284 Financial Accounting and ACCT 285 Managerial Accounting. This satisfies the State of Iowa CPA exam requirement. ACCT 316 Business Law is also highly recommended; please note this class does not count towards the aforementioned 24 hours required to sit for the exam. While students may sit for the CPA exam in Iowa after completing the required accounting course work and earning a bachelors degree, CPA candidates must complete a total of 150 credits in order to be certified or licensed to practice in Iowa. Qualified students should consider taking the Masters of Accounting (MAcc) to satisfy the 150-credit requirement. Juniors and seniors in accounting who are interested in graduate study should contact the Coordinator of the MAcc Program as early as possible to complete their graduate degree in an efficient manner. Students planning certification outside Iowa must check local rules, as each state determines its own exam qualification and licensing requirements.

Freshman

Fall	Credits	Spring	Credits
BUSAD 102 (or 103)	1	BUSAD 250	3
COM S 113	3	MATH 151	3
ECON 101	3	ECON 102	3
ENGL 150	3	HUM/SOC SCI	3
MATH 150	3	International Perspective[@]	3
LIB 160	1		
HUM/SOC SCI	3		
	17		15

Sophomore

Fall	Credits	Spring	Credits
BUSAD 203	1	PHIL 230	3
ACCT 284	3	SP CM 212	3
ENGL 250	3	ACCT 215	3
STAT 226	3	ACCT 285	3
HUM/SOC SCI	3	MIS 301	3
General Elective	3	ACCT 301	1
	16		16

Junior

Fall	Credits	Spring	Credits
ACCT 384	3	Core Business Courses	6
ACCT 386	3	ACCT 383	3
ENGL 302	3	ACCT 387	3
STAT 326	3	U.S. Diversity or Elective[#]	3
Core Business Course	3		
	15		15

Senior

Fall	Credits	Spring	Credits
ACCT 485	3	MGMT 478[*]	3
ACCT 497	3	ACCT Elective	3
Core Business Course	6	ACCT 498	2
International/Global Perspective	3	Natural Science	3

	General Elective	2
	15	13

Total Credits: 122

@ Courses in these requirements may be also used as Global Perspective.

\# US Diversity courses may be used to satisfy HUM/SOC SCI.

* All core classes must be completed prior to taking MGMT 478 in the graduating semester.

Students must be admitted to the professional program in business to major in accounting. The requirements to enter the professional program are:

1. Completion of 30 credits, Foundation Courses, ENGL 150, and all ENGL 101/99 courses if required.

2. A minimum GPA of 2.50 either cumulative or in the Foundation Courses.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.

2. 42 credits of 300+ level courses.

3. 50% of required Business courses must be earned at ISU.

4. At least 32 credits and the LAST 32 credits must be earned at ISU.

5. 122 Credits minimum and a Cumulative GPA of at least 2.00

6. Grade of "C" or higher in 2 of the 3 required ENGL courses.

Graduate Study

The department offers a graduate degree, the master of accounting (MAcc). This is a 30-hour degree. The program requires 15 hours of graduate accounting courses, ENGL 592C Core Studies: Professional Communication or its equivalent, at least 9 hours of non-accounting graduate electives, and an international course from an approved list. Included in the 15 required hours of graduate accounting courses is one 3-credit required course, ACCT 598 Financial Accounting: Theory and Contemporary Issues.

The MAcc is appropriate for accounting undergraduate students wanting to pursue a variety of accounting careers. The MAcc program is an efficient way for qualified candidates to meet the 150-hour education requirement for CPA certification in Iowa. Students without an accounting degree will be required to complete a substantial amount of accounting coursework prior to being considered for admission to the MAcc. Contact the coordinator of the MAcc program for details.

The department participates in the full-time and part-time Master of Business Administration (MBA) program. The MBA is a 48-credit, non-thesis, non-creative component curriculum. Thirty of the 48 credits are core courses and the remaining 18 are graduate electives. Within the MBA program, students may develop an area of specialization in accounting. The specialization is designed to help meet the education requirement for CPA certification in Iowa.

Courses primarily for undergraduates:

ACCT 215: Legal Environment of Business
(3-0) Cr. 3. F.S.SS.
Prereq: Sophomore classification
General history, structure, and principles of the US legal system. The legal system, as an agency of social control and tool for resolving disputes. The court systems, Constitution, torts, crimes, intellectual property, contracts, property rights, employment law, basic business entity law, bankruptcy, administrative agencies, environmental law and agency law.

ACCT 284: Financial Accounting
(3-0) Cr. 3. F.S.SS.
Prereq: not open to first term freshmen
Introduction to the basic concepts and procedures of financial accounting from a user perspective. The course examines the accounting cycle, business terminology, basic control procedures, and the preparation and evaluation of financial reports, with an emphasis on financial statement analysis.

ACCT 285: Managerial Accounting
(3-0) Cr. 3. F.S.SS.
Prereq: ACCT 284
Understanding of fixed and variable costs and their role in planning, control and performance evaluation. Examination of alternative costing methods. Making decisions by identifying and developing relevant information. Development of spreadsheet skills.

ACCT 301: The Accounting Cycle
(1-0) Cr. 1. F.S.SS.
Prereq: ACCT 284
Interactive computer-based analysis of the accounting cycle including transactions and financial statements. Preparation of journal entries and adjusting entries and completion of the closing process.

ACCT 316: Business Law
(3-0) Cr. 3. F.S.
Prereq: ACCT 215
Continuation of 215. The Uniform Commercial Code as applied to sales contracts and negotiable instruments. Property law, wills and estates, insurance, secured transactions, corporation law, partnership law and antitrust law.

ACCT 383: Intermediate Managerial Accounting
(3-0) Cr. 3. F.S.
Prereq: ACCT 285 or ACCT 501; and ACCT 301
Generation, communication and use of information to assist management with planning, control, and decision making in manufacturing and service organizations. Includes cost concepts and relevance to decision situations, operational and capital budgeting, and performance evaluation. Emphasis on developing effective teamwork skills as well as spreadsheet capabilities.

ACCT 384: Accounting Information Systems
(3-0) Cr. 3.
Prereq: ACCT 285 or ACCT 501; ACCT 301 and MIS 301
Analysis of concepts and procedures underlying the automated accumulation and processing of accounting data. EDP internal control and audit techniques. Trends in accounting information systems.

ACCT 386: Intermediate Accounting I
(3-0) Cr. 3. F.S.
Prereq: ACCT 285 or ACCT 501 and ACCT 301
The conceptual framework of financial accounting. Communication of financial information on the income and retained earnings statements, statement of cash flows, and the balance sheet. Accounting concepts relating to current and operational assets of the firm.

ACCT 387: Intermediate Accounting II
(3-0) Cr. 3. F.S.
Prereq: ACCT 386
Financial accounting and reporting practices for business entities. Generally accepted accounting principles (GAAP) relative to firm liabilities, equity, income, taxes, employee benefits, leases, accounting changes and cash flows. Discussion of current issues in financial accounting. Focus on written communication.

ACCT 483: Advanced Managerial Accounting
(Dual-listed with ACCT 583). Cr. 3.
Prereq: ACCT 383 or ACCT 581
Business simulation focusing on generation and communication of information to assist management with financial decision-making. Emphasis on developing teamwork, written communication, and oral presentation skills.

ACCT 484: Advanced Accounting Information Systems
(Dual-listed with ACCT 584). (3-0) Cr. 3.
Prereq: ACCT 384
Advanced accounting information systems concepts; database design and information retrieval, internal controls within computerized accounting information systems, financial reporting in an electronic environment.

ACCT 485: Principles of Federal Income Tax
(3-0) Cr. 3. F.S.
Prereq: ACCT 386 or ACCT 501
Introduction to the fundamentals of federal income taxation and concepts applicable to all tax entities. Addresses issues related to the measurement and recognition of income, deductions, gains, and losses, taxation of property transactions, and basis / cost recovery concepts. Includes coverage of tax law policy objectives, tax implications of business and investment decisions, tax versus financial reporting treatment of common business transactions, and ethical issues related to tax compliance and planning.

ACCT 487: Volunteer Income Tax Assistance
(Dual-listed with ACCT 587). (0-2) Cr. 1. Repeatable, maximum of 3 credits. S.
Prereq: ACCT 285 or ACCT 501
Introduction to and field work in the preparation of individual income tax returns (state and federal). Basic coverage of filing and residency status, taxable income, exemptions, deductions, and credits. Tax software usage and online filing.

ACCT 488: Governmental and Non-profit Institution Accounting
(Dual-listed with ACCT 588). (3-0) Cr. 3.
Prereq: ACCT 387
Accounting and financial reporting principles of local and state governments, including universities, schools, and hospitals. In addition, accounting and financial reporting of non-profit organizations will be addressed. Financial statements of local governmental units and the university are explored.

ACCT 490: Independent Study
Cr. 1-3. Repeatable. F.S.SS.
Prereq: ACCT 285, senior classification, permission of instructor

ACCT 495: Advanced Accounting Problems
(Dual-listed with ACCT 595). (3-0) Cr. 3.
Prereq: ACCT 387
Accounting for business combinations and affiliated companies, intercompany transactions, and consolidated financial statements; Partnership accounting; Segment and Interim Reporting; Multinational accounting.

ACCT 496: International Accounting
(Dual-listed with ACCT 596). (3-0) Cr. 3.
Prereq: ACCT 386 or ACCT 501
Financial reporting issues in a global environment, including introduction to International Financial Reporting Standards (IFRS) and the potential for the use of IFRS in the U.S. Accounting and managerial issues faced by multinational corporations. Technical issues such as transfer pricing, inflation accounting and taxation will be discussed.

ACCT 497: Introduction to Auditing
(3-0) Cr. 3. F.S.
Prereq: ACCT 384, ACCT 387 and STAT 326
The conceptual framework of auditing. Professional ethics. External reporting concepts. Audit methodology including risk analysis, internal control, procedures for gathering evidence and the role of statistical sampling in auditing.

ACCT 498: Capstone in Accounting
(2-0) Cr. 2. F.
Prereq: ACCT 383, ACCT 384, ACCT 387, and ACCT 485.
Integrative studies in accounting. Development of critical thinking, ethical reasoning, professional research and teamwork skills. Written, visual, and oral communication with corporate stakeholders.

Courses primarily for graduate students, open to qualified undergraduates:

ACCT 501: Financial Accounting
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission
A general introduction to financial accounting information. Topics covered include the use and analysis of financial information, the regulatory environment, the role of International Financial Reporting Standards (IFRS), and the use of the internet and electronic spreadsheets as a means of accessing and analyzing financial data.

ACCT 581: Accounting for Decision Making
(3-0) Cr. 3.
Prereq: ACCT 501 or equivalent
Decision analysis applied to managerial accounting issues. Generation of information for management decision making and control. Responsibility accounting and non-recurring decisions.

ACCT 582: Corporate Governance and Top Management
(Cross-listed with MGMT). (3-0) Cr. 3.
Prereq: MGMT 503 or permission
Duties, structure, and functioning of top management teams and corporate boards of directors. CEO/board tenure and succession planning, top management compensation, board committee composition, assessment of CEO and board performance, theories of corporate governance, management of the corporate strategic agenda, governance codes, international governance, and chairman/CEO duality. Case studies and contemporary issues discussed.

ACCT 583: Advanced Managerial Accounting
(Dual-listed with ACCT 483). Cr. 3.
Prereq: ACCT 383 or ACCT 581
Business simulation focusing on generation and communication of information to assist management with financial decision-making. Emphasis on developing teamwork, written communication, and oral presentation skills.

ACCT 584: Advanced Accounting Information Systems
(Dual-listed with ACCT 484). (3-0) Cr. 3.
Prereq: ACCT 384
Advanced accounting information systems concepts; database design and information retrieval, internal controls within computerized accounting information systems, financial reporting in an electronic environment.

ACCT 585: Taxes and Business Strategy
(3-0) Cr. 3.
Prereq: ACCT 485
Integration of concepts from accounting, finance, and economics to determine how taxes affect business decisions. Provides students with a conceptual framework for thinking about business tax planning and applies it to various common business decisions.

ACCT 586: Advanced Federal Taxation
(3-0) Cr. 3.
Prereq: ACCT 485
Advanced coverage of federal taxation including issues related to the taxation of corporations, partnerships, estates and trusts, and their owners. Includes coverage of rules, concepts, background, and planning opportunities related to a number of common transactions involving these entities.

ACCT 587: Volunteer Income Tax Assistance
(Dual-listed with ACCT 487). (0-2) Cr. 1. Repeatable, maximum of 3 credits. S.
Prereq: ACCT 285 or ACCT 501
Introduction to and field work in the preparation of individual income tax returns (state and federal). Basic coverage of filing and residency status, taxable income, exemptions, deductions, and credits. Tax software usage and online filing.

ACCT 588: Governmental and Non-profit Institution Accounting
(Dual-listed with ACCT 488). (3-0) Cr. 3.
Prereq: ACCT 387
Accounting and financial reporting principles of local and state governments, including universities, schools, and hospitals. In addition, accounting and financial reporting of non-profit organizations will be addressed. Financial statements of local governmental units and the university are explored.

ACCT 589: Corporate Social Responsibility Reporting
(3-0) Cr. 3. S.
Prereq: ACCT 386 or ACCT 501
Theory and practice of social and environmental reporting, the role of the corporation in society, and the mechanisms by which society might hold corporations accountable for their actions.

ACCT 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
For students wishing to do individual research in a particular area of accounting.

ACCT 591: Fraud Examination and Prevention
(3-0) Cr. 3.
Prereq: ACCT 497 or ACCT 501
Principles and methodology of fraud detection and deterrence. Addresses the causes and elements of fraud, asset theft, corruption, financial statement mis-representation, internal controls for fraud prevention, investigative evidence gathering, and legal aspects of fraud.

ACCT 592: Financial Statement Analysis
(3-0) Cr. 3.
Prereq: ACCT 284 or ACCT 501
Presentation and analysis of financial statement information from the point of view of the primary users of such data: owners and creditors. Topics include the financial reporting system, the primary financial statements, effects of accounting method choice on reported financial data, and firm valuation.

ACCT 594: Business Valuation
(3-0) Cr. 3.
Prereq: ACCT 387 or ACCT 592
Using financial statement analysis to value the firm. Topics covered include assessing how well a firm's financial statements reflect the economic effects of its resource management strategies and constructing proforma financial information that will serve as inputs to valuation models.

ACCT 595: Advanced Accounting Problems
(Dual-listed with ACCT 495). (3-0) Cr. 3.
Prereq: ACCT 387
Accounting for business combinations and affiliated companies, intercompany transactions, and consolidated financial statements; Partnership accounting; Segment and Interim Reporting; Multinational accounting.

ACCT 596: International Accounting
(Dual-listed with ACCT 496). (3-0) Cr. 3.
Prereq: ACCT 386 or ACCT 501
Financial reporting issues in a global environment, including introduction to International Financial Reporting Standards (IFRS) and the potential for the use of IFRS in the U.S. Accounting and managerial issues faced by multinational corporations. Technical issues such as transfer pricing, inflation accounting and taxation will be discussed.

ACCT 597: Advanced Auditing and Assurance Services
(3-0) Cr. 3.
Prereq: ACCT 497
A study of advanced auditing and assurance issues. Topics include risk analysis, internal control, fraud detection, analytical procedures, evaluating operational and strategic objectives, and reporting and implementing audit findings.

ACCT 598: Financial Accounting: Theory and Contemporary Issues
(3-0) Cr. 3. F.
Prereq: ACCT 386 or ACCT 501
Theoretical discussion of the financial accounting and reporting environment. The usefulness of financial accounting information for decision making. Current financial accounting issues, the financial accounting standard setting process, FASB Standards Codification, and the role of the SEC in financial reporting.

ACCT 599: Creative Component
Cr. 2.
Prereq: Admission to the Master of Accounting Program
This course prepares students to complete their creative component project option in the Master of Accounting degree.

Business Administration

The department of Business Administration supports the undergraduate programs in the departments of Accounting, Finance, Management, Marketing, and Supply Chain and Information Systems, by providing specialized coursework in orientation to business, and cooperative education opportunities.

Graduate Study

The College of Business offers a professional graduate degree program in business administration, the master of business administration (MBA), which is described below. The college also has four specialized master degree programs: the master of accounting (MAcc), the master of business analytics (MoBA), the master of finance (MFin), and the master of science in information systems (MSIS). The college also offers a PhD in business and technology, with specializations in information systems, management, marketing, supply chain management, and entrepreneurship. Finally, the College of Business is a participating

member of the following interdepartmental programs: master of engineering management, master of science in transportation, master of science in seed technology and business, master of science and PhD in human computer interaction, and master of science in information assurance.

Master of Business Administration (MBA)

The College of Business offers a 48 credit program leading to a non-thesis master of business administration degree with a specialization in accounting, finance, information systems, marketing, or supply chain management. The coursework is designed to provide the knowledge, skills, and abilities for managerial success and leadership in organizations. The MBA is the professional management education program for those pursuing careers in business.

Students may enroll in the MBA on either a full-time or part-time basis. The part-time MBA is designed for employed professionals. Part-time MBA classes are held in the evenings in downtown Des Moines.

Students working toward the MBA are required to complete a series of core courses in the basic functional areas of business (accounting, economics, quantitative analysis, finance, supply chain management, organizational behavior, management information systems, marketing, professional responsibilities, and strategic management), as well as advanced elective coursework. Two courses on professional skills development are also required for full-time MBA students.

Courses for the MBA are provided by the departments of Accounting, Economics, Finance, Management, Marketing, and Supply Chain and Information Systems. Courses from other departments may also be chosen to meet specific student interests.

A concurrent BS/MBA is available to eligible undergraduate students majoring in aereospace, agricultural, biosystems,chemical, civil, computer, electrical, industrial, software or mechanical engineering. A concurrent BS/MBA is available to eligible undergraduate students majoring in Agricultural Systems Technology, Agronomy, Animal Science, Chemistry, Food Science, and Industrial Technology. The College of Business and the College of Veterinary Medicine offer a concurrent MBA/DVM degree.

Double master's degree programs are offered with architecture (MArch/MBA), apparel, merchandising, and design (MBA/MSAMD)community and regional planning (MBA/MCRP), information systems (MBA/MSIS), finance (MBA/MFin), and statistics (MBA/MS-Statistics).

The College of Business also offers a business administration minor to students with majors outside the college.

The MBA program is open to all individuals with a baccalaureate degree. Undergraduates from arts and humanities, science, and technical programs are especially encouraged to apply. Academic potential and promise for a productive career in business and for managerial success and leadership in organizations are important criteria for admission. Applicants must submit official transcripts of previous academic work, Graduate Management Admission Test (GMAT) scores, personal essays, a resume, and two letters of reference. International students whose native language is not English and who did not graduate from a U.S. college or university are required to submit the Test of English as a Foreign Language (TOEFL) or International English Language Testing System (IELTS) scores.

Applicants are considered for fall semester entry only into the full-time MBA. Although applications will be considered after this date, candidates are encouraged to submit their application materials by June 1 (March 1 for international students). Part-time MBA applications are considered for fall, spring, or summer entry.

Ph.D. in Business and Technology

The College of Business offers graduate work leading to the doctor of philosophy degree in business and technology, with one of five specializations—entrepreneurship (ENTSP), information technology (IS), management (MGMT), marketing (MKT), or supply chain management (SCM). Departments in the college (Management, Marketing, and Supply Chain and Information Systems), and the departments of Statistics, Economics, Psychology and Sociology cooperate in providing coursework toward this degree. The program prepares individuals for academic careers in research, teaching, and public service at institutions of higher learning in the United States and other countries. The PhD program consists of a 44-credit course curriculum followed by a 12-credit thesis or dissertation.

Students do not need to have an undergraduate or master's degree in business in order to qualify for enrollment in the PhD program. However, students without a graduate degree in business will be required to complete 18 hours of business foundation requirements. These may include:

- Financial or managerial accounting (min. 3 Cr)
- Corporate finance (min. 3 Cr)
- Management information systems (min. 3 Cr)
- Marketing (min. 3 Cr)
- Supply chain management (min. 3 Cr)
- Economics – micro and macro (min. 6 Cr)

Students can choose one of five areas of specialization—ENTSP, IS, MGMT, MKT, or SCM.

The entrepreneurship (ENTSP) specialization is a 56 credit (minimum) curriculum designed around four interrelated areas (core, specialization, minor, and research methods) and dissertation. The focus of the

specialization is on preparing students to conduct and publish scholarly research in the fields of Entrepreneurship, Innovation, and Technology Management.

The information systems (IS) specialization examines issues related to the development, building, management, and use of information and knowledge-based technologies. Such technologies enable users to collect organizational data, provide a platform for organizing and disseminating the data, and offer operational, decision support, and knowledge management tools through which users can leverage data and information for making better organizational decisions. Students in the IS specialization will study areas such as information technology analysis and development, database and knowledge management systems, decision support and data mining, human computer interaction, system security and integrity, and project management and collaborative teamwork.

The management (MGMT) specialization applies a broad range of theoretical perspectives from the social sciences and diverse research methods to the study of organizational behavior, human resources, strategy, and entrepreneurship. The curriculum takes a multidisciplinary approach to analyze individuals and teams, the formulation and implementation of strategy, the effective use of human resources, social responsibility and ethics, entrepreneurship, innovation and technology, and the challenges of the global business environment. The program emphasizes personalized attention and the development of scholars who can contribute with high-quality theoretical and empirical research in these and related areas.

The marketing (MKT) area focuses on identification and delivery of solutions that help improve the ways in which businesses attract, capture, service and maintain customers. To do these activities well, organizations will need to integrate process goals and activities across different functional areas and across multiple organizational partners. This area of study will examine issues relating to inter-functional and inter-organizational relationships and their management in pursuit of maximizing the lifetime value of a businesses' customer base.

The supply chain management (SCM) specialization focuses on the design, development, and control of business processes for conversion of inputs into outputs and distribution of those outputs. The traditional focus of SCM was on integration of processes across multiple functions within the firm—operations management, logistics, and purchasing primarily, with elements of marketing and information systems included as well. However, in today's world, where competition occurs across supply chain networks, SCM also involves integrating business processes across firms.

Programs of study for the doctoral study are designed for each student in consultation with the major professor and the student's PhD committee. Each student must complete advanced courses in his/her area of specialization, a minor area that supports the major area, and research methods courses. Students must demonstrate competence in theory and research methods by passing qualifying examinations.

Application deadline for the PhD program is February 1 for fall admission. Applicants must submit official transcripts of previous educational coursework and degrees, Graduate Management Admission Test (GMAT) scores, personal essays, a resume, and three letters of reference. International students whose native language is not English and who did not graduate from a U.S. college or university are required to submit TOEFL (Test of English as a Foreign Language) scores.

Courses primarily for undergraduates:

BUSAD 102: Business Learning Team Orientation
(1-0) Cr. 1. F.S.
A required orientation for all College of Business Students involved with a Business Learning Team. Review of college and university requirements, transfer credits, academic planning, university policies and deadlines and registration procedures. Includes a consideration of various business majors and careers, tools for success in college including writing skills and presentations from employers, alumni and current students. Only one of BusAd 101, 102, or 103X may be counted towards graduation.

BUSAD 103: Orientation
(1-0) Cr. 1. F.S.
A required orientation for all College of Business students. Review of college and university requirements, transfer credits, academic planning, university policies and deadlines, and registration procedures. Includes group advising for course selection and registration. Only one of BUSAD 101, 102, or 103 may be counted toward graduation.

BUSAD 203: Business Careers and Employment Preparation
(1-0) Cr. 1.
Prereq: BUSAD 101 or 102
Careers in business and issues relevant to the workplace. Discussion of diversity and ethics issues in the workplace. Developing and implementing a professional job search, functioning professionally in the workplace setting, resume and profession correspondence, interviewing, evaluating offers, business etiquette, networking and transitioning from student to employee.

BUSAD 250: Introduction to Business
(3-0) Cr. 3.
Prereq: COM S 113X
Introduction to the functional areas of business and how the functional areas are integrated for the purpose of implementing business strategy. Introduces students to decision making tools (spreadsheets and databases) that are integral to business decision making. Includes application exercises to all functional areas of business.

BUSAD 291: Experiential Learning
Cr. 1-3. Repeatable.
Prereq: Written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 291A: Experiential Learning: Domestic Internship.
Cr. 1-3. Repeatable.
Prereq: Written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 291B: Experiential Learning: International Internship.
Cr. 1-3. Repeatable.
Prereq: Written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 291C: Experiential Learning: Domestic Travel and Study.
Cr. 1-3. Repeatable.
Prereq: Written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised travel and study experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 291D: Experiential Learning: International Travel and Study.
Cr. 1-3. Repeatable.
Prereq: Written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised travel and study experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 292: Entrepreneurship & Innovation Learning Community (EILC) Seminar
(1-0) Cr. 1.
Prereq: Current member of or have applied to be a member of Entrepreneurship and Innovation Learning Community (see www.isupjcenter.org/ELC for more information)
Topics related to entrepreneurship and entrepreneurial thinking. Presentations by entrepreneurs and faculty, field trips, business concept development.

BUSAD 398: Cooperative Education
Cr. R. Repeatable, maximum of 3 times.
Prereq: Permission of department
Required of all cooperative education students engaged in full-time internship/co-op. Students must register for this course prior to commencing each work period. No more than three credits may be taken in addition to BusAd 398 during any given semester. Offered on a satisfactory-fail basis only.

BUSAD 490: Independent Study
Cr. 1-3. Repeatable.
Prereq: Professional program in Business; permission of instructor; for 490H: Admission to the Business Honors Program

BUSAD 490A: Independent Study: International Business
Cr. 1-3. Repeatable.
Prereq: Professional program in Business; permission of instructor

BUSAD 490E: Independent Study: Entrepreneurship
Cr. 1-3. Repeatable.
Prereq: senior classification, permission of instructor

BUSAD 490G: Independent Study: General
Cr. 1-3. Repeatable.
Prereq: Professional program in Business; permission of instructor
Independent Study.

BUSAD 490H: Independent Study: Honors
Cr. 1-3. Repeatable.
Prereq: Admission to the Business Honors Program

BUSAD 491: Professional Experiential Learning
Cr. 1-3. Repeatable.
Prereq: Professional program, 12 credits from College of Business; written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 491A: Professional Experiential Learning: Domestic Internship
Cr. 1-3. Repeatable.
Prereq: Professional program, 12 credits from College of Business; written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 491B: Professional Experiential Learning: International Internship
Cr. 1-3. Repeatable.
Prereq: Professional program, 12 credits from College of Business; written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 491C: Professional Experiential Learning: Domestic Travel and Study
Cr. 1-3. Repeatable.
Prereq: Professional program, 12 credits from College of Business; written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised travel and study in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 491D: Professional Experiential Learning: International Travel and Study
Cr. 1-3. Repeatable.
Prereq: Professional program, 12 credits from College of Business; written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised travel and study in a business related discipline. Offered on a satisfactory-fail basis only.

BUSAD 491E: Professional Experiential Learning: Other Experiential Learning Experience
Cr. 1-3. Repeatable.
Prereq: Professional program, 12 credits from College of Business; written approval of supervising instructor and department chair on required form prior to the learning experience
Supervised work experience in a business related discipline.

Courses primarily for graduate students, open to qualified undergraduates:

BUSAD 501: Strategic Management
(Cross-listed with STB). (2-0) Cr. 2.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Critical analysis of current practice and case studies in strategic management with an emphasis on integrative decision making. Strategy formulation and implementation will be investigated in the context of complex business environments.

BUSAD 502: Quantitative Business Analysis and Decision Making
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission
Introduction to the sources and statistical analysis of data as well as optimization models for use in making business decisions. Data collection, descriptive and inferential statistics including hypothesis testing, analysis of variance, multiple regression, linear programming and simulation.

BUSAD 503: Information Systems
(Cross-listed with STB). (2-0) Cr. 2.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Introduction to a broad variety of information systems (IS) topics, including current and emerging developments in information technology (IT), IT strategy in the context of corporate strategy, and IS planning and development of enterprise architectures. Cases, reading, and discussions highlight the techniques and tactics used by managers to cope with strategic issues within an increasingly technical and data-driven competitive environment.

BUSAD 504: Marketing and Logistics
(Cross-listed with STB). (3-0) Cr. 3.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Integration of the business functions concerned with the marketing and movement of goods along the supply chain with the primary goal of creating value for the ultimate customer. Coordination of marketing, production, and logistics activities within the firm and with outside suppliers and customers in the supply chain.

BUSAD 507: Organizational Behavior
(Cross-listed with STB). (2-0) Cr. 2.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Understanding human behavior in organizations, and the nature of organizations from a managerial perspective. Special emphasis on how individual differences, such as perceptions, personality, and motivation, influence individual and group behavior in organizations and on how behavior can be influenced by job design, leadership, groups, and the structure of organizations.

BUSAD 508: Accounting and Finance
(Cross-listed with STB). (3-0) Cr. 3.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Survey of fundamental topics in accounting and finance. Financial statement reporting and analysis for agriculture firms, corporate governance issues related to financial reporting, (e.g., Sarbanes-Oxley). Basic tools and techniques used in financial management, including stock and bond valuation. How to assess and use capital budgeting methods to evaluate proposed firm investments.

BUSAD 509: Seed Trade, Policy and Regulation
(Cross-listed with STB). (3-0) Cr. 3.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Cultural, financial, economic, political, legal/regulatory environments shaping an organization's international business strategy. Topics include entry (and repatriation) of people, firms, goods, services, and capital. Special attention to the institutions of seed regulation and policy. Ethical issues facing managers operating in an international context.

BUSAD 590: Special Topics in Business
(3-0) Cr. 3. Repeatable.
Prereq: Enrollment in MBA program or departmental permission.
A special topics course covering contemporary issues in business. Topics vary by semester.

BUSAD 591: Professional Experiential Learning
Cr. 1-3. Repeatable.
Prereq: Graduate standing; written approval of supervising instructor and department chair on required form prior to the learning experience
Academically supervised travel and/or work experiences in a business related discipline.

BUSAD 592: MBA Professional Skills Development
Cr. R.
Prereq: Admission to Full-time MBA Program
Provides first-year MBA students with tools necessary to develop and implement a successful internship and career search, and to develop professional skills critical for success in the competitive business environment. Topics include career search strategy, resume and cover letter development, interviewing, strategic networking, salary negotiation, impression management, team skills development, presentation skills development, and business etiquette. Required for all full-time MBA students. Offered on a satisfactory-fail basis only.

BUSAD 594: MBA Professional Skills Development II
Cr. R.
Prereq: BUSAD 592
A second course designed to improve the professional skills of first-year MBA students. Emphasis on building effective communications and networking skills. Students will participate in professional workshops, company visits, executive speaker seminars, service learning projects, business case competitions, and related activities. Offered on a satisfactory-fail basis only.

BUSAD 598: Cooperative Education
Cr. R.
Prereq: Permission of instructor
Professional work experience. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

BUSAD 599: Creative Component
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599A: Creative Component: Accounting
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599C: Creative Component: Finance
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599E: Creative Component: Management
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599F: Creative Component: Marketing
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599I: Creative Component: Agribusiness
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599J: Creative Component: General Business
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599K: Creative Component: Management Information Systems
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

BUSAD 599M: Creative Component: Supply Chain Management
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

Courses for graduate students:

BUSAD 644: Business Research Methods
(3-0) Cr. 3. F.
Prereq: In PhD program in the College of Business or consent of instructor
A survey of the wide variety of research methods used in business. Methods will be presented and discussed with emphasis on applicability in different research situations.

BUSAD 699: Research
Cr. 3-6. Repeatable. F.S.SS.
Prereq: Graduate classification, permission of major professor
Research.

Business Economics

Cooperative Major between the College of Business and the Department of Economics

The objective of the Business Economics major is to provide a high quality education with a balanced emphasis in both business and economics. Such an education should equip graduates with a unique set of skills distinguishing them from other graduates. In particular, they will have the ability to use both business and economic reasoning to think critically and address complex issues using tools and decision making models of economics, business, mathematics, statistics, as well as concepts from the biological, physical, and social sciences; to make decisions and to communicate effectively.

Required courses (10 credits)		
ECON 301	Intermediate Microeconomics	3-4
ECON 353	Money, Banking, and Financial Institutions	3
ECON 431	Managerial Economics	3
ECON 492	Graduating Senior Survey	R
Elective courses (9 credits)		
Three credits of ECON 230-289, 300-389, 400-489.		
Select two additional 400 through 489 level ECON courses		
Notes:		
Business Economics majors must take STAT 326		
Business Economics majors take MATH 160 and ECON 207 instead of MATH 150 and 151		

Business Economics, B.S.

Freshman

Fall	Credits	Spring	Credits
BUSAD 102 (or 103X)	1	ECON 102	3
ECON 101	3	MATH 151[#]	3
COM S 113X	3	BUSAD 250	3
ENGL 150	3	International Perspective[@]	3
MATH 150[#]	3	Social Science	3
LIB 160	1		
	14		15

Sophomore

Fall	Credits	Spring	Credits
BUSAD 203	1	ACCT 215	3
SP CM 212	3	PHIL 230	3
STAT 226	3	Core Block Courses[##]	6-7
ENGL 250	3	MIS 207 or Elective[%]	3
ACCT 284	3		
Natural Science	3		
	16		15-16

Junior

Fall	Credits	Spring	Credits
STAT 326 or Elective[%]	3	Core Block Courses[##]	6
Core Block Courses[##]	6	Elective	1-3
Humanities	3	Major Courses	6-9
US Diversity	3		
	15		13-18

Senior

Fall	Credits	Spring	Credits
ENGL 302	3	MGMT 478	3
Social Science	3	Electives	4-5
Global Perspective	3	Major Courses	6
Major Courses	6	Humanities	3
	15		16-17

Students majoring in Business Economics (BUSEC) will take MATH 160 and ECON 207 instead of MATH 150 and MATH 151.

@ Courses in these requirements may be also used as Global Perspective, Humanities or Social Science.

% Students in the Management Information Systems major (MIS) will take MIS 207 instead of an elective. Students in Accounting, Finance or Business Economics majors will take STAT 326 instead of an elective.

Core Block Courses: Students take the Core Block Courses containing their MAJOR core course first. All Blocks must be completed prior to taking MGMT 478 in the last semester.
BLOCK A: ACCT 285, ACCT 301, MIS 301
BLOCK B: FIN 301 and SCM 301
BLOCK C: MGMT 370 and MKT 340

Professional Program Requirements:

1. Completion of 30 credits, Foundation Courses, ENGL 150, and all ENGL 101/99 courses if required.

2. A minimum GPA of 2.50 either cumulative or in the Foundation Courses.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.

2. 42 credits of 300+ level courses.

3. 50% of required Business courses must be earned at ISU.

4. At least 32 credits and the LAST 32 credits must be earned at ISU.

5. 122 Credits minimum and a Cumulative GPA of at least 2.00

6. A grade of C or higher in ENGL 250, and a C or better in either ENGL 150 or ENGL 302.

Finance

For undergraduate curriculum in business, major in finance.

The Department of Finance offers a major in finance. Students will complete the general education requirements (including business foundation courses), business core requirements for the bachelor of science (B.S.) degree, and 21 additional credits in the major.

Finance is a broad program of study designed to provide a descriptive, behavioral, and analytical background of financial management to enable students to qualify for opportunities in financial services, insurance, brokerage, government, real estate, and financial management of business enterprises. Finance is also an excellent area for those who wish to become more knowledgeable as consumers, particularly in the fields of investments, insurance, and real estate.

Areas of study in the field of finance include corporate financial management, investments, portfolio management, insurance, real estate, banking, and risk management. Upper-level courses include a review of contemporary literature in the field, case studies, and financial problem analysis integrating finance courses previously taken.

The instructional objective of the Finance program is to provide a well-rounded professional education in finance. Such an education should provide the student with:

1. a mastery of basic financial concepts and methods of analysis
2. an understanding of financial operations in a global setting and of the role of financial institutions in the economy
3. an ability to effectively communicate and work with others as the finance member of a team
4. an ability to demonstrate leadership capabilities in financial analysis and portfolio management.

In addition to the basic business requirements, finance majors must also complete:

FIN 310	Corporate Finance *	3
FIN 320	Investments	3
Select four from the following (at least two must be 400-level):		12
FIN 327	Fixed Income Securities	
FIN 330	Financial Markets and Institutions	
FIN 361	Personal Risk Management and Insurance	
FIN 371	Real Estate Principles	
FIN 415	Business Financing Decisions	
FIN 424	Financial Futures and Options	
FIN 425	Security Analysis and Portfolio Management	
FIN 428	Advanced Fixed Income Analysis and Portfolio Management	
FIN 435	Venture Capital, Private Equity, and Mergers and Acquisitions	
FIN 445	Bank Management Decisions	
FIN 450X	Analytical Methods in Finance	
FIN 462	Corporate Risk Management and Insurance	
FIN 472	Real Estate Finance	
FIN 474	Real Estate Investment	
FIN 480	International Finance	
Select one from the following:		3
ACCT 383	Intermediate Managerial Accounting	
ACCT 386	Intermediate Accounting I	
ACCT 387	Intermediate Accounting II	
or any additional 400 level FIN course.		
Total Credits		21

* STAT 326 Introduction to Business Statistics II is highly recommended to be taken as a prerequisite

The department also offers a finance minor for non-finance majors in the College of Business. The minor requires 15 credits from an approved list of courses, of which 9 credits must stand-alone. Students with declared majors have priority over students with declared minors in courses with space constraints.

Finance, B.S.

Freshman

Fall	Credits	Spring	Credits
BUSAD 102 (or 103)	1	BUSAD 250	3
COM S 113	3	MATH 151	3
ECON 101	3	ECON 102	3
ENGL 150	3	HUM/SOC SCI	3
MATH 150	3	International Perspective[@]	3
LIB 160	1		
HUM/SOC SCI	3		
	17		15

Sophomore

Fall	Credits	Spring	Credits
BUSAD 203	1	Core Business Course	3
ACCT 284	3	SP CM 212	3
ENGL 250	3	ACCT 215	3
STAT 226	3	PHIL 230	3
HUM/SOC SCI	3	STAT 326	3
General Elective			
	13		15

Junior

Fall	Credits	Spring	Credits
Core Business Courses	6	Core Business Courses	6
Natural Science	3	Major Courses	6
ENGL 302	3	U.S. Diversity or Elective[#]	3
Major Course	3		
	15		15

Senior

Fall	Credits	Spring	Credits
International/Global Perspective	3	MGMT 478[*]	3
Major Courses	6	Major Courses	6
Core Business Courses	6	General Electives	5
	15		14

Total Credits: 119

@ Courses in these requirements may also be used as Global Perspective.

\# US Diversity courses may be used to satisfy HUM/SOC SCI.

* All core classes must be completed prior to taking MGMT 478 in the graduating semester.

Students must be admitted to the professional program in business to major in finance. The requirements to enter the professional program are:

1. Completion of 30 credits, Foundation Courses, ENGL 150, and all ENGL 101/99 courses if required.

2. A minimum GPA of 2.50 either cumulative or in the Foundation Courses.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.

2. 42 credits of 300+ level courses.

3. 50% of required Business courses must be earned at ISU.

4. At least 32 credits and the LAST 32 credits must be earned at ISU.

5. 122 Credits minimum and a Cumulative GPA of at least 2.00

6. Grade of "C" or higher in 2 of the 3 required ENGL courses.

Graduate Study

The Finance Department offers a Master of Finance (MFin) degree. The MFin is a non-thesis, non-creative component curriculum designed to provide students with in-depth coverage of finance topics and a strong quantitative skill set. Students will learn financial analysis and valuation, advanced regression techniques and programming approaches for data analysis, time series analysis and forecasting, optimization techniques, modelling of financial and risk variables, simulation techniques, and tools for effective risk management. The 40 credit program requires 22 core credits, seven of which are taught in the economics department. Another 18 credits of electives are required, nine of which must be in finance courses.

The department also participates in a full-time and part-time Master of Business Administration (MBA) program. The MBA is a 48-credit, non-thesis, non-creative component curriculum. Thirty of the 48 credits are core courses and the remaining 18 are graduate electives. Within the MBA program, students may develop an area of specialization in finance.

Courses primarily for undergraduates:

FIN 301: Principles of Finance
(3-0) Cr. 3. F.S.SS.
Prereq: ACCT 284, ECON 101, STAT 226
Introduction to financial management with emphasis on corporate financing and investment decision making, time value of money, asset valuation, capital budgeting decision methods, cash budgeting, and financial markets.

FIN 310: Corporate Finance
(3-0) Cr. 3. F.S.SS.
Prereq: FIN 301
Theory used in a firm's investment and financing decisions. Analysis of environment in which financial decisions are made; applications of analytical techniques to financial management problems.

FIN 320: Investments
(3-0) Cr. 3. F.S.SS.
Prereq: FIN 301
Introduction to securities and markets from the viewpoint of the individual investor. Emphasis on mechanics of trading, measurement of return and risk, behavior of security prices, valuation of stocks and bonds, mutual funds, portfolio selection techniques, and performance evaluation.

FIN 327: Fixed Income Securities
(3-0) Cr. 3.
Prereq: FIN 301
Valuation of fixed income securities, including pricing conventions, term structure of interest rates, default, duration, and hedging of interest rate risk with derivatives. Analysis of bond market sectors, including treasury, agency, corporate, sovereign, municipal, and residential mortgage bonds.

FIN 330: Financial Markets and Institutions
(3-0) Cr. 3. F.S.
Prereq: FIN 301
Introduction to the structure and operations of the United States financial system and its markets and institutions. Emphasis on developing an integrated understanding of markets and financial service providers including global linkages.

FIN 361: Personal Risk Management and Insurance
(3-0) Cr. 3. F.S.
Prereq: ECON 101
Risk concepts and the use of insurance by individuals and families. Emphasis on the insurance mechanism and methods of dealing with income, property, and liability risks.

FIN 371: Real Estate Principles
(3-0) Cr. 3. SS.
Prereq: ECON 101
Legal, economic, social and financial aspects of real estate, including property rights, contracts, mortgage instruments, tax factors, brokerage, valuation, risk and return analysis, financing techniques, and investments.

FIN 415: Business Financing Decisions
(3-0) Cr. 3.
Prereq: FIN 301
In depth study of the firm's external financing decision. Emphasis on the development of cash flow statements, projected financing needs and the selection of the appropriate financing instrument. Focus on case studies and application of developed techniques on actual field project.

FIN 424: Financial Futures and Options
(3-0) Cr. 3.
Prereq: FIN 320 and STAT 326
Advanced study of pricing and using derivatives - instruments deriving value from fundamental items such as commodities, currency exchange rates, market indices, equities and bonds. Addresses basic building blocks of derivatives (i.e., forwards, futures, options and swaps) and relevant current topics and issues.

FIN 425: Security Analysis and Portfolio Management
(3-0) Cr. 3. F.S.
Prereq: FIN 320, STAT 326 and permission of instructor
Advanced study of security analysis, security selection techniques and portfolio management. Emphasis on the applications of methods learned via the selection and evaluation of a portfolio of actual securities purchased in securities markets in the U.S. or abroad. Tracking and periodic reporting of the portfolio's performance relative to standard benchmarks is also required.

FIN 428: Advanced Fixed Income Analysis and Portfolio Management
(Dual-listed with FIN 528). (3-0) Cr. 3.
Prereq: FIN 327, FIN 320, STAT 326
Advanced analysis of fixed income markets and securities, including valuation and trading of treasury securities, corporate bonds, mortgage backed securities. Analysis of structured financial securities, including CDO, CMBS, and ABS. Analysis of active and passive investment strategies for managing fixed income portfolios. Students are required to manage a fixed income portfolio for an institutional investor. A top-down approach to portfolio management is assumed, with active bets taken on market direction, duration, yield curve, and credit spreads.

FIN 435: Venture Capital, Private Equity, and Mergers and Acquisitions
(3-0) Cr. 3. S.
Prereq: FIN 310, FIN 320, STAT 326
An advanced investments class that focuses on alternative investments. Topics include techniques for valuing public and private firms, venture capital finance, investment banking, private equity finance, leveraged buyouts, hedge funds, the structure and financing of mergers and acquisitions, and divestitures.

FIN 445: Bank Management Decisions
(3-0) Cr. 3. F.S.
Prereq: STAT 326; and FIN 330 or ECON 353
Analysis of operations of depository financial institutions from management viewpoint. Emphasis on evaluating performance, policy formation, asset and liability management, the role of capital, and the operating environment.

FIN 462: Corporate Risk Management and Insurance
(3-0) Cr. 3. F.
Prereq: FIN 301 and STAT 326
Analysis of an organization's approaches to the management of price, credit, and pure risk. Emphasis on the consideration and selection of risk control and financing treatments and the decision making framework underlying the alternatives selected. Covers commercial insurance, self-insurance, and alternative financing arrangements.

FIN 472: Real Estate Finance
(3-0) Cr. 3.
Prereq: FIN 301 and STAT 326
Introduction to the techniques of assessing the value of real estate and real estate financing instruments.

FIN 474: Real Estate Investment
(3-0) Cr. 3. F.S.
Prereq: FIN 301, FIN 371
Introduction to theories and methods of investment analysis applied to real estate. Studies cash flow analysis, alternative measures of investment performance, the impact of the financing decision on real estate investment risks and return, and various real estate financing techniques. Covers cases involving more complex financing and capital markets tools used in real estate.

FIN 480: International Finance
(3-0) Cr. 3. F.S.
Prereq: FIN 310, FIN 320 or FIN 330
Advanced study of currency market equilibrium, use and analysis of currency derivatives, hedging currency risk, and additional topics, which could include multinational capital budgeting, taxation, raising capital internationally, international portfolio diversification, international capital market equilibrium, political and country risk, financing international trade, multinational corporate treasury management, and current issues.

FIN 490: Independent Study
Cr. 1-3. Repeatable.
Prereq: FIN 301, STAT 326 and permission of instructor

FIN 499: Finance Internship
(3-0) Cr. 1-3. F.S.SS.
Prereq: GPA 2.5; permission of internship coordinator; STAT 326; FIN 499A: FIN 330; FIN 499B: FIN 361; FIN 499C: FIN 301 plus 3 additional credits in finance; FIN 499D: FIN 320; FIN 499E: FIN 310
Supervised experience in a private sector banking, insurance, real estate, investments or corporate organization or in a governmental agency that regulates such organizations. Offered on a satisfactory-fail basis only.

FIN 499A: Finance Internship:Banking
(3-0) Cr. 1-3. F.S.SS.
Prereq: GPA 2.5; permission of internship coordinator; STAT 326.
Supervised experience in a private sector banking, insurance, real estate, investments or corporate organization or in a governmental agency that regulates such organizations. Offered on a satisfactory-fail basis only.

FIN 499B: Insurance
(3-0) Cr. 1-3. F.S.SS.
Prereq: GPA 2.5; permission of internship coordinator; FIN 361 and STAT 326
Supervised experience in a private sector insurance organization or in a governmental agency that regulates such organizations. Offered on a satisfactory-fail basis only.

FIN 499C: Real Estate
(3-0) Cr. 1-3. F.S.SS.
Prereq: GPA 2.5; permission of internship coordinator; FIN 301 plus 3 additional credits in finance and STAT 326;
Supervised experience in a private sector real estate organization or in a governmental agency that regulates such organizations. Offered on a satisfactory-fail basis only.

FIN 499D: Investments
(3-0) Cr. 1-3. F.S.SS.
Prereq: GPA 2.5; permission of internship coordinator; FIN 320 and STAT 326
Supervised experience in a private sector investment organization or in a governmental agency that regulates such organizations. Offered on a satisfactory-fail basis only.

FIN 499E: Corporate
(3-0) Cr. 1-3. F.S.SS.
Prereq: GPA 2.5; permission of internship coordinator; FIN 310 and STAT 326
Supervised experience in a private sector corporate organization or in a governmental agency that regulates such organizations. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

FIN 501: Financial Valuation and Corporate Financial Decisions
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission.
Shareholder wealth maximization as the goal of the firm within a social responsibility context, financial Math, valuation of securities, the global financial market place as the test of value, estimation of cost of capital, global capital investment decisions, capital structure policy, working capital management.

FIN 510: Advanced Corporate Finance
(3-0) Cr. 3.
Prereq: FIN 501
Examines corporate financial decisions, including theory and associated empirical evidence. Topics include agency conflicts, corporate governance, executive compensation, becoming publicly traded, raising capital through public and private offerings, capital structure, financial distress and bankruptcy, leasing, dividend policy, corporate control, restructuring, and risk management.

FIN 515: Case Studies in Financial Decision Making
(3-0) Cr. 3.
Prereq: FIN 501
This course focuses on case studies to develop an integrated set of financial decisions. Topic areas include fixed asset, working capital, capital structure, dividend and merger/acquisition decisions. The objective of the course is to examine different firm settings and establish a framework within which to apply financial tools.

FIN 520: Investments
(3-0) Cr. 3.
Prereq: FIN 501
Analysis of risk and return for individual securities and portfolios of securities. Topics include the market environment, mechanics of trading, measurement of return and risk, valuation of stocks and bonds, mutual funds, optimal asset allocation, market efficiency, portfolio performance evaluation, and risk management.

FIN 528: Advanced Fixed Income Analysis and Portfolio Management
(Dual-listed with FIN 428). (3-0) Cr. 3.
Prereq: FIN 327, FIN 320, STAT 326
Advanced analysis of fixed income markets and securities, including valuation and trading of treasury securities, corporate bonds, mortgage backed securities. Analysis of structured financial securities, including CDO, CMBS, and ABS. Analysis of active and passive investment strategies for managing fixed income portfolios. Students are required to manage a fixed income portfolio for an institutional investor. A top-down approach to portfolio management is assumed, with active bets taken on market direction, duration, yield curve, and credit spreads.

FIN 530: Financial Analysis and Valuation
(3-0) Cr. 3.
Prereq: FIN 501
Valuation of public and private firms through analysis of financial statements and other information. Study of drivers of value creation, industry analysis, patterns of growth, models for forecasting and analyzing firm cash flows, estimating and adjusting cost of capital, alternative methods of cash flow valuation, the calculation and use of valuation multiples, and valuing mergers and acquisitions.

FIN 534: Financial Derivatives
(3-0) Cr. 3. F.
Prereq: Graduate classification
An applied course in derivative markets. Topics covered include futures and options markets, option pricing, swaps, use and rating of insurance products, and alternative forms of reinsurance. Emphasis will be placed on agricultural commodity markets, but energy, interest, currency and stock index contracts will also be covered.

FIN 535: Venture Capital, Private Equity, and Mergers and Acquisitions
(3-0) Cr. 3.
Prereq: FIN 501
Advanced investments class focusing on alternative investments. Topics include the nature and scope of investment banking, techniques for valuing public and private firms, venture capital finance, private equity finance, leveraged buyouts, hedge funds, the structure and financing of mergers and acquisitions, and divestitures.

FIN 550: Financial Econometrics
(3-0) Cr. 3.
Prereq: FIN 501, ECON 571
Analysis, modeling, and forecasting of time series data, volatility modeling and forecasting, maximum likelihood estimation, robust standard error computation, specification testing, estimation under alternative distributional assumptions, and Monte Carlo simulation. Applications include tests of asset pricing models, analysis of asset volatility, corporate event studies, and value at risk analysis.

FIN 564: Advanced Derivatives and Risk Management
(3-0) Cr. 3.
Prereq: FIN 501, FIN 534
Risk management tools and how they are applied within financial institutions and the corporate enterprise. Focus on measuring exposure to stock market risk, interest rate risk, currency risk, and credit risk and how these exposures may be managed. Topics include bank risk management regulations, volatility modeling, value at risk analysis, extreme value theory, credit default swaps, and portfolio simulation.

FIN 572: Real Estate Finance
(3-0) Cr. 3.
Prereq: MBA Core
Survey of techniques for assessing the value of real estate assets. Introduction to real estate financing instruments, their use and appropriateness.

FIN 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
For students wishing to do individual research in a particular area of finance.

Management

For undergraduate curriculum in business, major in management.

The Department of Management offers a major in management. Students will complete the general education requirements (including business foundation courses), business core requirements for the Bachelor of Science (B.S.) degree, and 18 additional credits in the major.

The instructional objectives of the Management Department are to provide students with foundational knowledge of organizations, organizational leadership activities, and the ideals and activities of business entrepreneurship. Management majors will have an understanding of (1) employee work-related attitudes and behaviors, (2) challenges and strategies in international business, and (3) human resource management practices within firms. Students will demonstrate awareness for the role of diversity, ethics and technology in business decision-making, the impact of external forces and global issues on organizations. Students will display the ability to think critically, to communicate effectively and to contribute constructively to effective team performance.

Management is a broadly defined discipline and activity, which is neither industry nor function specific. Management theories, concepts, techniques, and skills are applicable to all functional areas of business and are essential for organizational success regardless of whether the venture thrives in character as large or small, well-established or entrepreneurial start-up. Management requires sound conceptual, technical, and human skills for the effective utilization of organizational resources. In addition to the basic business foundation and core courses, a management student has the option of selecting and participating in either: (a) an organizational leadership track or (b) an entrepreneurship track. Management majors are required to complete 18 credit hours of management or department-approved courses. Included in these 18 credits are three required courses:

MGMT 310	Entrepreneurship and Innovation	3
MGMT 371	Organizational Behavior	3
MGMT 414	International Management	3
Total Credits		9

Students choosing the Organizational Leadership Track will also complete 3 of the following courses:

MGMT 471	Personnel and Human Resource Management	3
Select 2 from the following:		6
MGMT 472	Management of Diversity	
MGMT 372	Responsible Management and Leadership in Business	
PSYCH 450	Industrial Psychology	
Total Credits		9

Students choosing the Entrepreneurship Track will also complete 3 of the following courses:

Select one of the following		3
MGMT 313	Feasibility Analysis and Business Planning	
MGMT 410	Social Entrepreneurship	
Select 2 from the following:		6
MGMT 471	Personnel and Human Resource Management	
MGMT 472	Management of Diversity	
MGMT 367	International Entrepreneurship	
Total Credits		9

The department also offers a minor for non-Management majors in the College of Business. The minor requires 15 credits from an approved list

of courses, of which 9 credits must stand alone. Students with declared majors have priority over students with declared minors in courses with space constraints.

Management, B.S.

Freshman

Fall	Credits	Spring	Credits
BUSAD 102 (or 103)	1	BUSAD 250	3
COM S 113	3	MATH 151	3
ECON 101	3	ECON 102	3
ENGL 150	3	HUM/SOC SCI	3
MATH 150	3	International Perspective[@]	3
LIB 160	1		
HUM/SOC SCI	3		
	17		15

Sophomore

Fall	Credits	Spring	Credits
BUSAD 203	1	Core Business Courses	6
ACCT 284	3	SP CM 212	3
ENGL 250	3	ACCT 215	3
STAT 226	3	PHIL 230	3
HUM/SOC SCI	3		
General Elective	3		
	16		15

Junior

Fall	Credits	Spring	Credits
Core Business Courses	6	Core Business Courses	6
Natural Science	3	Major Courses	6
ENGL 302	3	US Diversity or Elective[#]	3
Major Course	3		
	15		15

Senior

Fall	Credits	Spring	Credits
General Elective	3	MGMT 478[*]	3
International/Global Perspective	3	Major Course	3
Major Courses	6	General Electives	8
Core Business Course	3		
	15		14

Total Credits: 122

@ Courses in these requirements may also be used as Global Perspective.

US Diversity courses may be used to satisfy HUM/SOC SCI.

* All core classes must be completed prior to taking MGMT 478 in the graduating semester.

Students must be admitted to the professional program in business to major in management. The requirements to enter the professional program are:

1. Completion of 30 credits, Foundation Courses, ENGL 150, and all ENGL 101/99 courses if required.

2. A minimum GPA of 2.50 either cumulative or in the Foundation Courses.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.

2. 42 credits of 300+ level courses.

3. 50% of required Business courses must be earned at ISU.

4. At least 32 credits and the LAST 32 credits must be earned at ISU.

5. 122 Credits minimum and a Cumulative GPA of at least 2.00

6. Grade of "C" or higher in 2 of the 3 required ENGL courses.

Graduate Study

The Department of Management participates in the full-time and part-time Master of Business Administration (MBA) and in the PhD in Business and Technology. The MBA is a 48-credit, non-thesis, non-creative component curriculum. Thirty of the 48 credits are core courses and the remaining 18 are graduate electives.

The PhD in Business and Technology with a Management (MGMT) specialization is a 56 credit (minimum) curriculum designed around four interrelated areas (core, specialization, minor, and research methods) and dissertation. The focus of the specialization is on management issues relating to organizational behavior, human resources, strategy, and entrepreneurship.

Courses primarily for undergraduates:

MGMT 310: Entrepreneurship and Innovation
(3-0) Cr. 3. F.S.
Prereq: Sophomore classification
Review of the entrepreneurial process with emphasis on starting a new business. How to analyze opportunities, develop an innovative product, organize, finance, market, launch, and manage a new venture. Deals with the role of the entrepreneur and the importance of a business plan. Speakers and field project.

MGMT 313: Feasibility Analysis and Business Planning
(3-0) Cr. 3. F.S.
Prereq: MGMT 310
Developing an idea for a new business venture, conducting a feasibility study, researching the potential market, analyzing the competition, and writing a formal business plan. Basic business functions are discussed in terms of their application to conducting feasibility analysis and writing a business plan for an entrepreneurial venture.

MGMT 367: International Entrepreneurship
(3-0) Cr. 3.
Prereq: junior standing
The essentials of operating an entrepreneurial firm in an international environment. Topics include understanding the role of entrepreneurship in economic development, starting and developing a business in an international market, financing international ventures, international management issues and exchange rates.
Meets International Perspectives Requirement.

MGMT 370: Management of Organizations
(3-0) Cr. 3. F.S.SS.
Prereq: ECON 101 or ECON 102 or equivalent
A management functions approach is used to explain what managers do in organizations; how they deal with external constituents, how they structure their companies, and how they deal with employees. A contingency approach is used as a framework for understanding how to increase the effectiveness and efficiency of organizations in today's dynamic, highly competitive business environment.

MGMT 371: Organizational Behavior
(3-0) Cr. 3. F.S.
Prereq: MGMT 370
The study of individual attributes, interpersonal relations, and employee attitudes in organizations. Instructional emphasis is placed on how management concepts such as reward systems, job design, leadership, teams, etc., can be used to manage employee attitudes and behavior.

MGMT 372: Responsible Management and Leadership in Business
(3-0) Cr. 3. F.S.
Prereq: PHIL 230
Professional responsibilities of executives in terms of personal conduct and individual integrity, executive leadership style and values, formal organizational ethics policies, board and chief executive leadership roles, governance reform and ethics, corporate social responsibility, stakeholder management, strategies for sustainable development, pursuit of societal and corporate goals, and the manager as architect of corporate values and culture.

MGMT 377: Competitive Strategy
(3-0) Cr. 3. F.
Prereq: MGMT 370
Developing competitive strategy and achieving competitive advantage in firms, including: industry analysis, generic strategies, hypercompetition, competing against time, and building distinctive capabilities.

MGMT 410: Social Entrepreneurship
(3-0) Cr. 3. F.S.
Prereq: Sophomore classification
This course will introduce students to issues related to the role of social entrepreneurship in helping to solve social problems, including innovation, opportunity recognition, planning and the launch of new non-profit organizations.

MGMT 414: International Management
(3-0) Cr. 3. F.S.
The nature and economic role of the multinational firm and entrepreneurial ventures, including the impact of legal, political, and cultural variables upon firm performance and managerial activity; case studies illustrate interdependent nature of functional areas of business projected across national boundaries.

MGMT 415: Managing New Ventures
(3-0) Cr. 3. F.S.
Prereq: MGMT 310 or Business major with junior standing
Examination of business problems and main issues concerning new ventures. Students work in teams to identify problems in growing and new firms. The emphasis is on analyzing and solving an existing business problem. Includes a field project, a report, and a presentation to a business owner.

MGMT 419: Social Responsibility of Business
(3-0) Cr. 3. S.
A consideration of the role of business in society. Critical analysis of ethical, managerial, and public issues as they affect the corporation.

MGMT 471: Personnel and Human Resource Management
(3-0) Cr. 3. F.S.
Prereq: Junior standing
Recruitment and selection, utilization, and development of people in organizations. Examination of each personnel function; interrelationships among the functions.

MGMT 472: Management of Diversity
(3-0) Cr. 3. F.S.
Prereq: Junior classification
One of the most crucial problems in organizations today is the management of diversity. Attempts to define the difference between equal employment opportunity/affirmative action, which has a legal basis, and diversity which has an educational basis. Organized around the concepts of: (1) cultural diversity and cultural unity; (2) development of skills and tools to manage diversity; and (3) structure of diversity development programs in organizations.
Meets U.S. Diversity Requirement

MGMT 478: Strategic Management
(3-0) Cr. 3. F.S.SS.
Prereq: MGMT 370; ACCT 285; FIN 301; MKT 340; SCM 301; graduating senior
Strategy formulation, implementation, and evaluation and control in today's organizations. Emphasis is on strategic planning and decision making using the case method and/or projects.

MGMT 490: Independent Study
Cr. 1-3. Repeatable.
Prereq: MGMT 370, senior classification, permission of instructor

Courses primarily for graduate students, open to qualified undergraduates:

MGMT 502: Organizational Behavior
(3-0) Cr. 3. F.
Prereq: Enrollment in MBA program or departmental permission
Understanding human behavior in organizations and the nature of sustainable organizations from a managerial perspective. Special emphasis is placed on how individual differences, such as perceptions, personality, and motivation, influence individual and group behavior in organizations and on how behavior can be influenced by job design, leadership, groups, and the structure of organizations.

MGMT 503: Professional Responsibility in Business and Society
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or department permission, ACCT 501, FIN 501, MGMT 502, MKT 501
Ethical and social responsibilities of top managers in corporations. Topics include stakeholder management, corporate social responsibilities, strategies for sustainable development, pursuit of societal and corporate goals, board and chief executive leadership roles, governance reform and ethics, and executive leadership style and values. The presentation of course concepts is facilitated by the use of cases, discussion scenarios, and ethical dilemmas.

MGMT 504: Strategic Management
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission, ACCT 501, FIN 501, MGMT 502, MKT 501
Critical analysis of case studies in strategic management with an emphasis on integrative decision making. Strategy implementation in light of the global, legal, economic, cultural, and political contexts of business.

MGMT 565: Early Stage Entrepreneurship - Mind to Market
(3-0) Cr. 3.
Prereq: Graduate classification
Commercialization of new technology. Topics covered include market analysis, intellectual property, product development, feasibility analysis, and new business evaluation.

MGMT 566: Entrepreneurship and New Business Creation
(3-0) Cr. 3.
Prereq: Graduate classification or permission of instructor.
The essentials of starting and operating a new business. Topics include current research on entrepreneurial perspective, starting and developing a new business, financing the venture, managing the growing firm, and special issues.

MGMT 567: International Entrepreneurship
(3-0) Cr. 3.
Essentials of operating an entrepreneurial firm in an international environment. Topics include international entrepreneurship, starting and developing a business in an international market, financing international ventures, international management issues, exchange rates, and culture.

MGMT 569: Technology Entrepreneurship
(3-0) Cr. 3.
Prereq: Graduate standing or instructor's permission
Identification of high-potential, technology-intensive commercial opportunities, resources? gathering, and risk management under environmental uncertainty. Focus on technology ventures and firms that use technology strategically across several industries. Topics include key success factors and forecasting analysis across main value-chain activities.

MGMT 570: Managing Employee Attitudes and Behaviors
(3-0) Cr. 3. F.SS.
Prereq: MGMT 371 or MGMT 502 or PSYCH 450
Advanced topics germane to the management of individuals and groups over their work lives; sustained work commitment, motivation and job/career satisfaction, absenteeism, turnover, stress, leadership and career development (e.g., career ladders, mentoring).

MGMT 571: Seminar in Personnel and Human Resources Management
(3-0) Cr. 3. S.
Prereq: MGMT 371 or MGMT 502 or SOC 420
Topics and issues in personnel management with a focus on the management of human resources in organizations. Current personnel practices, philosophies, and behavioral science research.

MGMT 572: Personality and Management
(3-0) Cr. 3.
Prereq: Graduate standing or permission of instructor
Personality and individual differences have significant implications for human resource management, organizational behavior and strategic management. Research has shown that these characteristics affect many core management topics including motivation, leadership, and decision making. Surveys the literature relating personality and individual differences to management and organizations. Students will complete a wide variety of personality assessments and get their results, and reflect on how personality and individual differences can be practically relevant in the modern work environment.

MGMT 581: Contemporary Topics in Strategy
(3-0) Cr. 3. F.
Prereq: MGMT 504 or permission of instructor
Discussion of concepts and techniques used in long range strategic planning. Examination of planning practices in business and not-for-profit organizations. Topics include environmental scanning, industry analysis, forecasting, corporate and competitive strategies, and tactics.

MGMT 582: Corporate Governance and Top Management
(Cross-listed with ACCT). (3-0) Cr. 3.
Prereq: MGMT 503 or permission
Duties, structure, and functioning of top management teams and corporate boards of directors. CEO/board tenure and succession planning, top management compensation, board committee composition, assessment of CEO and board performance, theories of corporate governance, management of the corporate strategic agenda, governance codes, international governance, and chairman/CEO duality. Case studies and contemporary issues discussed.

MGMT 583: Strategic Management of Innovation
(3-0) Cr. 3.
Prereq: MGMT 504 or permission of instructor
Critical analysis and discussion of cases focused on strategic management of innovation. Assessment of a firm s innovative capabilities and competitive dynamics to manage innovative processes. Practical applications through emphasis on implementation including internal corporate venturing, management of the corporate R&D function, and institutionalization of innovation.

MGMT 584: Management Consulting
(3-0) Cr. 3.
Prereq: MGMT 504 or permission of instructor
Provides the opportunity for students to understand the role of the professional consultant, the issues facing the management consulting industry, the competencies of various management consulting firms, the nature and form of strategic consulting engagement, and the nature and scope of strategic change in business firms. Students will learn about management consulting functions and will practice the consultant role though cases and field studies.

MGMT 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
For students wishing to do individual research in a particular area of management.

Courses for graduate students:

MGMT 601: Philosophy of Science
(3-0) Cr. 3.
Prereq: enrollment in the PhD program
This course provides a philosophical introduction to the theoretical and empirical development of scientific knowledge. It focuses on a variety of basic problems common to the social sciences: the nature of explanation, the structure of theories, forms of knowledge, scientific laws, nature of theory and ethics. The purpose of the course is to help doctoral students define a research context by addressing the purposes, assumptions and primary components of scientific inquiry.

MGMT 602: Organizational Theory
(3-0) Cr. 3.
Prereq: enrollment in the PhD program
This seminar involves the examination of the core theories and perspectives in organizational theory, as well as their applications and extensions. This material addresses the fundamental rationale for organizations in modern society, basic processes of organizing and organizational structure, a consideration of inter-organizational relationships and the external environment, and a variety of factors that help determine organizational effectiveness.

MGMT 603: Strategic Management of Technology and Innovation
(3-0) Cr. 3.
Prereq: MGMT 601
This course will offer a critical review of organizational decision making with respect to technology and innovation. Students will learn how technological change can alter the basis of competition; how competitive strategy drives technology investment decisions; how market-orientation should be the other backbone of technological innovation; and best practices of organizing and managing the new product development process to achieve strategic goals.

MGMT 604: Seminar in Organizational Behavior
(3-0) Cr. 3.
Prereq: enrollment in the PhD program
The purpose of this seminar is to introduce behavioral science literature relevant to the study of behavior in organizational settings. The course will focus on the individual's role within organizations and cover topics such as individual differences, motivation, leadership, decision-making. Learning, risk taking, interpersonal relations, etc. Both theoretical and empirical contributions will be examined, with emphasis on integration of diverse theoretical perspectives.

MGMT 650: Research Practicum I
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a research manuscript to be submitted to a peer-reviewed academic journal. Students will work with a faculty mentor on a research project.

MGMT 651: Research Practicum
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a second research manuscript to be submitted to a peer-reviewed academic journal. Although students work under the supervision of a faculty mentor, the students will take independent responsibility for the research project.

MGMT 699: Dissertation
Cr. 1-12.
Prereq: Graduate classification, permission of dissertation supervisor
Research.

Management Information Systems

For undergraduate curriculum in business, major in management information systems.

The Department of Supply Chain and Information Systems offers a major in management information systems. Students will complete the general education requirements (including business foundation courses), business core requirements for the bachelor of science (BS) degree, and 18 additional credits in the major.

Management Information Systems is the analysis and use of information systems and technologies to support problem solving and decision making within and across organizations. Organizations and companies use data, most often in digital form, to conduct nearly every part of their businesses and functions. The program provides students with the core knowledge related to every dimension of information systems and technologies, including the creation and implementation of software and databases, to information security, analytics, and the user interface. The program takes a balanced approach to the management information systems major, with both technical and managerial coursework.

The study of Management Information Systems prepares students for professional careers with a wide variety of firms and roles, ranging from small start-up firms to large multinational corporations. Common job titles include business analyst and systems analyst. Students are also pursuing careers in Information Technology consulting.

The MIS major requires students to take 18 credit hours in the management information systems area, including 12 credit hours of required core courses and 6 credit hours of electives. The required core courses are:

MIS 307	Intermediate Business Programming	3
MIS 310	Information Systems Analysis	3
MIS 320	Database Management Systems	3
MIS 340	Project Management	3
Total Credits		12

The remaining 6 credits can be taken from the department approved electives, preferably with the specified clusters that focus on specific IT job related knowledge and skills (application development, IT infrastructure and security, business analytics, and supply chain technology). Students are encouraged to take electives that cover multiple clusters to enhance marketability and career flexibility.

The department also offers a minor for non-Management information Systems majors in the College of Business. The minor requires 15 credits from an approved list of courses, of which 9 credits must stand alone. The 15 credits must include MIS 301 Management Information Systems. Students with declared majors have priority over students with declared minors in courses with space constraints.

Management Information Systems, B.S.

Freshman

Fall	Credits	Spring	Credits
BUSAD 102 (or 103)	1	BUSAD 250	3

COM S 113	3	MATH 151	3
ECON 101	3	ECON 102	3
ENGL 150	3	HUM/SOC SCI	3
MATH 150	3	International Perspective	3
LIB 160	1		
HUM/SOC SCI	3		
	17		15

Sophomore

Fall	Credits	Spring	Credits
BUSAD 203	1	Core Business Courses	6
ACCT 284	3	SP CM 212	3
ENGL 250	3	ACCT 215	3
STAT 226	3	PHIL 230	3
HUM/SOC SCI	3		
MIS 207	3		
	16		15

Junior

Fall	Credits	Spring	Credits
Core Business Courses	6	Core Business Courses	6
Natural Science	3	Major Courses	6
ENGL 302	3	U.S. Diversity or Elective[#]	3
Major Course	3		
	15		15

Senior

Fall	Credits	Spring	Credits
Major Courses	6	MGMT 478[*]	3
Core Business Course	3	Major Course	3
General Elective	3	General Electives	8
International/Global Perspective	3		
	15		14

Total Credits: 122

@ Courses in these requirements may also be used as Global Perspective.

\# US Diversity courses may be used to satisfy HUM/SOC SCI.

* All core classes must be completed prior to taking MGMT 478 in the graduating semester.

Students must be admitted to the professional program in business to major in management information systems. The requirements to enter the professional program are:

1. Completion of 30 credits, Foundation Courses, ENGL 150, and all ENGL 101/99 courses if required.

2. A minimum GPA of 2.50 either cumulative or in the Foundation Courses.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.

2. 42 credits of 300+ level courses.

3. 50% of required Business courses must be earned at ISU.

4. At least 32 credits and the LAST 32 credits must be earned at ISU.

5. 122 Credits minimum and a Cumulative GPA of at least 2.00

6. Grade of "C" or higher in 2 of the 3 required ENGL courses.

Graduate Study

The Department of Supply Chain and Information Systems participates in the MS in Information Systems (MSIS), the full-time and part-time Master of Business Administration (MBA) and the PhD in Business and Technology programs. The department also participates in an interdepartmental MS in Information Assurance as well as in a master's and PhD program in Human Computer Interaction.

The MBA is a 48-credit, non-thesis, non-creative component curriculum. Thirty of the 48 credits are core business courses and the remaining 18 credits are graduate electives. Students may obtain a specialization in technology and innovation management within the MBA program.

The MSIS is a 30-credit (minimum) curriculum designed around three interrelated areas – business foundation, IS core, and electives. All students are expected to be familiar with basic computing skills before entering the program. The MSIS program will educate students on applying IS theory and concepts to modern IS development through classes that enable them to learn and use the latest software in application projects. Students graduating from the program will have advanced technical and managerial skills to develop and manage information systems projects.

The PhD in Business and Technology is a 56-credit curriculum (minimum) which includes a 12-credit dissertation designed around four interrelated areas—core, specialization, minor, and research methods—and the dissertation. The Management of Information Systems (MIS) specialization examines issues related to the development, building, management, and use of information and knowledge-based technologies. Such technologies enable users to collect organizational data, provide a platform for organizing and disseminating the data, and offer operational, decision support, and knowledge management tools through which

users can leverage data and information for making better organizational decisions. Students in the MIS specialization will study areas such as information technology analysis and development, database and knowledge management systems, decision support and data mining, human computer interaction, system security and integrity, and project management and collaborative teamwork.

Courses primarily for undergraduates:

MIS 207: Fundamentals of Computer Programming
(Cross-listed with COM S). (3-1) Cr. 3. F.S.
Prereq: MATH 150 or placement into MATH 140/MATH 141/MATH 142 or higher
An introduction to computer programming using an object-oriented programming language. Emphasis on the basics of good programming techniques and style. Extensive practice in designing, implementing, and debugging small programs. Use of abstract data types. Interactive and file I/O. Exceptions/error-handling. This course is not designed for computer science, software engineering, and computer engineering majors. Credit may not be applied toward graduation for both Com S 207/MIS 207 and Com S 227.

MIS 301: Management Information Systems
(3-0) Cr. 3.
Prereq: COM S 113 or BUSAD 150
The role of information technology in organizations. Overview of methodologies for design and development of systems including decision support systems, expert systems, data bases, end-user computing, etc. Computer applications relate concepts to practice. Lecture and laboratory work emphasizes the enabling role of IT in contemporary organizations.

MIS 307: Intermediate Business Programming
(3-0) Cr. 3.
Prereq: MIS 207/COM S 207 or COM S 227; credit or enrollment in MIS 301
Introduction to the concepts and use of data structures, file accesses and object oriented programming methodologies in contemporary business environments. Application development environments will be covered.

MIS 310: Information Systems Analysis
(3-0) Cr. 3.
Prereq: credit or enrollment in MIS 301
Critical analysis of business processes, data and process modeling, feasibility studies, CASE tools, and developing system design specifications.

MIS 320: Database Management Systems
(3-0) Cr. 3.
Prereq: Credit or enrollment in MIS 301
Database design, development, and implementation. Focus on data models, both classical and object oriented. Uses relational and/or object oriented database management systems.

MIS 340: Project Management
(Cross-listed with SCM). (3-0) Cr. 3.
Prereq: credit or enrollment in MIS 301
Equips students to support team activities in the general project management environment and better manage their careers. Practical experience using project management techniques and tools. Course topics include project initiation and execution, risk assessment, estimating and contracts, planning, human factors, and standard methods.

MIS 368: Spreadsheet-based Marketing Analytics
(Cross-listed with MKT). (3-0) Cr. 3. F.S.
Prereq: MKT 340
Use of spreadsheets to conduct various analyses to support marketing strategies. Topics include data visualization and exploration, marketing models and consultative problem-solving skills. Development of skills such as formulating problems, structuring and prioritizing problems, synthesizing results and communicating intuition from quantitative analyses.

MIS 407: Advanced Business Programming
(3-0) Cr. 3.
Prereq: MIS 307
Advanced software development and topics in contemporary programming languages. Topics include basic syntax, advanced programming techniques, file structures and management, database access, algorithm design, web forms and graphical user interfaces.

MIS 434: Electronic Commerce Strategy
(3-0) Cr. 3.
Prereq: MIS 301, MKT 340, SCM 301
Overview of business strategies and technologies used for electronic commerce. Emphasis is on the strategic, operational, and technical issues associated with global electronic commerce using class lecture/discussion and case studies.

MIS 435: Information Systems Infrastructure
(3-0) Cr. 3.
Prereq: MIS 301
Overview of Internet and telecommunications technology used in business applications. Understand Internet and network protocols, network and application architectures, design, and implementation.

MIS 436: Introduction to Business Analytics
(3-0) Cr. 3.
Prereq: MIS 320
Introduction to the field of business analytics (BA). Students will examine BA processes and techniques used in transforming data to knowledge and creating value for organizations. Business cases, presentations by business professionals, class lectures and discussions on data analysis, design and modeling, and extensive hands-on analytical exercises.

MIS 439: Topics in Management of Information Systems
(3-0) Cr. 3. Repeatable.
Prereq: MIS 301, permission of instructor
A variety of topics will be covered and topics may vary between semesters. Some of the topics are information resources management, electronic commerce, decision support systems, and expert systems.

MIS 440: Supply Chain Information Systems
(Cross-listed with SCM). (3-0) Cr. 3.
Prereq: MIS 301, SCM 301
Internal and inter-organizational information systems necessary for a supply chain to achieve competitive advantage. Topics include: design, development, implementation, and maintenance of supply chain information systems; enterprise resource planning; advanced planning and scheduling, manufacturing execution systems; and the interface between manufacturing planning and control processes, logistics processes, and the information system.

MIS 445: Enterprise Systems and Architecture
(3-0) Cr. 3.
Prereq: MIS 301
Contemporary theories, concepts, and practices in network infrastructure, network design, and information security. Design, install, and administer a complex network infrastructure. Study security threats and attacks and countermeasures. Investigate exposure to attacks, firewalls, and development of intrusion detection systems. Other security topics such as risk management, IT audit, and security regulations will also be addressed.

MIS 446: Advanced Business Analytics
(3-0) Cr. 3.
Prereq: MIS 320
Projects-based course which provides an in-depth understanding of BA methods of visualization, data mining, text mining, web-mining, and predictions through the use of specific BA tools. For students who are interested in understanding advanced techniques and applications of data analytics and acquiring hands-on skills for making intelligent business decisions in data-rich organizations.

MIS 447: Information Systems Development
(3-0) Cr. 3.
Prereq: MIS 301
Design of business systems using contemporary tools and methods such as SQL, CASE tools, OOD tools, etc. Focuses on synthesizing concepts from earlier MIS courses.

MIS 450: Enterprise Resource Planning Systems in Supply Chain
(Cross-listed with SCM). (3-0) Cr. 3.
Prereq: SCM 301, MIS 301 or I E 148, I E 341
Examination of the role of enterprise resource planning systems (ERP) in the supply chain. Hands-on experience with a major software application in use by many corporations to manage and improve the efficiency of their supply chains and operations. Students will develop a more process-centric perspective about how a supply chain operates and how ERP enables and supports such operations.

MIS 490: Independent Study
Cr. 1-3. Repeatable.
Prereq: MIS 301, senior classification, permission of instructor

MIS 495: Case Practicum
(3-0) Cr. 3. Repeatable, maximum of 2 times. F.S.
Prereq: MIS 301
Students explore different practical scenarios related information systems projects and cases. Students acquire necessary skills and knowledge to solve practical issues associated with presented cases and problems. Students compete at different venues around the country.

Courses primarily for graduate students, open to qualified undergraduates:

MIS 501: Management Information Systems
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission.
This course exposes the student to current theories and practices appropriate for understanding the role and application of information systems for individuals, organizations, and society within a globally competitive context. The course focuses on information technology and its uses in improving work practices, products, and tools for individuals and organizations. The course also addresses issues pertaining to current and emerging topics in the development and use of technology, the role of technology in and its alignment with organizational strategy and sustainable business practices, information system planning and the development of enterprise architectures, and human interface and personal characteristics in the design and use of technology.

MIS 532: Advanced Business Software Development
(3-0) Cr. 3.
Prereq: MIS 531 or equivalent
A survey of business-oriented programming languages with emphasis on state-of-the-art development techniques for business software. Topics include object-oriented and Internet programming issues and methods.

MIS 533: Data Management for Decision Makers
(3-0) Cr. 3.
Prereq: MIS 501
Addresses data needs of functions such as marketing, finance, and production. Advanced skills needed to design, develop and use database, data warehousing and data mining systems for effective decision support. Emphasis on importance of contemporary technologies.

MIS 534: Electronic Commerce
(3-0) Cr. 3.
Prereq: MIS 501
Overview of how modern communication technologies including the internet and world wide web have revolutionized the way we do business. Provides an understanding of various internet technologies and how companies are using the internet for commercial purposes. Explores future scenarios on the use of these technologies and their impact on various industries and the society.

MIS 535: Telecommunications Management
(3-0) Cr. 3.
Prereq: MIS 501
Issues involved in the management of telecommunications function. Overview of communications technology used in various business applications, local area network, wide area network, broad band network, wireless and voice networks. Internet technologies and protocols. Analyzing the strategic impact of these technologies on organizations. Strategic planning for telecommunications, including network planning and analysis.

MIS 536: Business Analytics Foundation
(3-0) Cr. 3.
Introduction to Business Analytics (BA) concepts and tools. Hands-on lab exercises and business case studies in data preparation, data querying and data visualization. Also covers various modeling techniques in predictive and prescriptive analytics.

MIS 537: Project Management
(3-0) Cr. 3.
Prereq: MIS 501
Prepares students to support team activities in the general project management environment and provides them with a working understanding of the full scope of project management activities. Students will also have practical experience using project management techniques and tools. Course topics include project initiation and execution, risk assessment, estimating and contracts, planning, human factors, and standard methods. The course follows the recommended content areas of the Project Management Institute, and provides students with a recognized foundational training in project management.

MIS 538: Business Process Systems
(3-0) Cr. 3.
Prereq: MIS 501
Examine current and historical perspectives on business process management. Topics include process identification, mapping, and improvement. Additional topics will address business process automation and integration, business process outsourcing. Investigate current and potential tools and methods for business process management. Include process management projects.

MIS 539: Topics in Management of Information Systems
(3-0) Cr. 3. Repeatable.
Prereq: MIS 501
A variety of topics may be offered in different semesters. Topics may include electronic commerce, information resources management, decision support systems, and expert systems.

MIS 546: Advanced Business Analytics
(3-0) Cr. 3. F.S.
An in-depth discussion of various advanced topics in Business Analytics (BA) such as Big Data Analytics, Text Analytics, and Web Analytics. Extensive hands-on exercises of using BA tools to solve real-world problems. Preparation for students' capstone projects.

MIS 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
For students wishing to do individual research in a particular area of MIS.

MIS 598: Research Seminar in Management Information Systems
(3-0) Cr. 3.
Prereq: Graduate classification
Examines issues such as the nature and content of information systems research; aspects of starting and pursuing research topics in information systems; exploring and understanding relevant research methods and tools. Develop preliminary research proposals.

MIS 599: Creative Component
Cr. 3.
Prereq: Graduate classification, permission of supervisory committee chair
Preparation and writing of creative component.

Courses for graduate students:

MIS 601: Behavioral Issues in IS Research
(3-0) Cr. 3.
Prereq: MIS 501 or equivalent, enrollment in PhD program
The state of behavioral research in the IS function. MIS activities in an organization span the following three major areas: design and implementation of the MIS, use of the MIS, and management of the MIS function. Each of these processes is carried out at several levels: individual, group, organizational and inter-organizational. Identify behavioral issues of relevance for the cells defined by the process and level dimensions. Reading and discussion of the research literature surrounding the development, use, and implications of information technology.

MIS 602: Current Issues in IS Research
(3-0) Cr. 3.
Prereq: MIS 501 or equivalent, enrollment in PhD program
Three fundamental areas of Information Systems, namely, infrastructure, management, and processes. Infrastructure studies examine the IT architecture including computing, communication, data, and application. Management focuses on addressing the value added notion of IT. Finally processing addresses topics related to enabling role of IT in myriad of areas.

MIS 603: Seminar on IT Strategy and Structure
(3-0) Cr. 3.
Prereq: MIS 601
Strategic issues in IT management. Address issues such as aligning IT strategy with corporate strategy and functional strategies, IT structure, valuation, governance and control, and related topics. Provide students with research skills related to the boundary between IT and the firm's external environment.

MIS 604: Collaboration, Knowledge, and Intelligence in Organizations
(3-0) Cr. 3.
Prereq: MIS 601
Research issues in the emerging areas of collaboration, knowledge management, and enterprise intelligence. Topics will include emerging and contemporary technologies of Data Mining, Knowledge Discovery from Databases, Web Mining, organizational memory, and knowledge management.

MIS 650: Research Practicum I
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a research manuscript to be submitted to a peer-reviewed academic journal. Students will work with a faculty mentor on a research project.

MIS 651: Research Practicum II
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a second research manuscript to be submitted to a peer-reviewed academic journal. Although students work under the supervision of a faculty mentor, the students will take independent responsibility for the research project.

MIS 655: Organizational and Social Implications of Human Computer Interaction
(Cross-listed with HCI). (3-0) Cr. 3.
Prereq: Graduate classification
Examine opportunities and implications of information technologies and human computer interaction on social and organizational systems. Explore ethical and social issues appurtenant to human computer interaction, both from a proscriptive and prescriptive perspective. Develop informed perspective on human computer interaction. Implications on research and development programs.

MIS 699: Research
Cr. 3-6. Repeatable.
Prereq: Graduate classification, permission of dissertation supervisor
Research.

Marketing

For undergraduate curriculum in business, major in marketing.

The Department of Marketing offers a major in marketing. Students will complete the general education requirements (including business foundation courses), business core requirements for the bachelor of science (BS) degree, and 18 credits in the major.

A major in marketing acquaints students with the managerial decisions and actions that surround the satisfaction of customer needs in the purchase and use of goods and services. Examples of marketing decisions areas are product development, pricing, marketing communication, marketing analytics, and personal selling. Completion of the major prepares students for careers such as product manager, marketing analyst, digital marketing specialist, marketing consultant, advertising or promotions manager, marketing researcher, sales representative or manager, and special events manager; in the public and private sectors. Some graduates also find careers in the retail industry, be it store management, market analysis, or purchasing.

The instructional objective of the Marketing department is to provide knowledge of the marketing process and an understanding of its functions. Students are expected to develop decision-making skills, computational skills, and communication skills with appreciation for global marketplace and ethical concerns. In addition to the basic business foundation and core courses, marketing majors are required to complete 18 credits of marketing or department approved courses. Included in these 18 credits are three required courses (see below).

Required and elective marketing major courses can be combined into three distinct tracks: brand management, marketing data analytics, and sales and sales management. See departmental lists for courses in each track.

Required Marketing Courses		
MKT 444	Marketing Research	3
MKT 447	Consumer Behavior	3
MKT 443	Strategic Marketing Management	3
Select three courses from the following electives		9
MKT 343	Personal Sales	
MKT 351	Services Marketing	3
MKT 368	Spreadsheet-based Marketing Analytics	3
MKT 410	Promotional Strategy	
MKT 442	Sales Management	
MKT 445	Customer Relationship Management	
MKT 446	Retailing	
MKT 448	Global Marketing	
MKT 449	Marketing Seminar	
MKT 451	Marketing Channels	
MKT 453	Brand Management	
MKT 492	Comparative Marketing	
Total Credits		24

The department also offers a minor for non-Marketing majors in the College of Business. The minor required 15 credits from an approved list of courses, of which 9 credits must stand alone. Students with declared majors have priority over students with declared minors in courses with space constraints.

Marketing

Freshman

Fall	Credits	Spring	Credits
BUSAD 102 (or 103)	1	BUSAD 250	3
COM S 113	3	MATH 151	3
ECON 101	3	ECON 102	3
ENGL 150	3	HUM/SOC SCI	3
MATH 150	3	International Perspective[@]	3
LIB 160	1		
HUM/SOC SCI	3		
	17		15

Sophomore

Fall	Credits	Spring	Credits
BUSAD 203	1	Core Business Courses	6
ACCT 284	3	SP CM 212	3
ENGL 250	3	ACCT 215	3
STAT 226	3	PHIL 230	3
HUM/SOC SCI	3		
General Elective	3		
	16		15

Junior

Fall	Credits	Spring	Credits
Core Business Courses	6	Core Business Courses	6
Natural Science	3	Major Courses	6
ENGL 302	3	US Diversity or Elective[#]	3
Major Course	3		
	15		15

Senior

Fall	Credits	Spring	Credits
General Elective	3	MGMT 478[*]	3
International/Global Perspective	3	Major Course	3
Major Courses	6	General Electives	8
Core Business Course	3		
	15		14

Total Credits: 122

@ Courses in these requirements may also be used as Global Perspective.

\# US Diversity courses may be used to satisfy HUM/SOC SCI.

* All core classes must be completed prior to taking MGMT 478 in the graduating semester.

Students must be admitted to the professional program in business to major in marketing. The requirements to enter the professional program are:

1. Completion of 30 credits, Foundation Courses, ENGL 150, and all ENGL 101/99 courses if required.

2. A minimum GPA of 2.50 either cumulative or in the Foundation Courses.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.
2. 42 credits of 300+ level courses.
3. 50% of required Business courses must be earned at ISU.
4. At least 32 credits and the LAST 32 credits must be earned at ISU.
5. 122 Credits minimum and a Cumulative GPA of at least 2.00
6. Grade of "C" or higher in 2 of the 3 required ENGL courses.

Graduate Study

The Department of Marketing participates in the full-time and part-time Master of Business Administration (MBA) and the PhD in Business and Technology. The MBA is a 48-credit professional degree program. Thirty of the 48 credits are core courses and the remaining 18 are graduate electives. Within the MBA program, students may develop an area of specialization in marketing.

The PhD in Business and Technology with a Marketing (MKT) specialization is a 56 credit (minimum) curriculum designed around four interrelated areas (core, specialization, minor, and research methods) and dissertation. The focus of the specialization is on marketing issues relating to strategic decision making, understanding consumer preferences and behaviors, and using data analytics for increasing the performance of the firm.

Courses primarily for undergraduates:

MKT 340: Principles of Marketing
(3-0) Cr. 3. F.S.SS.
Prereq: credit or current enrollment in ECON 101
The role of marketing in society. Markets, marketing institutions, and marketing functions with emphases on product, price, marketing communication, and marketing channel decisions.

MKT 343: Personal Sales
(3-0) Cr. 3.
Prereq: MKT 340
Analysis of the theory and practice of personal selling with the context of relationship marketing and salesforce automation. Topics include: goal setting, prospecting, time/territory management, questioning, presentations, objections, commitment and customer service; simulations of selling situations.

MKT 351: Services Marketing
(3-0) Cr. 3. F.
Prereq: MKT 340
In-depth appreciation and understanding of the unique challenges inherent in creating, managing, and delivering quality services. Students will be introduced to and have the opportunity to work with concepts, tools, and strategies that address these challenges.

MKT 368: Spreadsheet-based Marketing Analytics
(Cross-listed with MIS). (3-0) Cr. 3. F.S.
Prereq: MKT 340
Use of spreadsheets to conduct various analyses to support marketing strategies. Topics include data visualization and exploration, marketing models and consultative problem-solving skills. Development of skills such as formulating problems, structuring and prioritizing problems, synthesizing results and communicating intuition from quantitative analyses.

MKT 410: Promotional Strategy
(3-0) Cr. 3. F.S.
Prereq: Credit or enrollment in MKT 447
Principles, concepts, and problems involved in the development and implementation of promotional strategies. Coordination of a variety of promotional elements: advertising, sales promotion, direct marketing, public relations and publicity of web communications, and personal selling.

MKT 442: Sales Management
(3-0) Cr. 3. F.S.
Prereq: MKT 340
Functional aspects of sales force management; personal selling methods; procedures for recruiting, selecting, and training new salespeople; compensation and expense control systems; problems of sales force motivation and supervision; methods of territorial and quota assignment; sales department budgets; distributor-dealer relations; other selected topics.

MKT 443: Strategic Marketing Management
(3-0) Cr. 3. F.S.SS.
Prereq: MKT 444, MKT 447
Analysis of major elements of strategic marketing management. May include case studies or business simulations involving decision making using marketing tools from previous courses. (For marketing majors only.).

MKT 444: Marketing Research
(3-0) Cr. 3. F.S.
Prereq: MKT 340, STAT 226
Marketing research techniques: problem formulation, research design, questionnaire construction, sampling, data collection procedures, and analysis and interpretation of data related to marketing decisions.

MKT 445: Customer Relationship Management
(3-0) Cr. 3. F.S.
Prereq: MKT 340
Examines how customer data can be used to enhance decisions relating to acquisition, development and retention. Topics include customer lifetime value, customer as assets, customer loyalty programs and customization.

MKT 446: Retailing
(3-0) Cr. 3. F.S.
Prereq: MKT 340
Basic areas of retail management: buying, merchandising, retail promotion, store location, store layout, credit management, and inventory control. Emphasis on practical application of retail management principles.

MKT 447: Consumer Behavior
(3-0) Cr. 3. F.S.
Prereq: MKT 340
Study of how consumers select, purchase, use, and dispose of goods and services. Includes analyses of how markets and others influence these processes. Application of concepts and methods of the behavioral sciences to marketing management decision making.

MKT 448: Global Marketing
(3-0) Cr. 3. F.S.
Prereq: MKT 340
Marketing from a global perspective and familiarity with the problems and perspectives that global companies face. Concepts and principles of marketing strategies, market assessment, identify marketing opportunities, entry decision, emerging markets, effects of political, legal, economic and cultural environments, and decisions relating to segmentation, positioning, branding, product, price, distribution and promotions in a global setting.

MKT 449: Marketing Seminar
(3-0) Cr. 3.
Prereq: MKT 340
Analysis of current issues and problems in marketing with emphasis on new theoretical and methodological developments. Additional seminars may be offered.

MKT 451: Marketing Channels
(3-0) Cr. 3. F.S.
Prereq: MKT 340
Focuses on marketing channels, the downstream part of a value chain, companies that come together to bring products and services from their point of origin to the point of consumption. Topics include channel institutions, channel design, channel coordination and implementation. Highlights international and technological aspects of marketing channels so that students can successfully develop and manage marketing channels in a contemporary business environment.

MKT 453: Brand Management
(3-0) Cr. 3. F.S.
Prereq: MKT 447
Examines the role of brands and branding in market environments characterized by intense competition and consumer power. Covers issues relating to why branding is important to firms, what brands represent to consumers, and what should be done to manage them effectively.

MKT 490: Independent Study
Cr. 1-3. Repeatable.
Prereq: MKT 340, senior classification; permission of instructor

MKT 492: Comparative Marketing
(3-0) Cr. 3. SS.
Prereq: MKT 340
Provides experience to students in culture, social, economic, and political environment of marketing in a foreign country. Students complete a term project (e.g., a marketing plan) based on information collected in the foreign country. Students attend briefings by experts/officials of private and public organizations.

Courses primarily for graduate students, open to qualified undergraduates:

MKT 501: Marketing
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission
An analytical approach to the study of marketing issues and challenges of business firms and nonprofit organizations. Emphasis on the influence of the global marketplace and the marketing environment on marketing decision making; the determination of the organization's products, prices, channels and communication strategies; an orientation that ensures sustainability of marketing operations; and the organization's system for planning and controlling its marketing effort.

MKT 540: Advanced Marketing Management
(3-0) Cr. 3. F.S.
Prereq: MKT 501
Strategic marketing and decision making, with emphasis on cases utilizing qualitative and quantitative techniques and marketing models.

MKT 541: International Marketing
(3-0) Cr. 3. F.
Prereq: MKT 501, MKT 509
Scope and nature of global marketing operation; the context of international environment in which firms operate. Recent developments of international business activities, and a framework for better understanding of the basic forces driving international business and marketing operations. Development of market entry strategies and global marketing mix policies, as well as export operations. Organizational issues related to the globalization of the firm.

MKT 542: New Product Development and Marketing
(3-0) Cr. 3. S.
Prereq: MKT 501
Principles and concepts of new product development and introduction; decision areas include market definition and structure, idea generation, concept evaluation, test marketing, launch tracking, and global product planning; models and techniques of new product evaluation used by consumer product companies.

MKT 543: Services Marketing
(3-0) Cr. 3.
Prereq: MKT 501 and instructor permission
In-depth appreciation and understanding of the unique challenges inherent in managing and delivering quality services. Students will be introduced to and have the opportunity to work with tools and strategies that address these challenges.

MKT 544: Marketing Research
(3-0) Cr. 3. S.
Prereq: MKT 501, BUSAD 502 or STAT 401
Marketing research methods are examined with emphasis on the use of advanced research methods in business research. Application of advanced sampling, measurement, and data analysis methods in research on market segmentation, market structure, consumers' perceptions and decision processes, marketing communication, new product development, and pricing.

MKT 545: Integrated Marketing Communication
(3-0) Cr. 3.
Prereq: MKT 501
Introduces the student to the field of marketing communications. Covers a number of topics and areas essential for understanding how to design and evaluate communication strategies necessary for the successful marketing of products and services. An integrated marketing communications (IMC) perspective is employed in covering material, with a corresponding focus on various elements of an IMC strategy, including advertising, promotions, point-of-purchase communications, direct marketing techniques, and other topics.

MKT 546: Customer Relationship and Business-To-Business Marketing
(3-0) Cr. 3.
Prereq: MKT 501
Core concepts and issues involved in customer relationship strategy and management in consumer and business-to-business markets. Emphasis on customer opportunity analyses, customer relationship management tools and strategies.

MKT 547: Consumer Behavior
(3-0) Cr. 3. S.
Prereq: MKT 501
The behavior of consumers. Intensive review of literature from relevant disciplines. Applications of concepts and methods of the behavioral sciences to marketing management decision making.

MKT 549: Global Marketing Planning and Execution
(3-0) Cr. 3.
Prereq: MKT 501
Allows students to develop the ability to plan and execute a B2B business by integrating aspects of marketing with other business functions in the international context. Product strategy, innovation, foreign market entry, supply strategies for foreign markets, pricing strategy, market research, customer service, international payments, managing international subsidiaries, licensing, distribution strategy, and responding to changing international environmental conditions. Involves a simulation-based instruction in planning and managing an international B2B business.

MKT 551: Marketing Channels
(3-0) Cr. 3.
Prereq: MKT 501
Design of marketing channels, developing and managing relationships with resellers, and evaluating channel performance. Emphasis on international and technological aspects of marketing channels.

MKT 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
For students wishing to do individual research in a particular area of marketing.

Courses for graduate students:

MKT 601: Seminar in Consumer Behavior
(3-0) Cr. 3.
Prereq: MGMT 601
A rigorous foundation of the major conceptual and methodological paradigms in the consumer-behavior literature. Seeks to aid students in understanding the psychological, sociological, and anthropological roots of consumer behavior research. Read the latest research in the area reported in leading consumer behavior/psychology journals.

MKT 602: Marketing Strategy
(3-0) Cr. 3.
Prereq: MGMT 601
Review major contributions and recent developments in marketing strategy research and practice. Review commonly used modeling approaches and research methods to study strategic interaction between firms seeking to build competitive advantages. Provide an overview of empirical research regarding measurement, level and persistence of business success and implications of findings for theory and strategy development.

MKT 603: Customer Management Strategy and Implementation
(3-0) Cr. 3.
Prereq: Mkt 601
Addresses key strategy and implementation issues behind customer management. Topics such as typology of CM strategies, antecedents and outcomes; environmental and managerial influences on strategy formation; technology and impact on CM strategy; and value of CM strategy. Examine theories and concepts behind important CM issues such as customer satisfaction, customer loyalty and customer profitability.

MKT 604: Marketing Issues in Inter-Organizational Relations
(3-0) Cr. 3.
Prereq: MGMT 602
Inter-firm and network competition; relationship among suppliers, distributors, alliance partners, external employees, and internal employees. Theories including agency theory, network theory, relationship marketing, channels of distribution theories on cooperation versus competition, IOS theories.

MKT 644: Research Methods
(3-0) Cr. 3.
Prereq: Knowledge of introductory statistics, Stat 401, enrollment in the PhD program
Introduction to methodological issues that arise when addressing a wide variety of research questions in organizational and consumer studies. Address measurement issues (scales, reliability and construct validity), design (for experiments, surveys, or qualitative studies), sampling, and analysis (univariate and multivariate statistical procedures). Measurement issues in cross-cultural and international research will also be covered. It is assumed that students entering the course have knowledge of introductory statistics.

MKT 650: Research Practicum I
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a research manuscript to be submitted to a peer-reviewed academic journal. Students will work with a faculty mentor on a research project.

MKT 651: Research Practicum II
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a second research manuscript to be submitted to a peer-reviewed academic journal. Although students work under the supervision of a faculty mentor, the students will take independent responsibility for the research project.

MKT 699: Dissertation
Cr. 12.
Prereq: Graduate classification, permission of dissertation supervisor
Research.

Supply Chain Management

For undergraduate curriculum in business, major in supply chain management.

The Department of Supply Chain and Information Systems offers a major in supply chain management. Students will complete the general education requirements (including business foundation courses), business core requirements for the bachelor of science (B.S.) degree, and 18 additional credits in the major.

Supply Chain Management is an integrated program of study concerned with the efficient flow of materials, products, and information within and among organizations. Supply chain management involves the integration of business processes across organizations, from material sources and suppliers through manufacturing and processing to the final customer. The program provides students with the core knowledge related to a wide variety of supply chain activities, including demand

planning, manufacturing planning and control, purchasing, transportation management, warehouse management, inventory control, material handling, product and service support, information technology, and strategic supply chain management. The program takes a balanced approach to supply chain education, requiring courses in operations, logistics, and purchasing for all students.

The study of supply chain management prepares students for professional careers with manufacturers, retail distributors, logistics service providers (including carriers and non-asset based 3PLs), and consulting firms. The curriculum provides the required theoretical and conceptual base and analytical methods for making sound operational and strategic business decisions related to all activities in a supply chain.

The Supply Chain Management major requires students to take 18 credit hours in the supply chain management area. This requirement is met by completion of the following courses:

Core (15 credits)		
SCM 424	Process Management, Analysis, and Improvement	3
SCM 453	Supply Chain Planning and Control	3
SCM 460	Decision Tools for Logistics and Operations Management	3
SCM 461	Principles of Transportation	3
SCM 486	Principles of Purchasing and Supply Management	3
Select one elective from the following list		3
SCM 340	Project Management	
SCM 440	Supply Chain Information Systems	
SCM 450	Enterprise Resource Planning Systems in Supply Chain	
SCM 462	Transportation Carrier Management	
SCM 466	Global Trade Management	
SCM 487	Strategic Supply Chain Management	
SCM 491X	International Live Case and Study Tour	
SCM 495X	SCM Case Competition	
Total Credits		18

The department also offers a minor for non-Supply Chain Management majors in the College of Business. The minor requires 15 credits from an approved list of courses, of which 9 credits must stand alone. Students with declared majors have priority over students with declared minors in courses with space constraints.

Supply Chain Management, B.S.

Freshman

Fall	Credits	Spring	Credits
BUSAD 102 (or 103)	1	BUSAD 250	3
COM S 113	3	MATH 151	3
ECON 101	3	ECON 102	3
ENGL 150	3	HUM/SOC SCI	3
MATH 150#	3	International Perspective@	3
LIB 160	1		
HUM/SOC SCI	3		
	17		15

Sophomore

Fall	Credits	Spring	Credits
BUSAD 203	1	Core Business Courses	6
ACCT 284	3	SP CM 212	3
ENGL 250	3	ACCT 215	3
STAT 226	3	PHIL 230	3
HUM/SOC SCI	3		
General Elective	3		
	16		15

Junior

Fall	Credits	Spring	Credits
Core Business Courses	6	Core Business Courses	6
Natural Science	3	Major Courses	6
ENGL 302	3	US Diversity or Elective#	3
Major Course	3		
	15		15

Senior

Fall	Credits	Spring	Credits
General Elective	3	MGMT 478*	3
International/Global Perspective	3	Major Course	3
Major Courses	6	General Electives	8
Core Business Course	3		
	15		14

Total Credits: 122

@ Courses in these requirements may also be used as Global Perspective.

\# US Diversity courses may be used to satisfy HUM/SOC SCI.

* All core classes must be completed prior to taking MGMT 478 in the graduating semester.

Students must be admitted to the professional program in business to major in supply chain management. The requirements to enter the professional program are:

1. Completion of 30 credits, Foundation Courses, ENGL 150, and all ENGL 101/99 courses if required.

2. A minimum GPA of 2.50 either cumulative or in the Foundation Courses.

Graduation Requirements:

1. Grade of "C" or higher in at least 30 credits of Core and Major courses.

2. 42 credits of 300+ level courses.

3. 50% of required Business courses must be earned at ISU.

4. At least 32 credits and the LAST 32 credits must be earned at ISU.

5. 122 Credits minimum and a Cumulative GPA of at least 2.00

6. Grade of "C" or higher in 2 of the 3 required ENGL courses.

Graduate Study

The Department of Supply Chain and Information Systems participates in the full-time and part-time Master of Business Administration (MBA) and in the PhD in Business and Technology programs. The department also participates in the interdepartmental MS in Transportation program.

The MBA program is a 48-credit, non-thesis, non-creative component curriculum. Thirty of the 48 credits are core courses and the remaining 18 are graduate electives. Students can obtain a specialization in Supply Chain Management within the MBA program.

The PhD in Business and Technology is a 56-credit curriculum (minimum) that culminates in a dissertation. Students may select Supply Chain Management (SCM) as their major area of specialization. The primary objective of the SCM specialization is to prepare students for careers in research universities. The SCM domain is broad and includes the design, development and control of business processes for the conversion of inputs into outputs and distribution of those outputs. The traditional focus of SCM was on integration of processes across multiple functions within the firm—operations management, logistics, and purchasing primarily, with elements of marketing and information systems also included. However, in today's world, with competition across supply chain networks, SCM also involves integrating business processes across firms. Research in this area is therefore interdisciplinary in nature and addresses both intra- and inter-organizational issues.

Ph.D. core curriculum	6
Doctoral seminars and research practicum in the area of specialization	14
Minor area (9 cr.) plus electives (3 cr.)	12
Research methods courses	12
Dissertation	12
Total Credits	56

Courses primarily for undergraduates:

SCM 301: Supply Chain Management
(3-0) Cr. 3.
Prereq: ECON 101 and STAT 226
Various supply chain activities and integration of supply chain management with supply and demand, both within and between firms. Exposure to a wide range of supply chain management terminology, analytical tools, and theories related to four key elements of supply chain management: purchasing, operations, distribution, and integration. Specific topics include strategic sourcing, supply management, demand forecasting, resource planning, inventory management, process management, logistics, location analysis, process integration, and performance measurement.

SCM 340: Project Management
(Cross-listed with MIS). (3-0) Cr. 3.
Prereq: credit or enrollment in MIS 301
Equips students to support team activities in the general project management environment and better manage their careers. Practical experience using project management techniques and tools. Course topics include project initiation and execution, risk assessment, estimating and contracts, planning, human factors, and standard methods.

SCM 424: Process Management, Analysis, and Improvement
(3-0) Cr. 3.
Prereq: SCM 301
The design, analysis, and management of production processes to improve performance. Performance measures and their relationships; process design and evaluation; and managerial levers for improving and controlling process performance.

SCM 428: Special Topics in Operations Management
(3-0) Cr. 3.
Prereq: SCM 301
In-depth analysis of current issues, problems, and systems in operations management with emphasis on new theoretical and methodological developments. Topics may include in different semesters, supply chain management, productivity and quality improvement, management of technology and innovation, information technology in operations management, quick response manufacturing, and service operations management.

SCM 440: Supply Chain Information Systems
(Cross-listed with MIS). (3-0) Cr. 3.
Prereq: MIS 301, SCM 301
Internal and inter-organizational information systems necessary for a supply chain to achieve competitive advantage. Topics include: design, development, implementation, and maintenance of supply chain information systems; enterprise resource planning; advanced planning and scheduling, manufacturing execution systems; and the interface between manufacturing planning and control processes, logistics processes, and the information system.

SCM 450: Enterprise Resource Planning Systems in Supply Chain
(Cross-listed with MIS). (3-0) Cr. 3.
Prereq: SCM 301, MIS 301 or I E 148, I E 341
Examination of the role of enterprise resource planning systems (ERP) in the supply chain. Hands-on experience with a major software application in use by many corporations to manage and improve the efficiency of their supply chains and operations. Students will develop a more process-centric perspective about how a supply chain operates and how ERP enables and supports such operations.

SCM 453: Supply Chain Planning and Control
(3-0) Cr. 3. F.
Prereq: SCM 301
Supply chain planning and control is the process which synchronizes demand with manufacturing and distribution. This course will cover sales and operations planning with emphasis on forecasting, master scheduling, materials requirements planning, inventory management and demand planning. Linking business plans and information systems for integration and distribution channels are also covered.

SCM 460: Decision Tools for Logistics and Operations Management
(3-0) Cr. 3.
Prereq: SCM 301
Technical tools and skills required for problem solving and decision making in logistics and operations management. Transportation and network planning, inventory decision making, facility location planning, vehicle routing, scheduling, and production planning. Quantitative tools include linear and integer programming, non-linear programming, and simulation. Emphasis on the use of PC-based spreadsheet programs.

SCM 461: Principles of Transportation
(3-0) Cr. 3.
Prereq: SCM 301
Economic, operating, and service characteristics of the various modes of transportation, with a special emphasis on freight transportation. Factors that influence transport demand, costs, market structures, carrier pricing, and carrier operating and service characteristics and their influence on other supply chain costs and supply chain performance.

SCM 462: Transportation Carrier Management
(3-0) Cr. 3.
Prereq: Credit or enrollment in SCM 461
Analysis of transport users' requirements. Carrier management problems involving ownership and mergers, routes, competition, labor, and other decision areas.

SCM 466: Global Trade Management
(3-0) Cr. 3. F.S.
Prereq: SCM 301
Logistics systems and legal framework for the international movement of goods. Operational characteristics of providers of exporting and importing services. The effects of government trade policies on global logistics.

SCM 486: Principles of Purchasing and Supply Management
(3-0) Cr. 3.
Prereq: SCM 301
Sourcing strategies, concepts, tools and dynamics in the context of the integrated supply chain. Make or buy decision, supplier evaluation and selection, global sourcing, the total cost of ownership, contracts and legal terms, negotiation, purchasing ethics, and information systems requirements.

SCM 487: Strategic Supply Chain Management
(3-0) Cr. 3.
Prereq: SCM 460 or SCM 422 or SCM 424; SCM 485 or SCM 486
Capstone course in supply chain management. Integrating and applying the theories, concepts, and methods covered in the prerequisite courses through the use of readings, case studies, projects, and industry speakers.

SCM 490: Independent Study
Cr. 1-3. Repeatable.
Prereq: SCM 301, senior classification, permission of instructor

SCM 491: International Live Case and Study Tour
Cr. 3. S.
Prereq: SCM 301
Students follow supply chain of major firm from overseas manufacturer to domestic point-of-sale. Students are expected to complete projects and present findings to senior leadership.

SCM 495: Case Practicum
(3-0) Cr. 3. Repeatable, maximum of 2 times. F.S.
Prereq: SCM 301
Students explore different practical scenarios related supply chain projects and cases. Students acquire necessary skills and knowledge to solve practical issues associated with presented cases and problems. Students compete at different venues around the country.

Courses primarily for graduate students, open to qualified undergraduates:

SCM 501: Supply Chain Management
(3-0) Cr. 3.
Prereq: Enrollment in MBA program or departmental permission
Introduction to supply chain management including aspects of operations, logistics and global supply chain strategy development. Topic areas include lean manufacturing and value stream mapping; supplier development and measurement; sustainable supply chain operations; process measurement, management and improvement; supply chain risk and uncertainty; visibility and integration in the supply chain; and inventory control.

SCM 520: Decision Models for Supply Chain Management
(3-0) Cr. 3.
Prereq: SCM 501 or permission of instructor
The application of decision models for supply chain management. Topics include business applications of decision theory, inventory theory, business forecasting, optimization models, transportation and network models, routing problems, and project management.

SCM 524: Strategic Process Analysis and Improvement
(3-0) Cr. 3.
Prereq: SCM 501 or permission of instructor
Analysis, management, and improvement of the business processes used to produce and deliver products and services that satisfy customer needs. Process attributes that managers can control to influence the key operational performance measures of throughput time, inventory, cost, quality, and flexibility are discussed. Topics such as theory of constraints, lean production, and six sigma are included.

SCM 560: Strategic Logistics Management
(3-0) Cr. 3.
Prereq: SCM 501 or permission of instructor
Positions logistics vis-a-vis supply chain management (SCM). Presents different perspectives on SCM vs. logistics. Describes primary logistics functions: transportation, warehousing, facility location, customer service, order processing, inventory management and packaging. Benefits of and obstacles to the integration of these functions.

SCM 561: Transportation Management and Policy
(3-0) Cr. 3.
Prereq: SCM 501 or permission of instructor
Analysis of contemporary issues and strategies in transportation management and policy. Emphasis on evaluation of the impacts of transportation policies, new technologies, and strategic carrier and shipper management practices on the freight transportation industry and logistics systems.

SCM 563: Purchasing and Supply Management
(3-0) Cr. 3.
Prereq: SCM 501 or permission of instructor
Mechanics, procedures and tools used in purchasing. Recruiting, selecting, developing and managing supply chain partners in order to achieve competitive advantage via superior supply chain management. Factors and information needs for making supply management decisions.

SCM 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
For students who wish to do individual research in a particular area of supply chain management.

Courses for graduate students:

SCM 601: Theoretical Foundations of Supply Chain Management
(3-0) Cr. 3.
Prereq: MGMT 601 or permission of instructor
An overview of the development of supply chain management (SCM) theory, including review of seminal articles in logistics, operations, and purchasing management and theories from allied disciplines (e.g., economics, marketing, sociology, strategic management). Analysis of trends in SCM research topics and methodologies. Identification of emerging and future areas for research and theory development.

SCM 602: Seminar in Supply Chain Strategy
(3-0) Cr. 3.
Prereq: SCM 601 or concurrent enrollment
Review of research literature on supply chain strategy, including the impact of technology, global economic and social factors, and intra- and inter-organizational integration on supply chain strategy formation. The role of SCM in overall corporate strategy and the impact of SCM on firm performance will also be addressed.

SCM 603: Seminar in Purchasing
(3-0) Cr. 3.
Prereq: SCM 601 or concurrent enrollment
Review of classic purchasing theories. Discussion of contemporary supply management strategy; the role of supply management and its relationship with other functional areas; its impact on logistics and transportation issues; management of supply uncertainties.

SCM 604: Seminar in Logistics Management
(3-0) Cr. 3.
Prereq: SCM 601 or concurrent enrollment
Integration of network, economic, and systems theory in the design, management, and control of logistics systems in the context of integrated supply chain management. Functional areas addressed include transportation, inventory order fulfillment, distribution, and warehousing. Facility location analysis will also be covered.

SCM 605: Seminar in Operations Management
(3-0) Cr. 3.
Prereq: SCM 601 or concurrent enrollment
Review of the research literature on methods of organizing, planning, controlling, and improving manufacturing systems to achieve the desired performance objectives related to cost, quality, speed, and flexibility. The relationship between the performance of the manufacturing system and the performance of the supply chain system will also be discussed.

SCM 650: Research Practicum I
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a research manuscript to be submitted to a peer-reviewed academic journal. Students will work with a faculty mentor on a research project.

SCM 651: Research Practicum II
(1-0) Cr. 1.
Prereq: enrollment in the PhD program
Preparation of a second research manuscript to be submitted to a peer-reviewed academic journal. Although students work under the supervision of a faculty mentor, the students will take independent responsibility for the research project.

SCM 699: Dissertation
Cr. 12.
Prereq: Graduate classification, permission of dissertation supervisor
Research.

International Business

Interdepartmental Undergraduate Secondary Major

The international business secondary major is designed to provide students with an understanding of the international business environment. Students are expected to develop an understanding of factors associated with international business issues as applied to the different functional areas of business. They will also develop skills to prepare themselves for business positions with international responsibilities. The major is designed to prepare students for employment in multinational companies and for business assignments beyond the United States.

International business is an undergraduate secondary major that may be taken only in conjunction with a primary major in business. Technical knowledge of international business will strengthen the expertise acquired with the primary major. Business students pursuing this major should strengthen their placement opportunities with companies that are engaged in international business and trade.

For students with a primary major in the College of Business, the requirements for this secondary major include 12 credits in international business courses, one year of the same university-level foreign language (minimum of 6 credits), an approved international experience (minimum 3 months), and completion of the requirements of their primary major in Business. Fifteen of the 18 credits required for the International Business major must not be used for the primary major.

College of Design

Luis Rico - Gutierrez-Dean
Mark Chidister - Associate Dean
Cameron Campbell - Associate Dean for Academic Programs
Kevin Kane - Associate Dean for Research and Outreach

www.design.iastate.edu/ (http://www.design.iastate.edu)

Objectives of the Curricula in Design

The College of Design is among a small number of comprehensive design schools offering outstanding opportunities for both disciplinary and interdisciplinary education.

The College of Design strives to provide each student with a broad educational background and preparation in a specific design or art discipline. Each program is designed to develop knowledge and appreciation of the physical and cultural environment, to stimulate creative thinking and analysis, and to prepare students for participation in a wide variety of careers.

The college's programs also encompass many opportunities for individualized study and extracurricular activities such as visiting lectures and symposia, workshops, gallery exhibits, practicum and internship programs, field trips, and international study programs.

Graduates of the college are employed in private firms, government, industry, and education, or are self-employed as designers or artists. Opportunities for graduates include careers as architects, landscape architects, community and regional planners, graphic designers, industrial designers, interior designers, studio artists, arts administrators and environmental designers.

Organization of Curricula

All undergraduate programs in the College of Design share a common foundation curriculum, the Core Design program, followed by degree-specific curricula. The Core Design Program grounds the undergraduate

degree programs and provides a rich, rigorous inclusive base for the college's professional and non-professional programs. It creates shared language, experience, and community for programs, faculty and students and exposes students to all design disciplines, allowing them to make more informed degree choices, apply to multiple programs, and experiment with interdisciplinary work.

The intense, discipline-specific professional curricula that follow the Core Design Program focus on developing students' ability and knowledge in their major. Within the major area, students advance creative and professional skills through classroom and studio work, critiques of student projects, discussion with professional practitioners, and field studies.

General education, contained in both the Core Design Program and the degree programs, is composed to ensure that students receive a well-rounded undergraduate education.

High School Preparation

Courses in fine arts and design that develop visualization and freehand drawing abilities are highly recommended though not required for entrance. Students planning to enroll in an academic program in the College of Design must complete the following high school requirements:

- 4 years of English, including coursework in composition and literature and up to 1 year of speech and/or journalism, to develop communication skills and critical reading/writing ability
- 3 years of mathematics to develop problem-solving skills, including 1 year each of algebra, geometry, and advanced algebra
- 3 years of science, including at least two of the following:
  - 1 year of biology, 1 year of chemistry, or 1 year of physics
- 2 years of social studies, including at least 1 year of U.S. history and 1 semester of U.S. government.

Admission Standards to Enrollment-Managed Professional Programs

Admission into the enrollment managed professional programs of Architecture, Graphic Design, Industrial Design, Integrated Studio Arts, Interior Design, and Landscape Architecture requires a separate application after completing the Core Design Program, depends on available resources, and is subject to review by faculty committee. Applicants are reviewed on the basis of a portfolio of original work, academic performance, and a written essay.

Students may apply directly to the professional program in Community and Regional Planning and to the programs in Art and Design and Interdisciplinary Design. Transfer students from two-year institutions also may apply to these three programs.

Advising

Each student receives personal assistance from an academic advisor within the student's curriculum area. Students enrolled in the college's Core Design Program are advised by professional advisors. Once admitted to professional programs, students are assigned to faculty advisors within the student's curriculum area. Advisors help students develop a program of study, access pertinent university resources and provide information on career choice.

The college's career services office works with students to develop their career goals as well as prepare and search for employment.

Honors Program

The College of Design participates in the Honors Program which provides opportunities for outstanding students to individualize their programs of study. See Honors Program.

Departments of the College

- Architecture
- Art and Visual Culture
- Community and Regional Planning
- Graphic Design
- Industrial Design
- Interior Design
- Landscape Architecture

Requirements in the College of Design

All students in the College of Design are expected to meet the following requirements.

Core Design Program
Cr. Fall/Spring

DSN S 102	Design Studio I	4
DSN S 115	Design Collaborative Seminar *	0.5
DSN S 131	Design Representation	4
DSN S 183	Design Cultures	3
Social Science/Humanities Electives **		6
Math/Science Electives ***		6
Communications		7

* Students enrolled in the Design Exchange Learning Community take DSN S 110 in place of DSN S 115.

** General education credits in the Core Design Program may count toward the minimum credits.

*** Students who intend to apply to the Architecture program are strongly advised to take MATH 145 Applied Trigonometry and PHYS 111 General Physics during their Core year. While these specific courses are not required to apply to the program, they are required to advance in the B.Arch. program beyond the first semester. Students who intend to apply to the Industrial Design program are advised to takePHYS 101 Physics for the Nonscientist Physics for the Nonscientist,ECON 101 Principles of Microeconomics Principles of Microeconomics and a math course during their Core year.

General Education
International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communications: 7 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
Total Credits		7

(C- or better grade). Includes courses in the fields of English (composition) and speech communication (interpersonal and rhetorical).

Mathematics, physical sciences, and biological sciences 6 cr.
Includes courses in the fields of agronomy, astronomy and astrophysics, biology, chemistry, civil engineering, computer science, geology, mathematics, physics, and statistics.

Humanities: 6 cr.
Includes courses in the fields of classical studies, English (literature), foreign languages, history, philosophy, religious studies, as well as history/theory/literature courses in dance, music, theater, journalism, African American studies, American Indian studies, environmental studies, Latino/a studies, women's studies, and university studies.

Social Sciences: 6 cr.
Includes courses in the fields of African American studies, American Indian studies, anthropology, economics, environmental studies, geography, human development and family studies, Latino/a studies, psychology and sociology, women's studies, and university studies.

General Education Electives: 9 cr.
9 cr. from any of the above areas, 6 cr. of course level 300-400.

Minor in Critical Studies in Design

The undergraduate minor in Critical Studies in Design offers students opportunities to engage the history, theory and criticism of visual and material culture and the built environment. In lectures and focused seminars, students explore historical and contemporary issues, including cultural production, media and technology, design in everyday life, and models of professional practice. The minor is open to undergraduates in all university majors.

Total minor requirements: 15 cr.

ART H 292	Introduction to Visual Culture Studies	3
DSN S 183	Design Cultures	3
or another 100-200 level History/theory course offered in the College of Design		
Nine credit hours from approved list.		9
Total Credits		15

At least six of the 15 credits must be taken at Iowa State University in courses numbered 300 or above. At least nine of the 15 credits must not be used to meet any other college or university requirements except the credit requirement for graduation.

Undergraduate Curricula

Majors

- Art and Design
- Architecture
- Community and Regional Planning
- Graphic Design
- Industrial Design
- Integrated Studio Arts
- Interdisciplinary Design
- Interior Design
- Landscape Architecture
- Biological / Pre-Medical Illustration (BPMI)* (http://www.design.iastate.edu/bioillustration)

*The College of Design participates in this interdepartmental major.

Secondary Majors

- Environmental Studies*
- International Studies*

Minors

- Critical Studies (http://www.design.iastate.edu/criticalstudies.php)
- Design Studies (http://www.design.iastate.edu/designstudies.php)
- Digital Media
- Entrepreneurial Studies (http://www.business.iastate.edu/undergraduate/minors/entrepreneurship)*
- Environmental Studies* (http://catalog.iastate.edu/collegeofliberalartsandsciences/environmentalstudies/#minor)
- Gerontology* (http://catalog.iastate.edu/collegeofhumansciences/gerontology)
- International Studies* (http://catalog.iastate.edu/collegeofliberalartsandsciences/internationalstudies/#minor)
- Sustainability* (http://www.las.iastate.edu/sustainability)
- Technology and Social Change* (http://catalog.iastate.edu/interdisciplinaryprograms/minor/technologyandsocialchange)

*The College of Design participates in these interdepartmental secondary majors and minors.

Minor in Design Studies

The undergraduate minor in Design Studies is constructed to facilitate design awareness among interested students and to provide a vehicle for interdisciplinary study within the College of Design. This minor is open to all undergraduate students at Iowa State University.

This minor requires fifteen credits of course work: three credits selected from College of Design history/theory course offerings and twelve additional credits selected from any College of Design course offerings.

At least six of the fifteen credits must be taken at Iowa State University in courses numbered 300 or above. At least nine of the fifteen credits must not be used to meet any other college or university requirements except the credit requirement for graduation.

Students enrolled in the College of Design may not use courses required in their major degree programs or in the Core Design Program to satisfy this minor.

Minor in Digital Media

Manipulation of digital media has emerged as an essential skill for design inquiry alongside traditional methods of building models and drawing sketches. To familiarize students with the use of digital media in the design process, the College of Design offers an undergraduate Minor in Digital Media. This minor is open to all undergraduate students at Iowa State University.

This minor requires fifteen credits of coursework from an approved list. At least nine of the fifteen credits must be taken at Iowa State University in courses numbered 300 or above and may not be used to meet the requirements of the major.

Minor in Entrepreneurial Studies

The College of Design is an active participant in the Entrepreneurial Studies Minor for undergraduate students.

Graduate Curricula

The College of Design offers graduate study in the areas shown below. Graduate study is conducted through the Graduate College. Details are found in the Graduate College section of this catalog.

Majors

- Architecture
- Community and Regional Planning
- Graphic Design
- Industrial Design
- Integrated Visual Arts
- Interior Design
- Landscape Architecture
- Sustainable Environments
- Transportation*
- Urban Design

Double Degree Programs

- Architecture / Business
- Architecture / Community and Regional Planning
- Architecture / Urban Design
- Architecture / Sustainable Environments
- Community and Regional Planning / Landscape Architecture
- Community and Regional Planning/ Public Administration
- Community and Regional Planning / Sustainable Agriculture
- Community and Regional Planning / Business
- Community and Regional Planning / Urban Design
- Community and Regional Planning / Sustainable Environments
- Integrated Visual Arts / Sustainable Environments
- Landscape Architecture / Urban Design
- Landscape Architecture / Sustainable Environments

Minor

- Gerontology*

*The College of Design participates in this interdepartmental graduate program.

Certificate

Geographic Information Systems

Architecture

http://www.arch.iastate.edu

The undergraduate program in architecture is an accredited five-year curriculum leading to the Bachelor of Architecture degree. The program provides opportunities for general education as well as preparation for professional practice and/or graduate study. An optional one-semester foreign study program is offered to fourth year students.

The undergraduate curriculum includes one year of the college's Core Design Program followed by a four year professional program. Admission to the professional degree program is based on the applicant's performance in the completed pre-professional curriculum; previous high school record (or transfer record where applicable); portfolio and essay evaluations; and on available departmental resources.

Objectives of the Bachelor of Architecture program:

The department is committed to the study of architecture as a cultural discipline in which issues of practice, of the multiplicity of social

formations in which buildings exist, and of environmental effect are enfolded with the subject matter of building design - construction, space, material, form and use. Architecture arises from the aspirations that diverse individuals and groups have for their physical environment, and from the social enterprise of designing and fabricating the landscape we inhabit. It involves individual and multiple buildings, the spaces within them, and the exterior landscape.

It is our intent: that our students develop the skills with which to critically assess and research architectural questions and to invent architectural designs that address those questions; that they develop a working method for designing and that they have the communication, graphic, modeling and computational skills to support design exploration and to represent their design ideas to others; that they gain knowledge of architectural technologies through which buildings are given form, of which they are constructed and by which they are environmentally tuned and made sustainable; that they understand architectural history, that they understand the theoretical and diverse cultural underpinnings of the discipline of architecture, that they are able to reference architectural precedents and know how to utilize all of these in the development of their ideas; and that they have grounding in the ethical and practical aspects of the architectural profession in society.

For students entering the professional program, the department highly recommends purchase or lease of a laptop/notebook computer and appropriate software.

Curriculum in Architecture

The Department offers undergraduate and graduate degree programs:

A 167.5-credit undergraduate professional program, including the 30-credit Core Design Program, leading to the Bachelor of Architecture degree. (B. Arch.) A 102-credit graduate professional program leading to the Master of Architecture. Applicants holding B.S. or B.A. degrees in Architecture or
other affiliated design fields may be given advanced standing in this program. (M.Arch.)

A 30-credit interdisciplinary graduate program leading to the Master of Science in Architecture. (M.S. Arch.)

For more complete graduate program descriptions see Graduate Study under Architecture in the Courses and Programs section.

In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for licensure. The National Architectural Accrediting Board (NAAB), which is the sole agency authorized to accredit U.S. professional degree programs in architecture, recognizes three types of degrees: the Bachelor of Architecture, the Master of Architecture, and the Doctor of Architecture. A program may be granted a 6-year, 3-year, or 2-year term of accreditation, depending on the extent of its conformance with established educational standards.

Master's degree programs may consist of a pre-professional undergraduate degree and a professional graduate degree that, when earned sequentially, constitute an accredited professional education. However, the pre-professional degree is not, by itself, recognized as an accredited degree.

Total B. Arch. Requirement: 167.5 cr.
Only 65 cr from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communications: 10 cr.
(C- or better grade)

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
Plus three credits from approved list.		3
Total Credits		10

Humanities: 6 cr.
6 cr. from approved list.

Social Sciences: 6 cr.
6 cr. from approved list.

Math and Physical Sciences: 8 cr.

MATH 145	Applied Trigonometry	3
PHYS 111	General Physics	5
Total Credits		8

Design Core 11.5 cr.

DSN S 102	Design Studio I	4
DSN S 115	Design Collaborative Seminar	0.5
or DSN S 110	Design Exchange Seminar I	
DSN S 131	Design Representation	4
DSN S 183	Design Cultures	3
Total Credits		11.5

Design Communications: 3 cr.

ARCH 230	Design Communications I	3
Total Credits		3

Design: 48 cr.

ARCH 201	Architectural Design I	6
ARCH 202	Architectural Design II	6
ARCH 301	Architectural Design III	6
ARCH 302	Architectural Design IV	6

ARCH 401	Architectural Design V	6
12 credits:		
DSN S 546	Interdisciplinary Design Studio	
ARCH 403	Architectural Design VII	6
Total Credits		36

Building Technologies: 20 cr.

ARCH 345	Building Science and Technology I	2
ARCH 345L	Building Science and Technology I Lab	1
ARCH 346	Building Science and Technology II	3
ARCH 346L	Building Science and Technology II Lab	2
ARCH 347	Building Science and Technology III	3
ARCH 347L	Building Science and Technology III Lab	2
ARCH 348	Building Science and Technology IV	3
ARCH 348L	Building Science and Technology IV Lab	2
ARCH 445	Building Science and Technology V	2
Total Credits		20

Studies in History, Theory, and Culture: 18 cr.

ARCH 221	History of Architecture I	3
ARCH 222	History of Architecture II	3
ARCH 323	Theories of Architecture	3
Nine credits from approved HTC Option list.		9
Total Credits		18

Behavioral Studies/Practice: 6 cr.

ARCH 371	Human Behavior and Environmental Theory	3
ARCH 482	Professional Practice	3
Total Credits		6

Professional Options: 9 cr.

6 cr. 300-500 level Arch; 3 cr. from Arch, Art, Art H, ArtID, ArtGr, ArtIS, C R P, Des, Dsn S, or L A.

Electives: 21 cr.

6 cr. 300-500 level from department list.; 15 cr. from approved list. 2 cr. Kin or Ath allowed; 4 cr. AFAS, M S, or N S allowed; 9 cr. Arch allowed (no P/NP).

Architecture, B.Arch.

First Year

Fall		Credits	Spring		Credits
DSN S 102 or DSN S 131		4	DSN S 102 or DSN S 131		4
DSN S 110 or DSN S 115		0.5-1	DSN S 183 or ENGL 150		3
DSN S 183 (or General Elective)		3	PHYS 111		5
ENGL 150 or LIB 160 (or General Elective)		1-3	Social Science/Humanity Elective		3
MATH 145		3	LIB 160 or ENGL 250*		
Social Science/Humanity Elective		3	*LIB 160 is taken once.		
		14.5-17			15

Second Year

Fall		Credits	Spring		Credits
ARCH 201		6	ARCH 202		6
ARCH 221		3	ARCH 222		3
ARCH 230		3	ARCH 346		3
ARCH 345		2	ARCH 346L		2
ARCH 345L		1	Social Science/Humanity Elective		3
ENGL 250*		3			
*If not taken the first year.					
		18			17

Third Year

Fall		Credits	Spring		Credits
ARCH 301		6	ARCH 302		6
ARCH 323		3	ARCH 348		3
ARCH 347		3	ARCH 348L		2
ARCH 347L		2	ARCH 371		3
Social Sciences/Humanities Elective		3	HTC Elective Non-Wester Opton		3
		17			17

Fourth Year

Fall		Credits	Spring		Credits
ARCH 401		6	DSN S 546		6
ARCH 445		2	HTC Elective		3
ARCH 445L		1	General Elective		3
ARCH 482		3	General Elective		3
HTC Elective		3			
University Communication Elective		3			
		18			15

Fifth Year

Fall		Credits	Spring		Credits
ARCH 403		6	DSN S 546		6
Professional Elective		3	Professional Elective		3
Professional Elective		3	General Elective		3
General Elective		3	General Elective		3

General Elective	3	
	18	15

Total Credits: 164.5-167

Admission into the Bachelor of Architecture Program requires the completion of at least 30 credits, including the following courses: DSN S 102, 131, 183, 110 or 115, 6 credits of Social Sciences/ Humanities, at least 3 credits of MATH 145 or 5 credits of PHYS 11, ENGL 150 (or test-out credit), LIB 160. A portfolio review and essay will also be significant factors.

Graduate Study

The Department of Architecture offers two graduate degrees in architecture: a three-year accredited professional degree (M.Arch.) and a two-semester to three-semester research degree (M.S. in Arch.). Both degrees encourage interdisciplinary work within the College of Design and across related fields within the university. Double-degree programs are currently offered with the Department of Community and Regional Planning (M.Arch. / M.C.R.P.) and the College of Business (M.Arch. / M.B.A.). Financial support in the form of teaching and research assistantships is available competitively.

Master in Architecture

M.Arch. is an accredited professional degree in architecture. It is designed for students with undergraduate degrees in disciplines other than architecture as well as for students who hold four-year pre-professional degree in architecture.

The M.Arch. program demands engagement with contemporary issues and a commitment to lifelong learning. We encourage students to examine the relationships between local, regional and global contexts addressing environmental, social and technological issues. We believe that even though the scale of the architect's action might be limited, the range of information needed to make creative, intelligent and responsible design decisions is vast. We expect our graduates to value the necessity of research, interdisciplinary learning, and teamwork.

M.Arch. is accredited by the National Architectural Accreditation Board (NAAB) and leads to a professional Master of Architecture degree over three years including the first summer term. The curriculum starts with an intensive three-semester course sequence that places equal emphasis on three study areas: architectural design and media, science and technology, and theory and history seminars on the built environment. While this learning framework shapes the whole curriculum, the remaining four semesters have a more open structure that allows students to explore architecture within an interdisciplinary context. These four semesters include a number of options, including study abroad, specialized studios with a variety of faculty, and the opportunity to do an independent project.

Students with undergraduate degrees in architecture or other related design fields may be given advanced standing in the program; advanced standing students may waive up to the whole first year. Students admitted to the program hold undergraduate degrees in a broad range of fields such as art history, history, literature, interior design, economics, mathematics, computer science, anthropology, and medicine. These students must complete the full three years of the curriculum.

Master of Science in Architecture

M.S. in Arch. is a 30-credit research degree with a required graduate thesis. As a research degree, this program is not subject to NAAB accreditation.

M.S. in Arch. is open for applicants who hold a professional degree in architecture or other related design fields. Applicants are required to submit a research proposal that lies within one of the listed study areas. These study areas are: Sustainability and Green Design, Rural and Urban Studies, Representation and Digital Media, Design Inquiry, Advanced Building Design, Architectural and Construction History, and Building Science and Construction. The degree is also open for applicants with non-professional degrees in various fields depending on the study area proposed by the applicant.

Masters of Architecture
Studio Courses: 39 cr.

ARCH 505	Architectural Design and Media I: Mapping, Programming, Building	5
ARCH 506	Architectural Design and Media II: Materiality and Representation	5
ARCH 507	Architectural Design and Media III: Design in Detail	5
ARCH 601	Sustainable Building Design	6
ARCH 602	Community, Building and the Environment	6
ARCH 603	Comprehensive Design	6
ARCH 604	Design Studio Options	6

History and Theory Courses: 16 cr.

ARCH 595	Seminar on the Built Environment I: History	5
ARCH 596	Seminar on the Built Environment II: Landscape and Society	5
ARCH 597	Seminar on the Built Environment III: Theory	3
ARCH 598	Seminar on the Built Environment IV: Topical Study	3

Science and Technology: 26 cr.

ARCH 545	Building Science and Technology I	2
ARCH 545L	Building Science and Technology I Lab	1
ARCH 546	Building Science and Technology II	3
ARCH 546L	Building Science and Technology II Lab	2

ARCH 547	Building Science and Technology III	3
ARCH 547L	Building Science and Technology III Lab	2
ARCH 548	Building Science and Technology IV	3
ARCH 548L	Building Science and Technology IV Lab	2
ARCH 581	Service Learning	5
ARCH 582	Professional Practice	3

Electives: 21 cr.
Total Credits 102

Dual degree

Double degree programs are offered with Master of Design in Sustainable Environments (M.Arch./M.Des.S.E.), and Master of Urban Design (M.Arch/M.U.D.). Information about our programs and how to apply can be obtained from the department's web page at: www.design.iastate.edu/architecture

Financial support in the form of teaching and research assistantships is available.

Courses primarily for undergraduates:

ARCH 201: Architectural Design I
(1-15) Cr. 6. F.
Prereq: Completion of the pre-professional program and admission into the professional program in Architecture
Introduction to architectural design. Introduction to architectural design, including precedent research, drawing conventions, model making, and diagramming. Studio projects focus on investigating the impact of specific site conditions on design, threshold conditions, and small-scale domestic space. Students will learn skills in problem solving, visualization, and written, oral, and graphic communication. Field trips to relevant architectural sites.

ARCH 201H: Architectural Design I, Honors
(1-15) Cr. 6-7. F.
Prereq: Completion of the pre-professional program and admission into the professional program in Architecture
Introduction to architectural design. Introduction to architectural design, including precedent research, drawing conventions, model making, and diagramming. Studio projects focus on investigating the impact of specific site conditions on design, threshold conditions, and small-scale domestic space. Students will learn skills in problem solving, visualization, and written, oral, and graphic communication. Field trips to relevant architectural sites.

ARCH 202: Architectural Design II
(1-15) Cr. 6. S.
Prereq: ARCH 201; MATH 142; PHYS 111
Continuation of fundamental architectural design exploration. Studio projects focus on the generation of ideas based on experience and an understanding of urban spaces. Emphasis on systematic analysis of urban culture, scale, materiality, and networks. Students work in groups and individually. Representational methods expand on architectural conventions through experimentation. Fieldtrips to relevant architectural sites.

ARCH 202H: Architectural Design II, Honors
(1-15) Cr. 6-7. S.
Prereq: ARCH 201, MATH 142 and PHYS 111
Continuation of fundamental architectural design exploration. Studio projects focus on the generation of ideas based on experience and an understanding of urban spaces. Emphasis on systematic analysis of urban culture, scale, materiality, and networks. Students work in groups and individually. Representational methods expand on architectural conventions through experimentation. Fieldtrips to relevant architectural sites.

ARCH 221: History of Architecture I
(3-0) Cr. 3. F.
Survey of western architectural ideas and practices in their social, cultural, and representational contexts. Comparisons with global examples. Ancient through 1750.
Meets International Perspectives Requirement.

ARCH 222: History of Architecture II
(3-0) Cr. 3. S.
Survey of western architectural ideas and practices in their social, cultural and representational contexts. Comparisons with global examples. 1750 to present.
Meets International Perspectives Requirement.

ARCH 230: Design Communications I
(2-2) Cr. 3. F.
Prereq: Admission to the professional program in architecture
Investigations of various design media--including computer graphics and freehand drawing--and their applications to design, specifically to the course work in ARCH 201. Exercises to develop manual skill and perceptual sensitivity.

ARCH 301: Architectural Design III

(1-15) Cr. 6. F.

Prereq: ARCH 202

Consideration of landscape as a constructed, cultural artifact. Projects address the perceptual aspects and strategies of situation and location; examination of environmental phenomena and patterns of use and settlement as revealed and affected by the architectural artifact. Development of a critical design process is stressed.

ARCH 301H: Architectural Design III, Honors

(1-15) Cr. 6-7. F.

Prereq: ARCH 202

Consideration of landscape as a constructed, cultural artifact. Projects address the perceptual aspects and strategies of situation and location; examination of environmental phenomena and patterns of use and settlement as revealed and affected by the architectural artifact. Development of a critical design process is stressed.

ARCH 302: Architectural Design IV

(1-15) Cr. 6. S.

Prereq: ARCH 301 and minimum 2.0 GPA in previous studio courses

Continuation of ARCH 301, examining housing in the urban situation; diverse scales of use and occupation within the city as shaped by cultural tendencies. Projects examine collective and individual identities related by the condition of adjacency, the ability to consider varieties of scale within a project, and a further development of critical and technical methods.

ARCH 302H: Architectural Design IV, Honors

(1-15) Cr. 6-7. S.

Prereq: ARCH 301 and minimum 2.0 GPA in previous studio courses

Continuation of ARCH 301, examining housing in the urban situation; diverse scales of use and occupation within the city as shaped by cultural tendencies. Projects examine collective and individual identities related by the condition of adjacency, the ability to consider varieties of scale within a project, and a further development of critical and technical methods.

ARCH 321: History of the American City

(3-0) Cr. 3.

Prereq: Sophomore classification

Study of the development of the built environment and urban condition in the United States from the colonial period to today. Through the theme of infrastructure, primary attention is given to urban spatial organization, built form, technological change, regulatory and funding patterns, and social categories such as class, race, and gender. Credit counts toward fulfillment of History, Theory, Culture requirements.

Meets U.S. Diversity Requirement

ARCH 323: Theories of Architecture

(3-0) Cr. 3.

Prereq: ARCH 221, 222. Course restricted to ARCH majors only.

Survey of theories impacting the production of architecture, historically and in contemporary practice. Emphasis will be given to recent movements and architectural manifestations, as well as close examinations of socio-cultural conditions. Weekly readings and an analytic term paper (3000 words minimum) are required.

ARCH 334: Computer Applications in Architecture

(2-2) Cr. 3.

Current and potential applications of digital computers in architecture. Projects employing computer graphics and modeling methods. Awareness of programming languages related to applications.

ARCH 335: Three-Dimensional Studio

(Cross-listed with ARTIS). (1-4) Cr. 3. Repeatable, maximum of 6 credits. This course deals with three dimensional problems in visual invention, organization, and expression emphasizing creative manipulation of tools, materials, and techniques as means for three dimensional thinking. Projects cover the additive (modeling), subtractive (carving), substitutional (casting) as well as constructive techniques.

ARCH 345: Building Science and Technology I

(Dual-listed with ARCH 545). (2-0) Cr. 2. F.

Prereq: Undergraduate: Admission to the professional program in architecture; concurrent enrollment in ARCH 345L; graduate: Admission to the M. Arch. program and concurrent enrollment in ARCH 505 and ARCH 595; concurrent enrollment in ARCH 545L

First course in a sequence focused on architectural building technologies. Lectures and labs cover: environmental forces and systems (solar orientation, climate, daylighting, natural ventilation, human comfort and occupancy patterns), materials and assemblies (drawing conventions, building codes, and physical properties of materials) and fundamental structural principles (forces/loads, equilibrium, and stability).

ARCH 345L: Building Science and Technology I Lab

(0-2) Cr. 1. F.

Prereq: Admission to the professional program in architecture; concurrent enrollment in ARCH 345.

Laboratory to accompany Arch 345 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format.

ARCH 346: Building Science and Technology II

(Dual-listed with ARCH 546). (3-0) Cr. 3. S.

Prereq: Undergraduate: ARCH 345, ARCH 345L, MATH 145 and PHYS 111; concurrent enrollment in ARCH 346L. Graduate: ARCH 505, ARCH 545, ARCH 545L, and ARCH 595; concurrent enrollment in ARCH 506, ARCH 546L and ARCH 596.

Second course in a sequence focused on architectural building technologies. Lectures and labs cover: environmental systems (heat transfer in the building envelope, passive heating and cooling, daylighting, thermal comfort, analytical guidelines and building energy calculation methods), materials & assemblies (building envelope systems, accessibility, egress, and material properties), and structural systems (structural system selection/comparison, and design and analysis of "form-active" compression and tension structures).

ARCH 346L: Building Science and Technology II Lab

(0-4) Cr. 2. S.

Prereq: ARCH 345, ARCH 345L, MATH 145 and PHYS 111; concurrent enrollment in ARCH 346.

Laboratory to accompany Arch 346 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format.

ARCH 347: Building Science and Technology III

(Dual-listed with ARCH 547). (3-0) Cr. 3. F.

Prereq: Undergraduate: ARCH 346, Arch 346L; concurrent enrollment in ARCH 347L. Graduate: ARCH 506, ARCH 546, ARCH 546L, and ARCH 596 or advanced standing in the M.Arch program; concurrent enrollment in ARCH 601 and ARCH 547L.

Third course in a sequence focused on architectural building technologies. Lectures and labs cover: multistory building framing, assembly, and enclosure systems, sizing and selecting structural framing components (foundations, columns, beams, etc.), and an environmental design process that demonstrates the ability to integrate climate into the control of thermal, luminous, ventilative and acoustic environments. Introduction to plumbing and rain water collection systems.

ARCH 347L: Building Science and Technology III Lab

(0-4) Cr. 2. F.

Prereq: ARCH 346, Arch 346L; concurrent enrollment in ARCH 347.

Laboratory to accompany Arch 347 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format.

ARCH 348: Building Science and Technology IV

(Dual-listed with ARCH 548). (3-0) Cr. 3. S.

Prereq: Undergraduate: ARCH 347, Arch 347L; concurrent enrollment in ARCH 348L. Graduate: ARCH 547, ARCH 547L and ARCH 601; concurrent enrollment in ARCH 548L.

Fourth course in a sequence focused on architectural building technologies. Lectures and labs cover: ability to demonstrate active environmental HVAC control systems design, use and design of mechanical, electrical, plumbing, fire safety, transportation, and conveying systems and subsystems, constructed building assemblies and details (building envelope details for waterproofing and enclosure, advanced material properties, costs, and serviceability), and structural design for multi-story structures (design and documenting various framing patterns, integration with other building systems, and lateral stability strategies for wind and seismic).

ARCH 348L: Building Science and Technology IV Lab

(0-4) Cr. 2. S.

Prereq: ARCH 347, Arch 347L; concurrent enrollment in ARCH 348.

Laboratory to accompany Arch 348 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format.

ARCH 351: Whole Building Energy Performance Modeling

(2-2) Cr. 3.

Prereq: ARCH 202, 245, 341. Open to non-majors by permission of instructor.

Architectural design, design evaluation and technical analysis using energy performance modeling tools. Emphasis will be given to whole building energy efficiency including passive and active systems integration.

ARCH 371: Human Behavior and Environmental Theory

(3-0) Cr. 3.

Prereq: Completion of the pre-professional program and admission into the professional program in architecture

Exploration of theories that describe social structure and order and the manner in which individuals and societies organize themselves and structure their environment.

ARCH 401: Architectural Design V

(1-15) Cr. 6. F.

Prereq: ARCH 302

A rigorous examination of how buildings participate sustainably in socio-political and environmental systems. Student projects consider in a comprehensive proposal how issues of physical site, socio-economic context, programming, structure, form, materiality, and building systems are interconnected through the design process and within the built environment. Projects typically focus on a smaller scale urban public building that is closely connected to its physical, environmental, and social context.

ARCH 401H: Architectural Design V, Honors
(1-15) Cr. 6-7. F.
Prereq: ARCH 302
A rigorous examination of how buildings participate sustainably in socio-political and environmental systems. Student projects consider in a comprehensive proposal how issues of physical site, socio-economic context, programming, structure, form, materiality, and building systems are interconnected through the design process and within the built environment. Projects typically focus on a smaller scale urban public building that is closely connected to its physical, environmental, and social context.

ARCH 402: Architectural Design VI
(1-15) Cr. 6. S.
Prereq: ARCH 401 and minimum 2.0 GPA in previous studio courses
An examination of the relationship between architecture and the city. Studio projects stress analysis and interpretation of the diverse forces and conditions that impact and inform architecture in the urban environment. Urban design project. Study abroad option.
Meets International Perspectives Requirement.

ARCH 402H: Architectural Design VI, Honors
(1-15) Cr. 6-7. S.
Prereq: 401 and minimum 2.0 GPA in previous studio courses
An examination of the relationship between architecture and the city. Studio projects stress analysis and interpretation of the diverse forces and conditions that impact and inform architecture in the urban environment. Urban design project. Study abroad option.
Meets International Perspectives Requirement.

ARCH 403: Architectural Design VII
(1-15) Cr. 6. F.
Prereq: ARCH 402
A rigorous examination of architecture's relationship with culture and technology. Studio projects stress the interpretation and integration of contextual and historical considerations, as well as structural, environmental, and communication systems, in a comprehensive design proposal.

ARCH 403H: Architectural Design VII, Honors
(1-15) Cr. 6-7. F.
Prereq: ARCH 402
A rigorous examination of architecture's relationship with culture and technology. Studio projects stress the interpretation and integration of contextual and historical considerations, as well as structural, environmental, and communication systems, in a comprehensive design proposal.

ARCH 404: Architectural Design VIII
(1-15) Cr. 6. S.
Prereq: ARCH 403
Advanced forum for architectural research and/or design. Choice of thematic studios or student initiated research and design. Experimentation and innovation are encouraged. DSN S 446 or DSN S 546, for 6 cr. each time taken, can be substituted for this class and be taken up to a maximum of 12 credits.

ARCH 404H: Architectural Design VIII, Honors
(1-15) Cr. 6-7. S.
Prereq: ARCH 403
Advanced forum for architectural research and/or design. Choice of thematic studios or student initiated research and design. Experimentation and innovation are encouraged. DSN S 446 or DSN S 546, for 6 cr. each time taken, can be substituted for this class and be taken up to a maximum of 12 credits.

ARCH 420: Topics in American Architecture
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of American architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment of History, Theory, Culture requirements. A maximum of 6 credits of ARCH 420 may be applied to degree program.
Meets U.S. Diversity Requirement

ARCH 422: Topics in Medieval Architecture
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of medieval architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment of History, Theory, Culture requirements. A maximum of 6 credits of ARCH 422 may be applied to degree program.
Meets International Perspectives Requirement.

ARCH 423: Topics in Renaissance to Mid-Eighteenth Century Architecture
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of renaissance to mid-eighteenth century architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment of History, Theory, Culture requirements. A maximum of 6 credits of ARCH 423 may be applied to degree program.
Meets International Perspectives Requirement.

ARCH 424: Topics in Nineteenth Century Architecture
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of nineteenth century architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment History, Theory, Culture requirements. A maximum of 6 credits of ARCH 424 may be applied to degree program.

ARCH 425: Topics in Twentieth Century Architecture
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
History, theory, and principles of twentieth century architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment History, Theory, Culture requirements. A maximum of 6 credits of ARCH 425 may be applied to degree program.

ARCH 426: Topics in Native American Architecture
(Cross-listed with AM IN). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of Native American/American Indian architecture, landscape architecture and planning considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment History, Theory, Culture. A maximum of 6 credits of ARCH 426 may be applied to degree program.
Meets U.S. Diversity Requirement

ARCH 427: History, Theory, and Criticism of Chinese Architecture
(Dual-listed with ARCH 527). (3-0) Cr. 3. F.
Prereq: Junior classification
The history and theoretical concept of Chinese built environment with emphasis on the morphology of built form and its relationship to art, landscape design, and urban structure. Credit counts toward fulfillment History, Theory, Culture.
Meets International Perspectives Requirement.

ARCH 429: Topics in Italian Architecture and Urbanism
(3-0) Cr. 3. S.
History, theory and principles of Italian architecture and urban design considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 431: Analytical Drawing
(1-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARCH 230 and ARCH 302
Exploration of 2- and 3-dimensional representations. Emphasis on on-site freehand sketching, perspective and orthographic drawing, rendering of shadows and textures, and use of diverse media.

ARCH 432: Advanced Computer Lighting and Rendering
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ARCH 230 and ARCH 301
Exploration of the computer as a design and communication tool. Emphasis on lighting and rendering techniques.

ARCH 433: File to Fabrication
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.
Prereq: ARCH 230 and ARCH 301
Exploration of the computer as a design and manufacturing tool. Emphasis on fabrication techniques and rapid prototyping including laser-cutting, 3-D printing and CNC routing.

ARCH 434: Computer-aided Architectural and Environmental Design
(1-4) Cr. 3.
Prereq: ARCH 334
Emphasis on application of the computer as a design tool, topical applications and computer graphic methods, development of computer software for architectural and environmental problem solving.

ARCH 436: Advanced Design Media
(2-2) Cr. 3. Repeatable. F.SS.
Prereq: ARCH 230
Special topics in design media applications.

ARCH 437: Architectural Photography
(3-0) Cr. 3.
Prereq: ARCH 202
Emphasis on use of the camera and lighting in photographing drawings and interior and exterior building environments.

ARCH 445: Building Science and Technology V
(2-0) Cr. 2. F.
Prereq: ARCH 348, Arch 348L; concurrent enrollment in ARCH 445L.
Final course in a sequence of architectural building technology courses comprising environmental systems, materials/assembly, and building structures topics. Using both lectures and labs, the three interrelated modules each emphasize a particular building technology subject with an overall focus on synthesizing and integrating building technologies together in sustainable design strategies. Topics include: integration of active environmental control and service systems into the design of larger scale buildings, the development of construction details for building shell and interiors, and the design and analysis of various long-span structural systems.

ARCH 445L: Building Science and Technology V Lab
(0-2) Cr. 1. F.
Prereq: ARCH 348, Arch 348L; concurrent enrollment in ARCH 445.
Laboratory to accompany Arch 445 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format.

ARCH 482: Professional Practice
(Dual-listed with ARCH 582). (3-0) Cr. 3. F.
Prereq: ARCH 202
Emphasis on the circumstances and opportunities of the professional practice of architecture: practice as profession, process, organization, business, and evolving models of practice.

ARCH 486: Design: Made in Italy
(3-0) Cr. 3. S.
An investigation of the history of Italian design in its contemporary form as part of International study abroad program in Rome. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 490: Independent Study
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490A: Independent Study: Design Communications.
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490B: Independent Study: Design
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490C: Independent Study: Building Science and Technology
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490D: Independent Study: Architectural History
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490E: Independent Study: Behavioral Studies
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490F: Independent Study: Practice
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

ARCH 490H: Independent Study: Honors
Cr. 1-9. Repeatable.
Prereq: Written approval of instructor and department chair on required form
Independent investigation.

Courses primarily for graduate students, open to qualified undergraduates:

ARCH 505: Architectural Design and Media I: Mapping, Programming, Building
(0-10) Cr. 5. F.
Prereq: Admission to the M Arch program. Concurrent enrollment in ARCH 541 and ARCH 595
An introduction to comprehensive architectural design projects that focuses on three interrelated design skills: mapping, programming and building. Projects establish a framework for designing buildings that considers multiple factors such as environmental forces, construction methods, building codes, urban regulations, social relationships, and cultural values.

ARCH 506: Architectural Design and Media II: Materiality and Representation
(0-10) Cr. 5. S.
Prereq: ARCH 505, ARCH 541, ARCH 595 and concurrent enrollment in ARCH 542 and ARCH 596
Small-scale architectural design projects that investigate design representation through analogue and digital means. The projects explore different representation strategies to help students develop an understanding of the particular modes of architectural representation that advance the designer's knowledge of space as a complex interaction between materials with inherent physical characteristics, mobile socializing bodies, and changing environmental cycles.

ARCH 507: Architectural Design and Media III: Design in Detail
(0-10) Cr. 5. SS.
Prereq: ARCH 506, ARCH 542, ARCH 596 and concurrent enrollment in ARCH 581
Design projects that emphasize the multi-faceted role of the architectural detail in the design process through first, understanding the historical specificity of building construction and detailing; second, utilizing working drawing as a mode of communication; and third, designing with details. The term-long project will consider a set of working drawings of past buildings as a site for design intervention.

ARCH 517: Big and Tall: A History of Construction
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of construction from ancient times through today. Analytic project or term paper and weekly readings with discussion questions. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 519: Middle Eastern Cities
(Cross-listed with C R P). (3-0) Cr. 3.
Prereq: Graduate or Senior classification
Introduction to basic academic writings on Middle Eastern cities in addition to other contemporary cultural productions of the region. Study of various aspects of Middle Eastern life and the built environments that this life produces.
Meets International Perspectives Requirement.

ARCH 521: Celluloid Cities, Urbanism in Film
(3-0) Cr. 3.
Prereq: Junior classification
Urban theory and history as manifested in popular films and videos, both fiction and documentary. Term projects require students to make short videos. (Experience with video-making not necessary.) Credits counts towards fulfillment of History, Theory, Culture requirement.

ARCH 525: Meaning and Form in Architecture
(3-0) Cr. 3.
Prereq: Graduate or Junior or Senior classification
Seminar on critical analysis of meaning and form in architecture and human-made environment in various cultural contexts examined from historical and theoretical perspectives. Analytic term paper and weekly readings with discussion questions. Credit counts toward fulfillment of History, Theory, Culture requirements Meets International Perspectives Requirement.
Meets International Perspectives Requirement.

ARCH 527: History, Theory, and Criticism of Chinese Architecture
(Dual-listed with ARCH 427). (3-0) Cr. 3. F.
Prereq: Junior classification
The history and theoretical concept of Chinese built environment with emphasis on the morphology of built form and its relationship to art, landscape design, and urban structure. Credit counts toward fulfillment History, Theory, Culture.
Meets International Perspectives Requirement.

ARCH 528: Topical Studies in Architecture
(3-0) Cr. 2-3. Repeatable, maximum of 6 times.
Prereq: ARCH 221, ARCH 222 or senior classification or graduate standing
Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 528A: Studies in Architecture: Culture
(3-0) Cr. 2-3. Repeatable, maximum of 6 times.
Prereq: ARCH 221, ARCH 222 or senior classification or graduate standing

ARCH 528B: Studies in Architecture: Technology
(3-0) Cr. 2-3. Repeatable, maximum of 6 times.
Prereq: ARCH 221, ARCH 222 or senior classification or graduate standing
n/a.

ARCH 528C: Studies in Architecture: Communications
(3-0) Cr. 2-3. Repeatable, maximum of 6 times.
Prereq: ARCH 221, ARCH 222 or senior classification or graduate standing
n/a.

ARCH 528E: Studies in Architecture: Practice
(3-0) Cr. 2-3. Repeatable, maximum of 6 times.
Prereq: ARCH 221, ARCH 222 or senior classification or graduate standing

ARCH 529: Spatial Dialectics in the American Midwest
(3-0) Cr. 3.
Prereq: Graduate or Senior classification
The American Midwest has witnessed dramatic transformation during the last two centuries which impacted its physical, environmental, economic and social characteristics. This course is an interdisciplinary study of the evolution and sustainability of Midwestern space in relationship to forces of flow shaped by the mobility of bodies, products, meanings, and symbols that are enforced, incorporated, reproduced or destroyed. Credit counts toward fulfillment of History, Theory, Culture requirements.
Meets U.S. Diversity Requirement

ARCH 534: Advanced Computer-aided Architectural Design
(1-4) Cr. 3. Repeatable, maximum of 6 credits. F.
Prereq: ARCH 434 and permission of instructor
Emphasis on concepts, algorithms, data structures, advanced modeling, rendering, animation, and virtual reality applications in architectural design.

ARCH 535: Advanced Three-Dimensional Studio
(1-4) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ARCH 335 or Graduate classification
Advanced investigation of sculptural expression with emphasis on individual projects.

ARCH 541: Science and Technology for Architects I
(4-2) Cr. 5. F.
Prereq: Admission to the M. Arch. program and concurrent enrollment in ARCH 505 and 595
Introduction to Human Factors, Descriptive Geometry, Basic Building Materials, and Small-Scale Building Envelopes. Theory and case studies, stressing the connectivity of technical issues to broader formal, social, and cultural spheres.

ARCH 542: Science and Technology for Architects II
(4-2) Cr. 5. S.
Prereq: ARCH 505, ARCH 541, ARCH 595 and concurrent enrollment in ARCH 506 and ARCH 596
Elementary Statics and Beam Theory, Basic Construction Materials, and Site and Building Circulation. Theory and case studies stressing the connectivity of technical issues to broader formal, social, and cultural spheres.

ARCH 545: Building Science and Technology I
(Dual-listed with ARCH 345). (2-0) Cr. 2. F.
Prereq: Undergraduate: Admission to the professional program in architecture; concurrent enrollment in ARCH 345L; graduate: Admission to the M. Arch. program and concurrent enrollment in ARCH 505 and ARCH 595; concurrent enrollment in ARCH 545L
First course in a sequence focused on architectural building technologies. Lectures and labs cover: environmental forces and systems (solar orientation, climate, daylighting, natural ventilation, human comfort and occupancy patterns), materials and assemblies (drawing conventions, building codes, and physical properties of materials) and fundamental structural principles (forces/loads, equilibrium, and stability).

ARCH 545L: Building Science and Technology I Lab
(0-6) Cr. 3. F.
Prereq: Admission to the M. Arch. program and concurrent enrollment in ARCH 505 and ARCH 595; concurrent enrollment in ARCH 545.
Laboratory to accompany Arch 545 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format. Readings and project presentations.

ARCH 546: Building Science and Technology II
(Dual-listed with ARCH 346). (3-0) Cr. 3. S.
Prereq: Undergraduate: ARCH 345, ARCH 345L, MATH 145 and PHYS 111; concurrent enrollment in ARCH 346L. Graduate: ARCH 505, ARCH 545, ARCH 545L, and ARCH 595; concurrent enrollment in ARCH 506, ARCH 546L and ARCH 596.
Second course in a sequence focused on architectural building technologies. Lectures and labs cover: environmental systems (heat transfer in the building envelope, passive heating and cooling, daylighting, thermal comfort, analytical guidelines and building energy calculation methods), materials & assemblies (building envelope systems, accessibility, egress, and material properties), and structural systems (structural system selection/comparison, and design and analysis of "form-active" compression and tension structures).

ARCH 546L: Building Science and Technology II Lab
(0-4) Cr. 2. S.
Prereq: ARCH 505, ARCH 545, ARCH 545L, and ARCH 595; concurrent enrollment in ARCH 506, ARCH 546 and ARCH 596.
Laboratory to accompany Arch 546 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format. Readings and project presentations.

ARCH 547: Building Science and Technology III
(Dual-listed with ARCH 347). (3-0) Cr. 3. F.
Prereq: Undergraduate: ARCH 346, Arch 346L; concurrent enrollment in ARCH 347L. Graduate: ARCH 506, ARCH 546, ARCH 546L, and ARCH 596 or advanced standing in the M.Arch program; concurrent enrollment in ARCH 601 and ARCH 547L.
Third course in a sequence focused on architectural building technologies. Lectures and labs cover: multistory building framing, assembly, and enclosure systems, sizing and selecting structural framing components (foundations, columns, beams, etc.), and an environmental design process that demonstrates the ability to integrate climate into the control of thermal, luminous, ventilative and acoustic environments. Introduction to plumbing and rain water collection systems.

ARCH 547L: Building Science and Technology III Lab
(0-2) Cr. 1. F.
Prereq: ARCH 506, ARCH 546, ARCH 546L, and ARCH 596 or advanced standing in the M.Arch program; concurrent enrollment in ARCH 547 and ARCH 601.
Laboratory to accompany Arch 547 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format. Readings and project presentations.

ARCH 548: Building Science and Technology IV
(Dual-listed with ARCH 348). (3-0) Cr. 3. S.
Prereq: Undergraduate: ARCH 347, Arch 347L; concurrent enrollment in ARCH 348L. Graduate: ARCH 547, ARCH 547L and ARCH 601; concurrent enrollment in ARCH 548L.
Fourth course in a sequence focused on architectural building technologies. Lectures and labs cover: ability to demonstrate active environmental HVAC control systems design, use and design of mechanical, electrical, plumbing, fire safety, transportation, and conveying systems and subsystems, constructed building assemblies and details (building envelope details for waterproofing and enclosure, advanced material properties, costs, and serviceability), and structural design for multi-story structures (design and documenting various framing patterns, integration with other building systems, and lateral stability strategies for wind and seismic).

ARCH 548L: Building Science and Technology IV Lab
(0-2) Cr. 1. S.
Prereq: ARCH 547, ARCH 547L and ARCH 601; concurrent enrollment in ARCH 548.
Laboratory to accompany Arch 548 and must be taken concurrently. Integrating building technologies into architectural designs through experiments and exercises in laboratory format. Readings and project presentations.

ARCH 558: Sustainability and Green Architecture
(3-0) Cr. 3.
Prereq: Graduate or Senior classification
Issues of Sustainability as related to living patterns and city design, population, pollution and use and availability of natural resources for the built environment; Issues of Green Architecture as it relates to building material selection, systems of building materials, the environment of the United States and the World, architects and examples of buildings with green or sustainable designations.

ARCH 567: Preservation, Restoration, and Rehabilitation
(3-0) Cr. 3. S.
Prereq: Senior classification
Construction standards and procedures for preserving, restoring, reconstructing, and rehabilitating existing buildings following the guidelines of the National Park Service and the National Trust for Historic Preservation. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 568: Historic Preservation
(3-0) Cr. 3. F.
Prereq: Senior classification
The history and theory of the Historic Preservation movement including an overview of the National Trust for Historic Preservation; the National Register of the Historic Places; the National Park Service; federal programs, funding sources, preservation law, national landmarks, and historic distracts. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 571: Design for All People
(Cross-listed with GERON). (3-0) Cr. 3. S.
Prereq: Graduate or Senior classification
Principles and procedures of universal design in response to the varying ability level of users. Assessment and analysis of existing buildings and sites with respect to standards and details of accessibility for all people, including visually impaired, mentally impaired, and mobility restricted users. Design is neither a prerequisite nor a required part of the course. Enrollment open to students majoring in related disciplines. Credit counts toward fulfillment of History, Theory, Culture requirements.
Meets U.S. Diversity Requirement

ARCH 575: Contemporary Urban Design Theory
(3-0) Cr. 3.
Prereq: Graduate or Senior classification
Current urban design theory and its application to urban problems. Credit counts toward fulfillment of History, Theory, Culture requirements.

ARCH 576: Study Abroad Options
Cr. 1-12. Repeatable, maximum of 12 credits. SS.
Special topics in environmental design, architectural history and contemporary practice. Travel to relevant countries. General cultural and historical studies, topical projects and individual inquiry. Courses may be taught by departmental faculty or faculty from approved Iowa State Study Abroad programs. See current offerings for detailed syllabus.
Meets International Perspectives Requirement.

ARCH 581: Service Learning
(1-12) Cr. 5. SS.
Prereq: ARCH 506, 542 and ARCH 596
Planning and execution of a project serving a community need. Learning occurs through both theory and active involvement in on-site work. Projects connect previous coursework to practical applications and community involvement.

ARCH 582: Professional Practice
(Dual-listed with ARCH 482). (3-0) Cr. 3. F.
Prereq: ARCH 202
Emphasis on the circumstances and opportunities of the professional practice of architecture: practice as profession, process, organization, business, and evolving models of practice.

ARCH 583: Research in Practice
(3-0) Cr. 3. S.
Prereq: Graduate or Senior classification
Foundational course in the methods and conceptual tools of design research in the context of practice. Through team and individual guided projects, students generate, analyze and represent knowledge in design-related communications and contexts. Alternative models of practice, client groups and communities are addressed within projects that precede, feed, follow, or overlap with architectural contracts.

ARCH 590: Special Topics
Cr. 1-5. Repeatable.
Prereq: Written approval of instructor and department chair on approved form
Investigation of architectural issues having a specialized nature.

ARCH 595: Seminar on the Built Environment I: History
(5-0) Cr. 5. F.
Prereq: Admission to the M. Arch. program and concurrent enrollment in ARCH 505 and ARCH 541
Introduction to historical canons and traditions of architecture and urbanism. Discussion of the relationship between historical inquiry and contemporary practice. Students learn skills in critical thinking, visual analysis, and research methods. Course sessions develop thematically with interdisciplinary readings, group discussions, student presentations, and research projects.

ARCH 596: Seminar on the Built Environment II: Landscape and Society
(5-0) Cr. 5. S.
Prereq: ARCH 505, ARCH 541, ARCH 595 and concurrent enrollment in ARCH 506 and ARCH 542
Introduction to landscape as artifact and multi-disciplinary knowledge-base for design thinking. Literatures and methods of environmental psychology, cultural geography, landscape and architectural history and theory, site and circulation design as intersection of built infrastructural, natural, and social systems. Emphasis on sensory perception, and human movement; investigations of climate, environmental conditions, and values toward consumption and sustainability in everyday experience of the built environment.

ARCH 597: Seminar on the Built Environment III: Theory
(3-0) Cr. 3. F.
Prereq: Graduate or Senior classification
Multidisciplinary overview of contemporary theories concerned with the production of the built environment. Particular attention to urbanism as a discourse that relates social interactions and power structures to material space.
Meets International Perspectives Requirement.

ARCH 598: Seminar on the Built Environment IV: Topical Study
(3-0) Cr. 3. S.
Prereq: Graduate or Senior classification
A research seminar which considers a topic within contemporary discourses on the built environment outside of Europe and North America. The topic will be studied from multiple perspectives highlighting the historical and theoretical relationships between architecture, global cultures, geography, landscape, and urban planning. Credit counts toward fulfillment History, Theory, Culture requirements.

Courses for graduate students:

ARCH 601: Sustainable Building Design
(0-12) Cr. 6. F.
Prereq: ARCH 507, ARCH 542, ARCH 596 and concurrent enrollment in ARCH 643
Design projects that are developed through integrative design strategies that explore the relationship between buildings and environmental forces to maximize non-wasteful, efficient use of resources such as energy, water and building materials. Projects will include investigations of the impact of solar energy, airflow, building materials, passive and active systems and wall sections on spatial quality and form making. Design decisions will be quantitatively validated through energy modeling and performance simulation.

ARCH 602: Community, Building and the Environment
(0-12) Cr. 6. S.
Prereq: ARCH 601, ARCH 643, ARCH 597 and concurrent enrollment in ARCH 644
Design projects that explore the relationships between architectural, cultural, and environmental landscapes. Emphasis on regional sites, socio-economic conditions, and sustainable design and planning practices at multiple scales. Projects stress engagement with local circumstances and stakeholders; systemic interconnections and strategies; and the application of interdisciplinary research.

ARCH 603: Comprehensive Design
(0-12) Cr. 6. F.
Prereq: ARCH 601
Rigorous examination of architecture's relationship with culture and technology. Studio projects stress the interpretation of contextual and historical considerations, as well as structural, environmental, mechanical, electrical and plumbing systems, in a comprehensive design proposal. This course fulfills the Graduate College Creative Component Requirement.

ARCH 604: Design Studio Options
(0-12) Cr. 6. Repeatable, maximum of 12 credits. S.
Prereq: ARCH 602
Design studio selected by the students, which may include but is not limited to: independent design study, interdisciplinary design studio, study abroad, and design build. DSN S 546 for 6 cr. may be substituted for this course.

ARCH 643: Science and Technology for Architects III
(2-2) Cr. 3. F.
Prereq: ARCH 507, ARCH 542, ARCH 596, ARCH 581 and concurrent enrollment in ARCH 601 or or Graduate classification and concurrent enrollment in ARCH 601
Third in a four-course series in building science and technologies. Structural Elements and Systems, and Building Services. Theory and case studies stressing the connectivity of technical issues to broader formal, social and cultural spheres.

ARCH 644: Science and Technology for Architects IV
(2-2) Cr. 3. S.
Prereq: ARCH 643 or Graduate classification
Fourth of a four-course series in building science and technologies. Building Enclosures, Interior Construction and Sensory Qualities, Fabrication and Construction. Theory and case studies stressing the connectivity of technical issues to broader formal, social and cultural spheres. Summative Student Project.

ARCH 690: Independent Design Study
(1-15) Cr. 6. Repeatable.
Prereq: Admission to the M. S. in Arch. program
Independent architectural design projects commensurate with student interests requiring approval of Architecture Graduate Committee.

ARCH 698: Graduate Seminar
Cr. R. Repeatable. F.S.
Prereq: Admission to the M. Arch. or M. S. in Arch. programs
Special topics and guest speakers.

ARCH 699: Research
(1-18) Cr. 3-9. Repeatable.
Research.

Art and Design

The Bachelor of Arts in Art and Design is a four-year degree program with two options: *Art and Culture* or *Visual Culture Studies*. Both options require students to complement their art coursework with study in an area outside of the College of Design. This can include a second major or minor, or an alternative program of study approved by your academic adviser.

Many students pursue this BA degree in conjunction with a second major or minor such as journalism, advertising, business, history or psychology.

The two Art and Design curricula provide a solid liberal arts educational experience that can be a springboard into a wide array of graduate school and career opportunities, including art criticism, art history, art sales, corporate art collections, gallery/museum studies, and art therapy.

Art and Culture Option

The *Art and Culture* option provides a general studies degree in which students combine art with another area of interest. Students create their own programs of study, which can include another major or minor in a subject taught outside the College of Design. This concentration emphasizes studio components.

Required courses include three (3) art or design history courses (two at the 300/400 level).

Visual Culture Studies Option

For students who are interested in art history, design history, or museum studies, the Visual Culture Studies option allows the student to take a larger number of courses in those topics. Required courses include several art or design history courses at the 300/400 level, which may include a museum or gallery internship.

This curriculum offers two concentrations: Art and Culture and Visual Culture Studies. Both concentrations are combined with an applied career minor or approved program of study.

Art and Culture Concentration

The curriculum in Art and Design, Art and Culture Concentration leads to a 120.5 credit undergraduate Bachelor of Arts degree

Total Degree Requirements: 120.5 cr.
Only 65 cr. from a two-year institution can apply, and may include up to 16 technical cr; 9 P-NP cr. of free electives; 2.00 minimum GPA

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communication: 10 cr.
(C or better grade)

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
One course from the following:		3
COMST 101	Introduction to Communication Studies	
COMST 102	Introduction to Interpersonal Communication	
CMDIS 286	Communicating with the Deaf	
SP CM 110	Listening	
SP CM 212	Fundamentals of Public Speaking	
Total Credits		10

Humanities: 6 cr.
6 cr. from department curriculum sheet.

Social Sciences: 6 cr.
6 cr. from department curriculum sheet

Math/Physics/Biol. Sciences: 6 cr.
6 cr. from department curriculum sheet

General Education Courses: 9 cr.

6 credits of course levels 300-400 from department curriculum sheet.		6
3 credits from department curriculum sheet.		3
Total Credits		9

College of Design Core: 11.5-12 cr.

DSN S 102	Design Studio I	4
DSN S 115	Design Collaborative Seminar	0.5-1
or DSN S 110	Design Exchange Seminar I	
DSN S 131	Design Representation	4
DSN S 183	Design Cultures	3
Total Credits		11.5-12

Art History and Theory: 15 cr.

ART H 280	History of Art I	3
ART H 281	History of Art II	3
Six credits from 300-level or above from ART H		6
Three credits from history courses in ARCH, ART H, DSN S, or LA		3
Total Credits		15

Art and Culture Concentration: 12 cr.
12 credits from 200 level or above in College of Design courses.

Program of Study: 30 cr.
30 cr. from an approved program of study, including 6 cr. at 300-400 level.

Electives: 15 cr.

Visual Culture Studies Concentration

Total Degree Requirements: 119 cr.
Only 65 cr. from a two-year institution can apply and may include up to 16 technical cr; 9 P-NP cr. of free electives; 2.00 minimum GPA

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communication: 10 cr.
(C or better grade)

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
One course from the following:		3
COMST 101	Introduction to Communication Studies	
COMST 102	Introduction to Interpersonal Communication	
CMDIS 286	Communicating with the Deaf	
SP CM 110	Listening	
SP CM 212	Fundamentals of Public Speaking	
Total Credits		10

Humanities: 6 cr.
6 cr. from department curriculum sheet.

Social Sciences: 6 cr.
6 cr. from department curriculum sheet

Math/Physics/Biol. Sciences: 6 cr.
6 cr. from department curriculum sheet

General Education Courses: 9 cr.

6 credits of course levels 300-400 from department curriculum sheet.		6
3 credits from department curriculum sheet.		3
Total Credits		9

Visual Culture Studies Core: 9 cr.

ART H 280	History of Art I	3
ART H 281	History of Art II	3
Choose ONE from the following		
DSN S 183	Design Cultures	3
or ART H 292	Introduction to Visual Culture Studies	
Total Credits		9

Visual Culture Studies Concentration: 28 cr.
24 cr. in History/Theory/Criticism courses from any department in the College of Design. May include up to 9 cr. Museum/Gallery Internship. 12 cr. must be at 300 level or above. 4 cr. ART H 499 Visual Culture Studies Capstone Seminar.

Program of Study: 30 cr.
30 cr. from an approved program of study, including 6 cr. at 300-400 level and 6 cr. foreign language.

Electives: 15 cr.
Art and Design, B.A., Art and Culture Concentration

First Year

Fall	Credits	Spring	Credits
DSN S 102 (or DSN S 131)	4	DSN S 102 (or DSN S 131)	4
DSN S 183 (or General Education)	3	DSN S 183 (or General Education)	3
ENGL 150 (or General Education)	3	ENGL 150 (or General Education)	3
DSN S 110 or DSN S 115	0.5-1	General Education	3
General Education	3	General Education	3
General Education	3	LIB 160	1
	16.5-17		17

Second Year

Fall	Credits	Spring	Credits
Studio Option	3	Studio Option	3
Approved POS	3	Approved POS	3
General Education	3	General Education	3
ART H 280 (fall only)	3	ART H 281 (spring only)	3
ENGL 250 (or General Education)	3	ENGL 250 (or General Education)	3
	15		15

Third Year

Fall	Credits	Spring	Credits
Studio Option	3	Studio Option	3
Approved POS	3	Approved POS	3
Approved POS	3	Approved POS	3
General Education	3	Elective	3
ART H 300-level or above	3	ART H 300-level or above	3
	15		15

Fourth Year

Fall	Credits	Spring	Credits
Approved POS	3	Approved POS	3
Approved POS	3	Approved POS	3
Elective	3	Elective	3
Elective	3	Elective	3
Art or Design History	3		
	15		12

Art and Design, B.A., Visual Culture Studies Concentration

First Year

Fall	Credits	Spring	Credits
ART H 280 (fall only)	3	ART H 281 (spring only)	3
DSN S 183 or ART H 292 (or General Education)	3	DSN S 183 or ART H 292 (or General Education)	3
ENGL 150 (or General Education)	3	ENGL 150 (or General Education)	3
LIB 160	1	General Education	3
General Education	3	General Education	3
General Education	3		
	16		15

Second Year

Fall	Credits	Spring	Credits
Visual Culture Studies Option	3	Visual Culture Studies Option	3
Approved POS	3	Approved POS	3
General Education	3	Approved POS	3
General Education	3	General Education	3
ENGL 250 (or General Education)	3	ENGL 250 (or General Education)	3
	15		15

Third Year

Fall	Credits	Spring	Credits
Visual Culture Studies Option	3	Visual Culture Studies Option	3
Visual Culture Studies Option	3	Visual Culture Studies Option	3
Approved POS	3	Approved POS	3
Approved POS	3	Approve POS	3
Elective	3	Elective	3
	15		15

Fourth Year

Fall	Credits	Spring	Credits
ART H 499 Visual Culture Studies Senior Capstone Seminar	4	Visual Culture Studies Program	3
Approved POS	3	Approved POS	3
Elective	3	Approved POS	3
Elective	3	Elective	3
		Elective	3
	13		15

Biological/Pre-Medical Illustration

The interdepartmental undergraduate BPM I major is designed for students who want to combine their interests and aptitudes in science and art. Based on the theme of "communicating science through art," the major prepares students for careers in biological illustration or for graduate education in medical illustration elsewhere. Graduates enter fields such as biocommunications, environmental display design, free-lance illustration, museum display design, and various careers in the publishing industry.

Entrance into the BPM I program is by application to the BPM I Advisory Committee. Eligibility is based on an academic standard of at least 2.00 CGPA on 30 credits of university level work and a consideration of artistic ability as demonstrated through submission of a portfolio of representative drawings or other art work. Freshman and transfer students usually declare pre-BPM I as their major while satisfying the conditions for entrance into the major, although other majors can be declared.

To earn the B.A. degree offered by the College of Liberal Arts and Sciences, students must complete the general education requirements in that college and take at least 41 credits in design and 32 credits in the biological sciences.

Design courses		29
DSN S 131	Design Representation	
ARTIS 230	Drawing II	
ARTIS 233	Watercolor Painting	
ARTIS 308	Computer Modeling, Rendering and Virtual Photography	
ARTIS 330	Drawing III: Life Drawing	
BPM I 323	Scientific Illustration Principles and Techniques	
BPM I 326	Illustration and Illustration Software	
BPM I 327	Illustration as Communication	
BPM I 337	Application of Scientific Illustration Techniques	
BPM I 497	Illustration Internship	
12 credits chosen from a list of approved upper level courses in art and design		12
Biological Science courses		24
LAS 101	Orientation for Open Option and Preprofessional Students	
BIOL 211	Principles of Biology I	
BIOL 211L	Principles of Biology Laboratory I	
BIOL 212	Principles of Biology II	
BIOL 212L	Principles of Biology Laboratory II	
BIOL 255	Fundamentals of Human Anatomy	
BIOL 256	Fundamentals of Human Physiology	
BIOL 351	Comparative Chordate Anatomy	
One of the following		3
BIOL 356	Dendrology	
BIOL 366	Plant Systematics	
BIOL 454	Plant Anatomy	
9 credits chosen from a list of approved biological science courses		9

Chemistry and Mathematics are also required as supporting courses. Students must earn a grade of C- or better in all art and science courses included in the major and must earn a cumulative GPA of 2.00 in both categories. A brochure is available in 102 Catt Hall that gives a detailed listing of the requirements.

Communication Proficiency Requirement: Students must have credit for ENGL 150; earn a C or better in ENGL 250 or equivalent composition courses; and earn a C or better in one advanced writing course numbered ENGL 302 through ENGL 316.

Students in BPM I must complete a senior project or an internship experience (BPM I 497) in which they design and produce artwork that is suitable for publication or public display.

A minor in biological illustration is offered. A minimum of 17 credits must be taken, including 8 credits in biological science courses and 9 credits in art and design courses.

The biological sciences must include:

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1

The art and design courses must include:

BPM I 323	Scientific Illustration Principles and Techniques	3
BPM I 337	Application of Scientific Illustration Techniques	3
Advanced drawing, illustration, electronic media or painting course		3

For more information, contact the BPM I adviser in 102 Catt Hall or view the website listed above.

Biological/Pre-Medical Illustration, B.A.
120 minimum credits required.

Freshman

Fall	Credits	Spring	Credits
LAS 101	1	LIB 160	1
ENGL 150	3	Humanities	3
CHEM 163	4	BIOL 212	3
CHEM 163L	1	BIOL 212L	1
BIOL 211	3	ARTIS 230	3

BIOL 211L	1	Soc Sci Choice	3
DSN S 131	4	CHEM 231.231L or STAT or MATH	3-4
	17		17-18

Sophomore

Fall	Credits	Spring	Credits	Summer	Credits
Foreign Lang. or Humanities (ART 280)	3-4	For Lang or Social Sci	3-4	Consider study abroad or attending summer GNSI Workshops or a Biological Station to take advanced Biology Courses	
CHEM 231/231L or STAT or MATH	3-4	BPM I 326	3		
BPM I 323	3	ARTIS 330	3		
ENGL 250	3	Humanities	3		
BIOL 255	3	BIOL 256	3		
	15-17		15-16		0

Junior

Fall	Credits	Spring	Credits
BPM I 327	3	BPM I 337	3
Advanced Biology	3-4	BIOL 351	5
ARTIS 308	3	Soc Sci	3
Humanities or Social Sci	3	ARTIS 233	3
Advanced Biology or Art or plant science	3	Humanities and Advanced Art	3
Work with BPMI advisory committee to plan senior project for portfolio			
If planning to attend graduate school, take GRE in Fall and prepare up to 20 portfolio pieces for submission in January			
	15-16		17

Senior

Fall	Credits	Spring	Credits
Advanced Biology	3-5	Advanced Biology	3-4
Advanced Art	3-6	Advanced Art	3-6
Humanities/ Social Elective	3	Humanities/ Social Sci/ Elective	3-6
BPMI 497	1	ENGL 302-316	3
Electives	2		
	12-17		12-19

Courses primarily for undergraduates:

BPM I 323: Scientific Illustration Principles and Techniques
(Cross-listed with ARTIS). (0-6) Cr. 3. Repeatable.
Prereq: 6 credits in art and design and 3 credits in biological sciences
Studio basics and professional techniques in black & white, continuous tone, and color. Emphasis on tools, materials, and rendering.

BPM I 326: Illustration and Illustration Software
(Cross-listed with ARTIS). (0-6) Cr. 3. Repeatable.
Prereq: ARTIS 323
Application of painting, drawing, and image making techniques to communication. Development of technical abilities using illustration software. Digital and print production techniques.

BPM I 327: Illustration as Communication
(Cross-listed with ARTIS). (0-6) Cr. 3.
Prereq: ARTIS 326
Studio problems in illustration emphasizing composition and communication. Problem solving methodologies.

BPM I 337: Application of Scientific Illustration Techniques
(Cross-listed with ARTIS). (0-6) Cr. 3. Repeatable, maximum of 6 credits. S.
Prereq: ARTIS 327
Rendering techniques applied to different types of biological and scientific subjects emphasizing communication. The use of traditional and digital media. Term project required.

BPM I 395: Field Illustration
Cr. 1-3. Repeatable, maximum of 6 credits. S.SS.
Prereq: Permission of instructor
A combination seminar and field trip course emphasizing nature interpretation, field sketching techniques and preparation of a final illustration based on field experience.

BPM I 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the program cooperative education coordinator, junior classification
Required of all cooperative education students. Students must register for these courses prior to commencing each work period.

BPM I 435I: Illustrating Nature I Sketching
(Cross-listed with IA LL). Cr. 2. SS.
Sketching plants, animals and terrain. Visual communication, development of a personal style, and integration of typographic and visual elements on a page will be emphasized.

BPM I 436I: Illustrating Nature II Photography
(Cross-listed with IA LL). Cr. 2. SS.
Beginning to intermediate technical and compositional aspects of color photography of natural areas and their plants and animals.

BPM I 490: Independent Study
Cr. 1-3. Repeatable, maximum of 3 credits.
Prereq: Written approval of instructor and advisory committee chair on required form in advance of semester of enrollment

BPM I 494: Special Topics in Illustration
Cr. 1-3. Repeatable.
Intensive exploration of illustration techniques in a studio or field setting.

BPM I 497: Illustration Internship
Cr. 1-6. Repeatable, maximum of 6 credits.
Prereq: Junior or senior classification in BPM I, written approval of supervising instructor and advisory committee chair on required form in advance of semester of enrollment
Offered on a satisfactory-fail basis only.

Community and Regional Planning

www.design.iastate.edu/communityplanning (http://www.design.iastate.edu/communityplanning)

Community and regional planning is a field of study aimed at understanding the ever-changing socioeconomic and physical environments of our communities and planning for their future. Planners evaluate and seize opportunities to solve problems. Planners work at multiple levels, and they are concerned with issues that affect every corner of the world: the preservation and enhancement of the quality of life in a community, the protection of the environment, the promotion of equitable economic opportunity; and the management of growth and change of all kinds.

Graduates of the Community and Regional Planning department are able to integrate planning knowledge and skills in a variety of practical applications, and can communicate effectively in written and oral form. Graduates will be qualified for a variety of entry-level positions. They will also be well prepared for graduate study in a variety of fields, including law, public policy, public health, environmental science, geography, sociology, urban design, and architecture.

Graduates of the Community and Regional Planning Department are expected to understand the structure and functions of urban settlements, including the history of planning and urban development and the processes for plan and policy making. Graduates should have skills in problem formulation, quantitative analysis, written/oral and graphic communications, collaboration, and in synthesizing and applying knowledge to practice. Graduates are expected to be able to assess the impact of plans and alternatives based on equity and social justice, economic welfare and efficiency, environmental sustainability, and cultural heritage in the context of citizen involvement in decision making.

The curriculum is accredited by the Planning Accreditation Board of the American Institute of Certified Planners and the Association of Collegiate Schools of Planning. Our students gain an education that, when combined with experience, supports eligibility for membership in the American Institute of Certified Planners.

The department administers two undergraduate minors, Urban Studies and Geographic Information Systems (GIS). The department cooperates in the undergraduate minors in Design Studies, Digital Media, Critical Studies in Design, Environmental Studies, and Sustainability.

Curriculum in Community and Regional Planning

The Department of Community and Regional Planning administers the 128 hour credit undergraduate program leading to the Bachelor of Science. Students have the opportunity to work with their faculty advisers to define their own areas of interest, which may include a minor.

The Community and Regional Planning Program can be completed in two to four years. Students may apply for admission to the program at any time during their enrollment at Iowa State University. If applying by transfer from another program or institution, admission is based on the student's cumulative GPA and a departmental review of course work. Transfer applications from students in programs in sociology, political science, history, geography, engineering, and other related disciplines are encouraged. Community and Regional Planning emphasizes responsibility and citizenship, writing and analytical ability, and critical thinking.

Total Degree Requirement: 128 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA average; Completion of all requirements listed below.

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communication: 13 cr.
(C or better grade)

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGL 309	Proposal and Report Writing	3
or ENGL 314	Technical Communication	
SP CM 212	Fundamentals of Public Speaking	3
LIB 160	Information Literacy	1
Total Credits		13

Humanities: 9 cr., 6 cr. 300 level or above

PHIL 201	Introduction to Philosophy	3
or PHIL 206	Introduction to Logic and Scientific Reasoning	
or PHIL 230	Moral Theory and Practice	
Six credits from program curriculum sheet		6
Total Credits		9

Social Sciences: 18 cr. 300 level or above

ECON 101	Principles of Microeconomics	3
or ECON 102	Principles of Macroeconomics	
POL S 215	Introduction to American Government	3
SOC 134	Introduction to Sociology	3
Nine credits from program curriculum sheet.		9
Total Credits		18

Math/Physics/Biol. Sciences: 13 cr.
STAT 101 Principles of Statistics, 6 cr. in Natural Sciences, 3 cr. in Math.

Design Core: 3 cr.

DSN S 102	Design Studio I	3-4
or DSN S 183	Design Cultures	
Total Credits		3-4

Community and Regional Planning Core: 24 cr.

C R P 201	The North American Metropolis	3
C R P 293	Environmental Planning	3
C R P 301	Planning Methods Studio	4
C R P 383	Theory of the Planning Process	3
C R P 391	Field Travel	1
C R P 432	Community Planning Studio	4-6
C R P 492	Planning Law, Administration and Implementation	3
C R P 331	Professional Practice Seminar	2
Total Credits		23-25

Planning Elective: 24 cr.
24 cr. from:

C R P 416	Urban Design and Practice	6
C R P 417	Urban Revitalization	3
C R P 429	Planning in Developing Countries	3
C R P 435	Planning in Small Towns	3
C R P 445	Transportation Policy and Planning	3
C R P 451	Introduction to Geographic Information Systems	3
C R P 484	Sustainable Communities	3
C R P 491	Environmental Law and Planning	3
C R P 494	Senior Seminar in Planning	3

General Electives: 24 cr.
Twenty-four credits of general electives from program curriculum sheet

Undergraduate Minors

The department of Community and Regional Planning offers 15-credit minors in Urban Studies and Geographic Information Systems (GIS).

The Urban Studies minor is earned by completing both CRP 201 (The North American Metropolis) and CRP 291 (World Cities and Globalization), plus 9 additional credit hours from the approved list of courses. At least 6 credit hours must be in courses numbered 300

or above at Iowa State. The College of Design requires students to earn a C or higher in at least 6 of the required 300-level credits. The minor must include at least nine credits that are not used to meet any other department, college or university requirement except the credit requirement for graduation. The Urban Studies minor is open to students from any college and any major.

Introduction to Urban Studies: 6 cr.

C R P 201	The North American Metropolis	3
C R P 291	World Cities and Globalization	3

Advanced Urban Studies: 9 cr.

C R P 293	Environmental Planning	3
C R P 301	Planning Methods Studio	4
C R P 320	Urban Geography	3
C R P 383	Theory of the Planning Process	3
C R P/ECON 376	Rural, Urban and Regional Economics	3
C R P 391	Field Travel	1-2
C R P 417	Urban Revitalization	3
C R P 427X	Comparative Urbanism	3
C R P 429	Planning in Developing Countries	3
C R P 451	Introduction to Geographic Information Systems	3
C R P 457X	GeoGames and Civic Engagement	3
C R P 460	Social Justice	3
C R P 471X	Real Estate Development	3
C R P 484	Sustainable Communities	3
C R P 492	Planning Law, Administration and Implementation	3
C R P/ARCH 519	Middle Eastern Cities	3
C R P 521X	Introduction to Historic Preservation Planning: Theory and Practice	3
C R P/ARCH 573X	Contemporary Issues in Global Housing	3
POL S 310	State and Local Government	3
POL S 311	Municipal Government and Polics	3
POL S 334	Politics and Society	3
POL S 371	Public Organizations and Leadership	3
POL S 480	Ethics and Public Policy	3
ARCH 221	History of Architecture I	3
ARCH 222	History of Architecture II	3
ARCH 321	History of the American City	3
ARCH 420	Topics in American Architecture	3
ARCH 429	Topics in Italian Architecture and Urbanism	3
ARCH 575	Contemporary Urban Design Theory	3
SOC 310	Community	3
SOC 331	Social Class and Inequality	3
SOC 332	The Latino/Latina Experience in U.S. Society	3
SOC 360	Globalization and Development	3
SOC 435	Urban Sociology	3
ANTHR 418	Global Culture, Consumption and Modernity	3
HIST 429	"Monstrous London": London's Histories 1500-1800	3-4
HIST 465	The American West	3
CL ST 275	The Ancient City	3
L A 274	The Social and Behavioral Landscape	3
L A 371	History of Modern Landscapes, 1750 to Present	3
L A 373	Gardens and Landscapes from Antiquity to 1750	3
C E 451	Urban Transportation Planning Models	3
URB D 521	Foundations of Urban Design	3
URB D 522	Contemporary Urban Design Practices	3

The Geographic Information Systems (GIS) minor is earned by taking CRP 251 and CRP 351, plus 9 additional credit from the approved list of courses. At least 6 credit hours must be in courses numbered 300 or above at Iowa State. The College of Design requires students to earn a C or higher in at least 6 of the required 300-level credits. The minor must include at least nine credits that are not used to meet any other department, college or university requirement except the credit requirement for graduation. The GIS minor is open to students in any college and any major.

Foundation of GIS: 6 cr.

C R P 251X	Introduction to Geographic Inofmration Systems	3
C R P 351X	Intermediate Geographic Inofmration Systems	3

GIS Tools and Techniques: 9 cr.

C R P 452	Geographic Data Management and Planning Analysis	3
C R P 454	Fundamentals of Remote Sensing	3
C R P 456	GIS Programming and Automation	3
C R P 457X	GeoGames for Civic Engagement	3
C R P 458	Web Mapping/GIS	3
NREM 345	Natural Resource Photogrammetry and Geographic Information Systems	3
NREM 546	Integrating GPS and GIS for Natural Resource Management	3
GEOL 452	GIS for Geoscientists	3
GEOL 488	GIS for Geoscientists II	3

Community and Regional Planning. B.S.

First Year

Fall	Credits	Spring	Credits
DSN S 102 or DSN S 183		3 Math/Science	3

ENGL 150	3	SP CM 212	3
ECON 101 or ECON 102	3	PHIL 201, 206, or 230	3
SOC 134	3	Natural Sciences	3
Elective	3	Elective	3
LIB 160	1		
	16		15

Second Year

Fall	Credits	Spring	Credits
C R P 201	3	C R P 293	3
STAT 101	4	C R P 301	4
ENGL 250	3	C R P 391	1
POL S 215	3	Soc. Science/Humanities Electives	6
Humanities Elective	3	Elective	3
	16		17

Third Year

Fall	Credits	Spring	Credits
C R P 492	3	Planning Electives	6
C R P 383	3	Elective	3
ENGL 309 or ENGL 314	3	Social Science/Humanities Electives	3
Social Science/Humanities Elective	3	Elective	3
Elective	3		
	15		15

Fourth Year

Fall	Credits	Spring	Credits
C R P 432	4-6	Planning Elective or Option Studio	6
C R P 331	2	Planning Elective	3
Planning Elective	3	Planning Elective	3
300-400 Elective	3	Planning Elective	3
300-400 Elective	3	300-400 Elective	3
	15-17		18

Graduate Study

The Department offers the Master of Community and Regional Planning degree with areas of concentration in land use and transportation, community design and development, and rural and environmental planning. Students may design their own area of concentration with the assistance of their major professor. The primary focus of the M.C.R.P. degree is to prepare students with the education and practical skills to be leaders in the practice of planning. The program of graduate study is accredited by the Planning Accreditation Board of the American Institute of Certified Planners and the Association of Collegiate Schools of Planning.

Degree requirements include completion of a 2-year, 48-credit program, including a required core (21 credits), electives (21-23 credits) and one of the following: capstone studio (4 credits), professional report (4 credits), or thesis (6 credits). The required core consists of C R P 532, 561, 563, 564, 566, 568 and 592. Students select electives in consultation with their Program of Study (POS) committee.

C R P 532	Community Planning Studio	4
C R P 561	Planning Theory for Practice	3
C R P 564	Introduction to Analytical Methods for Planning	3
C R P 566	Policy Analysis and Planning	3
C R P 568	Planning and Development	3
C R P 592	Land Use and Development Regulation Law	3

Admission to the M.C.R.P. program is by application to the department and to the Graduate College. Students with a Bachelors degree in planning or students who have taken highly relevant coursework may be able to waive up to 9 credits of course requirements. Students must petition the department's Director of Graduate Education (DOGE) in writing prior to the first day class of the student's first semester in the program to have credits waived. Students are encouraged to complete an internship in a planning office. No foreign language is required for the degree master of community and regional planning.

Double degree programs are offered with architecture (M.C.R.P/M.Arch.), business administration (M.C.R.P./M.B.A.), landscape architecture (M.C.R.P./M.L.A.) and sustainable agriculture (M.C.R.P/M.S.). The department also participates in the interdepartmental major in transportation (see Transportation). Information about our programs and how to apply can be obtained from the department's web page at: www.design.iastate.edu/communityplanning (http://www.design.iastate.edu/CRP), or send an email to crp@iastate.edu.

The department also offers a 13-credit graduate certificate in Geographic Information Systems (GIS) in spatial analysis, GIS applications and program management. The program is open to graduate students in all disciplines of the University. Information about the graduate certificate may be obtained from the department office and from the department's web page at: www.design.iastate.edu (http://www.design.iastate.edu).

CRP currently offers several courses via distance learning to graduates and planning professionals interested in expanding their knowledge of planning. Further details of current distance course offerings may be found on the CRP website and on the ISU Continuing Education website. For more information, send an e-mail to crp@iastate.edu

Courses primarily for undergraduates:

C R P 201: The North American Metropolis
(3-0) Cr. 3. F.S.
Examination of the evolution of American urban centers from the colonial era to the present. Considers the demographic changes and social movements underway in urban America and explores how an understanding of the history of cities provides us with knowledge that we can use to improve our cities today.
Meets U.S. Diversity Requirement

C R P 291: World Cities and Globalization
(3-0) Cr. 3. F.S.
World cities and globalization in developed and developing countries. Topics include globalization, world cities and regions, uneven economic development, the international division of labor, multinational corporations, international environmentalism, tourism, popular culture and place- based identity.
Meets International Perspectives Requirement.

C R P 293: Environmental Planning
(Cross-listed with ENV S). (3-0) Cr. 3. F.S.
Comprehensive overview of the field of environmental relationships and the efforts being made to organize, control, and coordinate environmental, aesthetic, and cultural characteristics of land, air, and water.

C R P 301: Planning Methods Studio
(3-2) Cr. 4. S.
An introduction to the methods and analytical techniques used by planners to study community change. Course includes identification of key sources of planning information and data. Students learn to use quantitative methods for analysis of population, land use, economic and transportation data. Students learn to apply basic analytic methods to community problems and learn the art of effective written, graphic, and oral presentation of data.

C R P 320: Urban Geography
(3-0) Cr. 3. F.S.
An introduction to urban geography. Study of urban centers, including people and infrastructure. Investigation of the origin and evolution of urban areas and the processes that shape urban change. Topics include urban form, and the social, economic, political, cultural, and institutional factors that shape cities.

C R P 330: Practicum
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Major in community and regional planning
Structured work experience under close supervision of a professional planner. Practical planning experience; relationships between theory and practice, professional responsibilities, and the scope of various planning roles.

C R P 331: Professional Practice Seminar
(2-0) Cr. 2. F.
Prereq: CRP 301 and junior classification
Preparation for working as a planning professional; development of resume and portfolio; discussion of professional ethics and expectations of employers and clients; presentations from planning professionals, and discussion of the range of career choices within the planning profession.

C R P 376: Rural, Urban and Regional Economics
(Cross-listed with ECON). (3-0) Cr. 3.
Prereq: ECON 101
Firm location with respect to regional resources, transport, scale economies, externalities, and policies. Measures of local comparative advantage and specialization. Spatial markets. Population location considering jobs, wages, commuting, and local amenities. Business, residential, and farm land use and value. Migration. Other topics may include market failure, regulation, the product cycle, theories of rural and urban development, developmental policy, firm recruiting, local public goods and public finance, schools, poverty, segregation, and crime.

C R P 383: Theory of the Planning Process
(3-0) Cr. 3. F.
Prereq: Junior classification
The nature of planning and its relation to social and economic planning; levels of planning, place of planning in decision making; steps in the planning process, uses and limitation of knowledge in planning, relation of facts and values.

C R P 391: Field Travel
Cr. 1-2. Repeatable. F.S.
Prereq: CRP major and permission of instructor
Observation of professional practice and community or regional problems and issues. Offered on a satisfactory-fail basis only.

C R P 410: Professional Work Experience
Cr. R. F.S.SS.
Prereq: Permission of department chair
Approved professional work experience.

C R P 416: Urban Design and Practice
(Dual-listed with C R P 516). (3-6) Cr. 6. S.
Prereq: C R P 201
Principles of urban design and their application to residential and commercial development in studio projects.

C R P 417: Urban Revitalization
(Dual-listed with C R P 517). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Junior classification
Planning methods available to further revitalization and preservation efforts, with particular attention to housing and neighborhoods. Relationship between neighborhood change and urban development process; public policy implications.

C R P 429: Planning in Developing Countries
(Dual-listed with C R P 529). (3-0) Cr. 3. F.S.
Introduction to issues in planning and governance in an international setting. Problems and strategies may include population movement and change, economic globalization, urban growth, rural development, and housing.

C R P 432: Community Planning Studio
(1-6) Cr. 4-6. F.S.
Prereq: C R P 201, C R P 301, or permission of instructor.
Integration of planning methods and theory in dealing with a community planning problem. Analysis of problem and formulation of strategies for implementation. Preparation of a community planning report.

C R P 435: Planning in Small Towns
(Dual-listed with C R P 535). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: C R P 201 or Junior classification
Contemporary planning problems in small towns and the design of viable strategies to enhance their social and economic position in today's society.

C R P 436: Community Economic Development
(Dual-listed with C R P 536). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
The nature and process of economic development in the context of community development. Recent changes and trends and their implications for local and regional development. Selected case studies and applications. Contemporary community economic development issues.

C R P 442: Site Development
(Dual-listed with C R P 542). (3-0) Cr. 3. S.
Introduction to site development including site review. Studio project integrating concept, finance, selection, analysis, and design.

C R P 445: Transportation Policy and Planning
(Dual-listed with C R P 545). (3-0) Cr. 3. F.
Prereq: C E 350 or equivalent. Note: CRP 545 prerequisite: Graduate Classification
Comprehensive overview of key policy issues related to transportation planning and investment in the United States and abroad. Policy issues explored include safety, environmental impact, sustainable communities, and economic development. Policy analysis and planning are studied in conjunction with each policy issue explored. Issues of concern to state, metropolitan, and local governments.

C R P 451: Introduction to Geographic Information Systems
(2-2) Cr. 3. F.S.SS.
Introduction to geographic information systems, including discussions of GIS hardware, software, data structures, data acquisition, data conversion, data presentation, analytical techniques, and implementation procedures. Laboratory emphasizes practical applications and uses of GIS.

C R P 452: Geographic Data Management and Planning Analysis
(Dual-listed with C R P 552). (2-2) Cr. 3. F.S.
Prereq: C R P 451 or equivalent
Extensive coverage of geo-relational database concept and design, GIS database creation and maintenance, geographic data manipulation and analysis. GIS output generation and geographic data presentation. Laboratory emphasizes practical applications and uses of GIS.

C R P 454: Fundamentals of Remote Sensing
(Cross-listed with L A). (3-0) Cr. 3. F.
Introduction to remote sensing techniques needed for basic analysis of satellite images, including: filtering and conflation techniques, stacking, pan sharpening, image rectification, image enhancement, unsupervised and supervised classification. Practical applications in a variety of topics to understand how to interpret images.

C R P 456: GIS Programming and Automation
(Dual-listed with C R P 556). (2-2) Cr. 3. F.
Prereq: one of the following: CRP 451, CRP 551, NREM 345, NREM 546, GEOL 552
Introduction to automated geoprocessing in Geographic Information Systems. Focus on learning scripting language and object-oriented programming, automation of custom-designed geoprocessing scripts, and application toward student research and/or interests.

C R P 458: Web Mapping/GIS
(Dual-listed with C R P 558). (Cross-listed with L A). (2-2) Cr. 3.
Prereq: CRP 451/551, LA 302. GEOL 452/552 or instructor permission.
Use and development of online mapping tools to support participatory GIS, Volunteered Geographic Information, information sharing, geodesign and decision making actions. Geoprocessing and Web Scripting/coding and user interface design. Laboratory emphasis practical applications and uses of Web GIS.

C R P 459: Digital Design Methods for Landscape Architecture
(Dual-listed with C R P 559). (Cross-listed with L A). (3-0) Cr. 3. S.
Introduction to digital tools used by landscape architects for design communication, visualization, and design development. Include 2D drafting, 3D modeling, image CAD, geospatial data handling (GIS), and animation. Emphasis on concepts and workflow interoperability.

C R P 460: Social Justice and Planning
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Investigation of the topic of social justice as it relates to the challenge of planning more socially just urban societies, emphasizing the importance of social justice issues to planning in a globalized world. Includes a range of issues and case studies of local social justice initiatives, both US and global. Students will complete individual service learning projects as part of the course requirement.

C R P 475: Grant Writing
(Dual-listed with C R P 575). (1-0) Cr. 1. F.
A short introduction to effective grant writing for the public and non-profit sectors. Includes identifying appropriate funding sources for an organization, identifying goals and objectives, and budgeting.

C R P 479: Public Finance and Planning
(Dual-listed with C R P 579). (3-0) Cr. 3. S.
Effective management of state and local government finance critical to successful community and regional planning. Economic concepts, topics in budgeting, revenue, expenditure, and financing, analytical techniques, economic impact, and case studies. Understanding of economic assessment in planning and understanding of various linkages between planning and public finance.

C R P 484: Sustainable Communities
(Dual-listed with C R P 584). (Cross-listed with ENV S). (3-0) Cr. 3. S.
Prereq: Junior classification
The history and theory of sustainable community planning. Procedural and substantive dimensions. Case studies of communities engaged in sustainability planning. Use and development of indicators.

C R P 490: Independent Study
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of an approved topic commensurate with student's interest and ability. Offered on a satisfactory-fail basis only.

C R P 490H: Independent Study: Honors
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of an approved topic commensurate with student's interest and ability. Offered on a satisfactory-fail basis only.

C R P 491: Environmental Law and Planning
(Dual-listed with C R P 591). (Cross-listed with ENV S, L A). (3-0) Cr. 3. S.
Prereq: 6 credits in natural sciences
Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs.

C R P 492: Planning Law, Administration and Implementation
(3-0) Cr. 3. F.
Prereq: C R P 383
The basis in constitutional, common, and statutory law for the powers of plan implementation. Problems of balancing public and private interests as revealed in the study of leading court cases. Administration of planning agencies and programs.

C R P 494: Senior Seminar in Planning
Cr. 1-3. Repeatable, maximum of 2 times. F.S.
Prereq: Senior classification
An advanced forum for seniors that focuses upon recent trends and important issues affecting planning today. Topics addressed will vary. A demonstration of understanding of current issues and their effects upon planning applications is expected.

Courses primarily for graduate students, open to qualified undergraduates:

C R P 510: Professional Work Experience
Cr. R. F.S.SS.
Prereq: Permission of department chair
Approved professional work experience.

C R P 516: Urban Design and Practice
(Dual-listed with C R P 416). (3-6) Cr. 6. S.
Prereq: C R P 201
Principles of urban design and their application to residential and commercial development in studio projects.

C R P 517: Urban Revitalization
(Dual-listed with C R P 417). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Junior classification
Planning methods available to further revitalization and preservation efforts, with particular attention to housing and neighborhoods. Relationship between neighborhood change and urban development process; public policy implications.

C R P 519: Middle Eastern Cities
(Cross-listed with ARCH). (3-0) Cr. 3.
Prereq: Graduate or Senior classification
Introduction to basic academic writings on Middle Eastern cities in addition to other contemporary cultural productions of the region. Study of various aspects of Middle Eastern life and the built environments that this life produces.
Meets International Perspectives Requirement.

C R P 529: Planning in Developing Countries
(Dual-listed with C R P 429). (3-0) Cr. 3. F.S.
Introduction to issues in planning and governance in an international setting. Problems and strategies may include population movement and change, economic globalization, urban growth, rural development, and housing.

C R P 530: Practicum
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification in Community and Regional Planning
Practical planning experience. Structured work in range of tasks under close supervision of a professional planner. Relationships between theory and practice, exposure to variety of roles in functioning specialties. Offered on a satisfactory-fail basis only.

C R P 532: Community Planning Studio
(1-6) Cr. 4. F.
Prereq: C R P 564 or equivalent
Comprehension and analysis of various geographic contexts pertinent to community planning and the use of planning theory, tools and techniques in an applied setting. Process of making a community plan: historical patterns, current conditions and strategies for planning.

C R P 535: Planning in Small Towns
(Dual-listed with C R P 435). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: C R P 201 or Junior classification
Contemporary planning problems in small towns and the design of viable strategies to enhance their social and economic position in today's society.

C R P 536: Community Economic Development
(Dual-listed with C R P 436). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
The nature and process of economic development in the context of community development. Recent changes and trends and their implications for local and regional development. Selected case studies and applications. Contemporary community economic development issues.

C R P 542: Site Development
(Dual-listed with C R P 442). (3-0) Cr. 3. S.
Introduction to site development including site review. Studio project integrating concept, finance, selection, analysis, and design.

C R P 545: Transportation Policy and Planning
(Dual-listed with C R P 445). (3-0) Cr. 3. F.
Prereq: C E 350 or equivalent. Note: CRP 545 prerequisite: Graduate Classification
Comprehensive overview of key policy issues related to transportation planning and investment in the United States and abroad. Policy issues explored include safety, environmental impact, sustainable communities, and economic development. Policy analysis and planning are studied in conjunction with each policy issue explored. Issues of concern to state, metropolitan, and local governments.

C R P 551: Introduction to Geographic Information Systems
(2-2) Cr. 3. F.S.SS.
Introduction to geographic information systems, including discussions of GIS hardware, software, data structures, data acquisition, data conversion, data presentation, analytical techniques, and implementation procedures. Laboratory emphasizes practical applications and uses of GIS.

C R P 552: Geographic Data Management and Planning Analysis
(Dual-listed with C R P 452). (2-2) Cr. 3. F.S.
Prereq: C R P 451 or equivalent
Extensive coverage of geo-relational database concept and design, GIS database creation and maintenance, geographic data manipulation and analysis. GIS output generation and geographic data presentation. Laboratory emphasizes practical applications and uses of GIS.

C R P 553: Analytical Planning/GIS
(2-2) Cr. 3. F.
Prereq: C R P 451/C R P 551
Integration of exploratory, participatory and predictive spatial analyses and 3D visualization into the planning process. GIS tools and techniques are used to automate decision analysis and facilitate future planning in analyzing and visualizing planning actions. Laboratory emphasizes practical uses of GIS tools and techniques.

C R P 556: GIS Programming and Automation
(Dual-listed with C R P 456). (2-2) Cr. 3. F.
Prereq: one of the following: CRP 451, CRP 551, NREM 345, NREM 546, GEOL 552
Introduction to automated geoprocessing in Geographic Information Systems. Focus on learning scripting language and object-oriented programming, automation of custom-designed geoprocessing scripts, and application toward student research and/or interests.

C R P 558: Web Mapping/GIS
(Dual-listed with C R P 458). (Cross-listed with L A). (2-2) Cr. 3.
Prereq: CRP 451/551, LA 302. GEOL 452/552 or instructor permission.
Use and development of online mapping tools to support participatory GIS, Volunteered Geographic Information, information sharing, geodesign and decision making actions. Geoprocessing and Web Scripting/coding and user interface design. Laboratory emphasis practical applications and uses of Web GIS.

C R P 559: Digital Design Methods for Landscape Architecture
(Dual-listed with C R P 459). (Cross-listed with L A). (3-0) Cr. 3. S.
Introduction to digital tools used by landscape architects for design communication, visualization, and design development. Include 2D drafting, 3D modeling, image CAD, geospatial data handling (GIS), and animation. Emphasis on concepts and workflow interoperability.

C R P 561: Planning Theory for Practice
(3-0) Cr. 3. S.
Use and development of theory/action relationship in planning practice. Competing normative theories of planning and their evolution, key components and fundamental critiques. Exploration of planning frameworks and approaches, including comprehensive planning; incrementalism; advocacy; communicative rationality; and others.

C R P 563: Planning the American Metropolis
(3-0) Cr. 3. F.
Focus on the historical role of planning in the shaping of American cities and regions, from the beginning of the Republic to the present. Examine the legacy of planning by exploring the intersection of design, politics and policy. Investigate the factors and the processes that produce the built environment.

C R P 564: Introduction to Analytical Methods for Planning
(3-0) Cr. 3. F.
Applications of analytical methods in planning with emphasis on the collection, description, analysis, presentation, and interpretation of planning data. Introduction to descriptive statistics. Sources of planning information and data including primary and secondary data types and sources. Demographic analysis, population projection techniques for planning at local and regional levels.

C R P 566: Policy Analysis and Planning
(3-0) Cr. 3. F.
Principles and methods for analyzing community problems and policies including forecasting, efficiency and equity measures, cost/benefit, political feasibility, and sensitivity analysis. Examination of social, political, economic, and environmental values and their manifestation in decision making methods used in planning. Application of tools used to analyze planning problems, project evaluation and public policies.

C R P 568: Planning and Development
(3-0) Cr. 3. S.
Prereq: C R P 564 or equivalent
Exploration and evaluation of the techniques, processes, and professional skills required to effectively manage land use change at various scales. Land classification systems; land supply and needs inventory for residential uses and commercial and employment centers; capacity and needs analysis for public infrastructure. Includes land use planning project(s) designed to apply the methods explored in this and other courses.

C R P 575: Grant Writing
(Dual-listed with C R P 475). (1-0) Cr. 1. F.
A short introduction to effective grant writing for the public and non-profit sectors. Includes identifying appropriate funding sources for an organization, identifying goals and objectives, and budgeting.

C R P 579: Public Finance and Planning
(Dual-listed with C R P 479). (3-0) Cr. 3. S.
Effective management of state and local government finance critical to successful community and regional planning. Economic concepts, topics in budgeting, revenue, expenditure, and financing, analytical techniques, economic impact, and case studies. Understanding of economic assessment in planning and understanding of various linkages between planning and public finance.

C R P 584: Sustainable Communities
(Dual-listed with C R P 484). (3-0) Cr. 3. S.
Prereq: Junior classification
The history and theory of sustainable community planning. Procedural and substantive dimensions. Case studies of communities engaged in sustainability planning. Use and development of indicators.

C R P 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590A: Special Topics: Planning Law, Administration and Implementation
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590B: Special Topics: Economic Development
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590C: Special Topics: Urban Design
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590D: Special Topics: Housing and Urban Revitalization
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590H: Special Topics: Environmental Planning
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590I: Special Topics: Land Use and Transportation Planning
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590N: Special Topics: International Planning
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590O: Special Topics: Spatial Analytical Methods
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590P: Special Topics: Planning in Small Towns
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590Q: Special Topics: Diversity and Equity in Planning
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 590R: Special Topics: Geographic Information Systems
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and written approval of instructor and department chair on required form

C R P 591: Environmental Law and Planning
(Dual-listed with C R P 491). (Cross-listed with L A). (3-0) Cr. 3. S.
Prereq: 6 credits in natural sciences
Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs.

C R P 592: Land Use and Development Regulation Law
(3-0) Cr. 3. F.
An in-depth analysis of the legal constructs that shape the practice of planning and plan implementation in the United States. An exploration of how land use regulations are applied to reconcile the competing needs and diverse uses of land. The positive and negative consequences of developing and implementing regulatory controls will be addressed.

C R P 595: Seminar in GIS Applications/Research
(1-0) Cr. 1. F.S.
Prereq: 9 credits in GIS Certificate program
Discussion and demonstration of current GIS applications and research in multiple disciplines. Offered on a satisfactory-fail basis only.

C R P 599: Professional Planning Report
Cr. arr. Repeatable.
Independent planning project with practical application, including research element.

Courses for graduate students:

C R P 698: Capstone Studio
(1-6) Cr. 4. S.
Prereq: Permission of instructor.
Synthesis and integration of core planning knowledge into professional work in a team setting.

C R P 699: Research
Cr. arr. Repeatable.

Interdisciplinary Design

The Bachelor of Arts in Interdisciplinary Design is a 122.5 credit non-professional undergraduate degree program that combines design studios and the liberal arts in a four-year curriculum focused on educating students to use design and critical thinking skills to generate ideas, solve complex problems and be creative and innovative makers. focused on the interdisciplinary nature of design and the power of the design studio as a place and method for generating ideas and solving

problems. The core of the degree program is a series of forums seminars, workshops, and studios intended to connect history, theory and practice, and give students hands-on experience grappling with design challenges that vary in complexity and scale. Thematic course modules are taught by faculty from multiple design disciplines. Seniors complete a capstone project and a portfolio course in preparation for graduate school or the job market. The program works well with a second major or a minor, can be completed on a part-time schedule, and is transfer-friendly.

The curriculum developed out of a shared philosophy across the college's disciplines that designers have the capacity to generate ideas and think creativelystrategically about society's increasing economic, social and environmental challenges. Innovation and entrepreneurship are encouraged and valued. Our graduates pursue a wide range of professional career paths in design practice, digital media and entrepreneurship. Upon completion, students may enter graduate programs in the design professions or other fields in which design thinking, skills in making, and critical analysis are valued.

Curriculum for Bachelor of Arts in interdisciplinary design

Total Degree Requirement: 122.5 cr.

Only 65cr. from a two-year institution may apply which may include up to 6 cr. in Design History/Theory/Criticism and 6 cr. in Design Skills credit; 16 technical cr.; 21 P-NP cr. of free electives; 2.00 minimum GPA average; completion of all requirements listed below.

International Perspective: 3 cr.

U.S. Diversity: 3 cr.

Communications: 10 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
3 credits selected from:		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
Total Credits		10

***Mathematics/Physical Sciences/Biological Sciences: 9 cr.**

9 cr. from approved list

***Social Sciences: 9 cr.**

9 cr. from approved list

***Humanities: 9 cr.**

9 cr. from approved list

*At least 3 credits in Mathematics/Physical Sciences/Biological Sciences, Social Sciences, or Humanities must be above 300-level.

Design Core Program: 11.5 cr.

DSN S 102	Design Studio I	4
DSN S 115	Design Collaborative Seminar	0.5
or DSN S 110	Design Exchange Seminar I	
DSN S 131	Design Representation	4
DSN S 183	Design Cultures	3
Total Credits		11.5

BDes Concentration: 32 cr.

DES 230	Design Thinking	3
4- 6 credits:		4-6
DES 240	Design Studio I (**)	
6 credits:		6
DES 250	Design Forum (*)	
DES 330	Visual Literacy for Design Critique	3
6-8 credits:		6-8
DES 340	Design Studio II (**)	
DES 491	Portfolio and Professional Preparation	4
DES 495	Capstone Experience	4
*2 cr. of DES 250 can be substituted with approved equivalent.		
**Studio distribution as follows: 4-6 cr. DES 240 and 6-8 cr. DES 340 for 12 total credits.		
Total Credits		32

Design Skills: 12 cr.

DSN S 232	Digital Design Communications	3
Select 9 credits from approved list		9
Total Credits		12

Design History/Theory/Criticism: 9 cr.

9 cr. selected from approved list.

Minor and/or Electives: 21 cr.

Interdisciplinary Design, B.A.

First Year

Fall	Credits	Spring	Credits
DSN S 102 or 131	4	DSN S 131 or 102	4

DSN S 115 or 110	0.5-1	DSN S 183	3
DSN S 183	3	or Minor/Elective	
or Minor/Elective		ENGL 150	3
ENGL 150	3	or General Education	
or General Education		General Education	6
General Education	3		
LIB 160	1		
	14.5-15		16

Second Year

Fall	Credits	Spring	Credits
DES 230	3	DES 240	2
DES 240	2	DES 250	2
DSN S 232	3	ENGL 250	3
Design Skills	3	General Education	6
History/Theory/Criticism	3	History/Theory/Criticism	3
	14		16

Third Year

Fall	Credits	Spring	Credits
DES 240/340 Studio I/II	4	DES 250	2
DES 250	2	DES 330	3
Design Skills	3	DES 340	4
ENGL 302, 309 or 314	3	General Education	6
History/Theory/Christicism	3		
	15		15

Fourth Year

Fall	Credits	Spring	Credits
DES 491	4	DES 495	4
Design Skills	3	Minor/Elective	9
Minor/Elective	9	General Education	3
	16		16

Courses primarily for undergraduates:

DES 230: Design Thinking

(3-0) Cr. 3. F.S.

Introduction to the phenomenon of design thinking as it appears in various design fields, including methodologies of reasoning and problem solving; patterns of creativity and individual style; and the interaction of art, science, and technology.

DES 240: Design Studio I

(0-8) Cr. 2. Repeatable.

Prereq: DSN S 102, DSN S 131 and DSN S 183

Half-semester course. Studio projects develop students' ability to generate ideas and communicate those ideas visually, orally, and through writing. Emphasis on representation and conceptualization of interdisciplinary work.

DES 250: Design Forum

(2-0) Cr. 2. Repeatable, maximum of 6 credits. F.S.SS.

Prereq: DSN S 102, DSN S 131, DSN S 183 and credit or concurrent enrollment in DES 230

Introduction of themes and issues that are relevant to the design fields through theoretical readings, case studies, and visiting lecturers.

DES 259: Design Field Study

Cr. R. Repeatable.

Prereq: Enrollment in or 2 credits of DES 240.

Off-campus tours of areas of interest within the design professions such as design offices, museums, buildings, and neighborhoods. Offered on a satisfactory-fail basis only.

DES 330: Visual Literacy for Design Critique

(3-0) Cr. 3. S.

Prereq: DSN S 102 or DSN S 183 or 3 credits of ART H or equivalent.

Students will learn to interpret, analyze and evaluate visual materials, use images and text effectively to communicate ideas, and understand issues surrounding the creation and use of images and visual media for design critique. Precedent study and critique of sample student design work to understand principles of visual literacy and how to apply them to the presentation of design work. Emphasis on peer-to-peer discussion and in-class participation. Lecture and discussion format.

DES 340: Design Studio II

(0-8) Cr. 2. Repeatable.

Prereq: 4 credits of DES 240 or equivalent.

Half-semester course. Studio projects of increasing complexity requiring interdisciplinary approaches to contemporary challenges and opportunities. Continued development of students' abilities to generate ideas and communicate those ideas visually, orally, and through writing. Field trip.

DES 491: Portfolio and Professional Preparation

(2-4) Cr. 4. F.

Prereq: classification as DES major; 4 credits of DES 240

Preparation of printed and online portfolio of student work and materials for job search and/or graduate school applications. Guidance for interviewing, professional networking, business etiquette, and resume writing. Workshops and lectures.

DES 495: Capstone Experience
(1-6) Cr. 4. S.
Prereq: classification as DES major; 2 credits of DES 340
Individual projects designed by students in consultation with faculty instructor and mentor. Demonstration of student skill sets and knowledge of project planning and development.

Graphic Design

http://www.design.iastate.edu/graphicdesign/index.php

Undergraduate Study

The department offers the degree Bachelor of Fine Arts (B.F.A.) in Graphic design.

B.F.A. Graphic Design. Emphasis is on creative problem solving, design process, visual organization and communication media, and interaction design. Graphic design graduates effectively integrate abstract thinking skills such as communication design theory, history, methodology; and technology. Components of visual communication including typography, symbology, time-based media, information design, branding, image creation, and other communication systems are integrated with an understanding of professional practice.

Curriculum in Graphic Design

The Curriculum in Graphic Design leads to a 123.5 credit undergraduate Bachelor of Fine Arts in Graphic Design including the 30 credit core Design Program.

Admission into the professional program depends upon available resources and is subject to the approval of a faculty committee at the completion of the Core Design Program. Applicants are reviewed on the basis of academic performance, a portfolio of original work, and a written essay.

Transfer students with studio credits from other programs, colleges, and universities must present for departmental review a portfolio of work done in those courses in order to have the credits apply toward studio requirements. Students are required to present this portfolio upon admission and prior to registration for classes. Arrangements for this process must be made with department advisors.

A 34 graduate credit program is offered leading to the Master of Arts specialized in Environmental Graphic Design for students planning to undertake professional degree. (NOTE: Applicants without a degree in background in environmental graphic design may be required to complete up to 15 additional credits of coursework).

A 30 graduate credit program is offered leading to the Master of Arts specialized in Graphic Design for students planning to undertake professional degree. (NOTE: Applicants without a degree in background in graphic design may be required to complete up to 18 additional credits of coursework).

A 60 graduate credit post-professional graduate program is also offered leading to the degree Master of Fine Arts.

For more complete graduate program descriptions see Graduate Study under Graphic Design in the Courses and Programs section.

Total Degree Requirement: 123.5 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communications: 10 cr.

ENGL 150	Critical Thinking and Communication *	3
ENGL 250	Written, Oral, Visual, and Electronic Composition *	3
LIB 160	Information Literacy	1
One of the following:		3
COMST 101	Introduction to Communication Studies	
COMST 102	Introduction to Interpersonal Communication	
CMDIS 286	Communicating with the Deaf	
SP CM 110	Listening	
SP CM 212	Fundamentals of Public Speaking	
Total Credits		10

* with a C or better

Humanities: 6 cr.
6 cr. from program curriculum sheet.

Social Sciences: 6 cr.
6 cr. from program curriculum sheet.

Math/Physics/Biol. Sciences: 6 cr.
6 cr. from program curriculum sheet.

General Education Courses: 12 cr.
6 cr. of course level 300-400 from program curriculum sheet; Complete 6 cr. from department curriculum sheet.

College of Design Core: 11.5 cr.

DSN S 102	Design Studio I	4
DSN S 115	Design Collaborative Seminar	0.5
or DSN S 110	Design Exchange Seminar I	
DSN S 131	Design Representation	4
DSN S 183	Design Cultures	3
Total Credits		11.5

Art and Design History: 12 cr.

ART H 280	History of Art I	3
ART H 281	History of Art II	3

Six credits from program curriculum sheet	6
Total Credits	12

Studio Options: 6 cr.
6 cr from ArtIS, ArtID, LA, Arch, or other approved studio course.

Graphic Design: 52 cr.

ARTGR 270	Graphic Design Studio I	3
ARTGR 271	Graphic Design Studio II	3
ARTGR 272	Digital Photography for Graphic Design	3
ARTGR 275	Graphic Technology I	2
ARTGR 276	Graphic Technology II	2
ARTGR 281	Visual Communication and Branding	3
ARTGR 377	Graphic Design Internship Seminar	1
ARTGR 370	Graphic Design Studio III	3
ARTGR 371	Graphic Design Studio IV	3
ARTGR 387	Graphic Design History/Theory/ Criticism I	3
ARTGR 372	Graphic Design Materials and Processes	3
ARTGR 470	Graphic Design Studio V	3
ARTGR 471	Graphic Design Capstone	3
ARTGR 480	Graphic Design Internship	3
ARTGR 481	Graphic Design Professional Practices	3
Nine credit options from program curriculum sheet		9
ARTGR 482	Professional Presentation	2
Total Credits		52

Electives: 2 cr.
Remaining electives sufficient to complete graduation requirements.

Graphic Design, B.F.A.

First Year

Fall	Credits	Spring	Credits
DSN S 102 or DSN S 131	4	DSN S 102 or DSN S 131	4
DSN S 183 or General Education	3	DSN S 183 or General Education	3
DSN S 110 or DSN S 115	0.5-1.0	ENGL 150 or General Education	3
ENGL 150 or General Education	3	General Education	3
General Education	3	LIB 160	1
	16.5-17		17

Second Year

Fall	Credits	Spring	Credits
ARTGR 270	3	ARTGR 271	3
ARTGR 275	2	ARTGR 276	2
ART H 280	3	ART H 281	3
ARTGR 281	3	ARTIS, ARTID, LA or ARCH studio or ART GR 272	3
ARTIS, ARTID, LA, or ARCH Studio or ART GR 272	3	ENGL 250 (or Communication Study)	3
ENGL 250 (or Communication Study)	3		
	17		14

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
ARTGR 370	3	ARTGR 371	3	ARTGR 480 (or)	
ARTGR 387	3	ART GR Option	3	ARTGR 495	3

ARTGR Option	3 ARTGR 372	3	Students who elect to participate in the Rome Program need to take additional 3 elective credits to reach the 123.5 needed to graduate.
ARTIS, ARTID, LA, or ARCH Studio	3 ART or DSN History, General Education, or Rome Prep	3	
General Education	3 ARTGR 377	1	
	DSN S 301	1	
	ARTGR 494	1	
	Elective: ROME, Italian	1	
	15	16	3

Fourth Year

Fall	**Credits**	**Spring**	**Credits**
ARTGR 470	3	ARTGR 471	3
ARTGR Option	3	ARTGR 481	3
ART & DESIGN History or General Education	3	Elective	2-3
ARTIS, ARTID, LA or ARCH Studio or General Ed	3	General Education	3
General Education	3		
	15		11-12

Admission into the BFA in Graphic Design Program is based on departmental resources and will be determined by overall cumulative grade point average following completion of 29.5 credits including DSN S 120, 131, ENGL 150 or 250, and other general education requirements. A portfolio review and essay will also be significant factors.

Graduate Study

The department offers the degrees of Master of Fine Arts (M.F.A.) in Graphic Design, Master of Arts (M.A.) in Graphic Design, and Master of Arts (M.A.) in Graphic Design with a specialization in environmental graphic design.

M.F.A. in Graphic Design

The Master of Fine Arts in Graphic Design is recognized as the terminal degree in the field and requires a minimum of 64-credits. M.F.A. graduates in Graphic Design are skilled in communication design, problem solving, and are adept in the use of visual language, symbology, and interaction. Graduates are proficient in the design of communications and the use of technologies that incorporate human interaction with environments, objects, and electronic and traditional publications. Students and faculty work collaboratively on a required thesis; integrating theory, creation, research, and design problem solving.

The M.A. in Graphic Design

This 30-credit degree focuses on preparing students for professional practice. This degree is well suited for individuals whose undergraduate degree is not within graphic design. The degree includes seminar courses in art and design, a studio concentration, a history course, a business practice course, courses outside of graphic design, and the completion of a Creative Component in graphic design.

The degree acquaints students with theory, research and methodology for professional practice and the opportunity to apply these in studio investigations. Through studios focused on design thinking this degree will prepare students to practice in the quickly evolving field of graphic design. This program values cultural and intellectual diversity in its students, whose individual strengths are realized through a balanced and structured curriculum.

The M.A. in Graphic Design with a specialization in environmental graphic design

This 34-credit degree focuses on preparing student for 3-dimensional visual communication. Credits include a seminar course in art and design, a studio concentration, a history course, courses in design methods, and the completion of a Creative Component in environmental graphic

design, an extensive EGD project that synthesizes what they have learned in the program. This program is ideal for students with an undergraduate degree in architecture, interior design, industrial design, landscape or graphic design, that have an interest in expanding their skills. Applicants without a degree or background in environmental graphic design may be required to complete up to 15 additional credits of coursework.
This degree provides a comprehensive exposure to all aspects of the discipline, including wayfinding, exhibit design, interaction, information design, and placemaking. This program is offers interdisciplinary opportunities in architecture, interior design, landscape architecture, planning, art and visual culture, and industrial design. Our Institute for Design Research and Outreach coordinates community design projects, which engage students in real world experiences. The M.A. in Art and Design, with specialization in Environmental Graphic Design is the first and only program of its kind in the United States.

Graphic Design Graduate Program

Credit earned at Iowa State University or other institution for the Master of Arts degree may be applied toward the Master of Fine Arts degree at the discretion of the program of study committee.

Applicants to the graduate program should have an undergraduate major in an art or design area and demonstrate the ability to do technically competent and original work through the presentation of a digital portfolio for faculty review. Past academic performance and the quality of studio work are critical in the admission process. A minimum 3.0 GPA in the student's undergraduate major is the standard for full admission to the graduate program. Admission is also determined by studio space available within the program area, which changes yearly due to graduate students' progress in their programs of study.

Graduate students who have not completed an undergraduate program of study substantially equivalent to that required of undergraduates in the department can expect that additional supporting coursework, determined by the graduate faculty, will be required.

Prospective students are advised to contact the graduate coordinator with specific questions about admission procedures and portfolio review. Application and additional program information may be obtained from the Department of Graphic Design, College of Design, Iowa State University, Ames, IA 50011-3092.

MFA in Graphic Design Degree Requirement

Potential Prerequisites (based on Application materials), 9 cr.

ARTGR 587	Graphic Design History/Theory/ Criticism I	3
ARTGR 588	Graphic Design History/Theory/ Criticism II	3
ARTGR 697X	Internship	3

Graphic Design Studio Requirements, 33 cr.

ARTGR 501X	Graduate Graphic Design Studio I	3
ARTGR 570	Advanced Studies in Visual Communication	3
ARTGR 502X	Graudate Graphic Design Studio II	3
ARTGR 571	Signs, Symbols, Images	3
ARTGR 672A	Usability	3
ARTGR 601X	Thesis Preparation Studio	3
ARTGR 672B	Design for Behavioral Change.	3
ARTGR 602X	Graduate Thesis Studio I	3
ARTGR 603X	Graduate Thesis Studio II	3
ARTGR 699	Research-Thesis	3

Students may select additional credits from graphic design option studios. Choose from:

ARTGR 564	Digital Imaging	3
ARTGR 572	Photography and Narrative Message	3
ARTGR 573	Multimedia Design	3
ARTGR 574	Exhibition Design	3
ARTGR 575	Advanced Typography	3
ARTGR 576	Graphic Design Methodology	3
ARTGR 578	Design for E-Commerce/Graphic Applications	3
ARTGR 579	Wayfinding Design	3
ARTGR 584	Selected Studies in Graphic Design	1-3
ARTGR 591	Publication Design: Magazines	3
ARTGR 592	Publication Design: Books	3

Graphic Design Seminar Requirements, 10 cr.:

ARTGR 611	Teaching in Higher Education and Design Practice	3
ARTGR 698A	Current Issues in Graphic Design (Design Theory)	3
ARTGR 698B	Current Issues in Graphic Design (Semiotics)	3
ARTGR 632X	Thesis Preparation	1

Minor Area, 9 cr.

Outside of graphic design but supports area of research, may be studio (ex. DSN S 546) or other class outside the College of Design: See Graphic Design MFA Suggested Minor Course List

Art History, Theory, Criticism, 12 cr.

ART 501	Seminar (or Seminar in College of Design such as ARTID 551, 552)	6
Art History or other College of Design History Course		6

Optional Summer Thesis, 1-3 cr.

ARTGR 699	Research-Thesis	1-3

Total 64-66 cr.

Courses primarily for undergraduates:

ARTGR 270: Graphic Design Studio I
(0-6) Cr. 3. F.
Prereq: DSN S 102, DSN S 131 and enrollment in ARTGR 275; admission to the graphic design program through department review
Basic design concepts and color principles used for visual communication.

ARTGR 271: Graphic Design Studio II
(0-6) Cr. 3. S.
Prereq: ART 230, ARTGR 270, ARTGR 275 and enrollment in ARTGR 276
Principles of typographic composition, structure and hierarchy. Formal and conceptual principles of symbology.

ARTGR 272: Digital Photography for Graphic Design
(0-6) Cr. 3. F.S.
Prereq: Concurrent enrollment in ARTGR 270 OR ARTGR 271
This course will address the development of "seeing" as a medium design, expression, and visual communication including compositional dynamics, advanced digital image manipulation, software usage and support, digital camera operations along with scanning and other digital input devices, color management, digital format for presentation and printing with digital ready formats.

ARTGR 275: Graphic Technology I
(0-4) Cr. 2. F.
Prereq: concurrent enrollment in ARTGR 270
Basic 2-dimensional computer skills for graphic design.

ARTGR 276: Graphic Technology II
(1-2) Cr. 2. S.
Prereq: ARTGR 275 and concurrent enrollment in ARTGR 271
Basic 3-dimensional computer skills for graphic design.

ARTGR 281: Visual Communication and Branding
(3-0) Cr. 3. F.
Introduction to basic principles of visual communication that contribute to the successful comprehension of intended visual messages; these include promotional messages, such as corporate branding and marketing campaigns, as well as informational messages, such as those used in computer interface design or in the clear presentation of diagrammatic data. Emphasis is placed on sensitivity to the diversity of the intended American or global audience, and to the cross-cultural differences that may affect the ways that visual messages are interpreted. Methods for creating brand experiences are explored as they apply to both small and large enterprises, ranging from personal brand to corporate brand identities.

ARTGR 370: Graphic Design Studio III
(0-6) Cr. 3. F.
Prereq: ARTGR 271, ARTGR 276, and credit or concurrent enrollment in ARTGR 387
Creation and design of images and symbols for communication. Application and integration of typography with images and symbols.

ARTGR 371: Graphic Design Studio IV
(0-6) Cr. 3. S.
Prereq: ARTGR 370 and ARTGR 387
Development and preparation of design concepts for application to the printing and electronic publishing process. Creative problem-solving skills, introduction to systems design.

ARTGR 372: Graphic Design Materials and Processes
(3-0) Cr. 3. S.
Prereq: Credit or concurrent enrollment in ARTGR 371
Lecture about the processes and materials involved in graphic design arts reproduction. Course covers pre-press, paper selection and specification, ink systems, type systems and fonts, output technology, printing presses and bindery operations.

ARTGR 377: Graphic Design Internship Seminar
(1-0) Cr. 1. S.
Prereq: Credit or concurrent enrollment in ARTGR 370 or ARTGR 371
Procedural and ethical concerns related to the graphic design internship. Personal goals, preparation of resume and plans for internship. Study and tours of areas of interest within the graphic design profession.

ARTGR 378: Critical Issues in Graphic Design
(2-0) Cr. 2.
Prereq: Credit or concurrent enrollment in ARTGR 370
Lecture, discussion and writing about the critical issues facing the communications field today and in the future.

ARTGR 387: Graphic Design History/Theory/ Criticism I
(Dual-listed with ARTGR 587). (3-0) Cr. 3. F.
Late nineteenth century to the 1990s. This course will explore the cultural, social, political, industrial, and technological forces that have influenced the practice of graphic design in Britain, Europe, and the United States. Students will study the historical issues and problems facing designers, their clients, and their publics.

ARTGR 388: Graphic Design History/Theory/ Criticism II
(Dual-listed with ARTGR 588). (3-0) Cr. 3. S.
Critical issues that affect the contemporary practice of graphic design as it relates to the United States. Students will study a variety of issues that include, but are not exclusive to, new media, gender, class, design and the public sphere, design as social action, postmodern design theory, sustainability, and ethical practice.
Meets U.S. Diversity Requirement

ARTGR 391: Graphic Design Field Study
(0-1) Cr. 1. Repeatable, maximum of 2 credits.
Prereq: Concurrent enrollment in 300 or 400 level graphic design studio course
Travel, study, and tours of areas of interest within the graphic design profession such as print production companies, design studios, and museums. Offered on a satisfactory-fail basis only.

ARTGR 463: 3D Motion Graphics
(Dual-listed with ARTGR 563). (0-6) Cr. 3. S.
Prereq: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470
3D visualization in a Motion Graphics context. Emphasis on design in 3D computer animation as it relates to various electronic media.

ARTGR 464: Digital Imaging
(Dual-listed with ARTGR 564). (0-6) Cr. 3. F.
Prereq: Concurrent enrollment in ARTGR 370, ARTGR 371 or ARTGR 470.
Studio in experimental techniques using the digital drawing tablet combined with manual drawing mediums, exploring the digital tablet, scanner, and camera as ways to collect and make images, conceptual and compositional development of digital techniques and software, and connecting digital techniques to visual processes and ideation. Students will have a better understanding of different ways of working digitally while exploring image-making processes.

ARTGR 470: Graphic Design Studio V
(0-6) Cr. 3. F.
Prereq: ARTGR 371
Advanced design systems as applied to corporate identity and environmental graphic design. Symbology as an integrated component of communication systems.

ARTGR 471: Graphic Design Capstone
(0-6) Cr. 3. S.
Prereq: ARTGR 470 or permission of instructor
Experience design and innovation in a multi-disciplinary design studio. Class will use unique research, design, evaluation, creativity, and innovation methodologies to solve human problems on special topics. Designed solutions will be in the form of products, artifacts, interfaces, information, and human environments.

ARTGR 472: Photography and Narrative Message
(Dual-listed with ARTGR 572). (0-6) Cr. 3.
Prereq: Enrollment in ARTGR 370, ARTGR 371, ARTGR 470, or ARTGR 471
Photography as a tool for creating conceptually-driven images and metaphors. Emphasis is on photography as an evocative storytelling device for a range of audiences and design applications. Compositional and technical aspects are explored to ensure successful interpretation of the photograph's intended message.

ARTGR 473: Multimedia Design
(Dual-listed with ARTGR 573). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470 Graduate: graduate enrollment in College of Design
The design of visual, aural and textual communication for electronic media.

ARTGR 474: Exhibition Design
(Dual-listed with ARTGR 574). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470 Graduate: graduate enrollment in College of Design
Visual communication applied to exhibition design focusing on educational or interactive museum exhibitions, trade show booth design, and modular unit design for traveling exhibitions. Translation of graphic information to a three-dimensional space.

ARTGR 475: Advanced Typography
(Dual-listed with ARTGR 575). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470 Graduate: graduate classification in College of Design
Typographic theory exploring traditional and non-traditional forms, both historical and contemporary typographic achievements.

ARTGR 476: Graphic Design Methodology
(Dual-listed with ARTGR 576). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371 or ARTGR 470 Graduate: graduate enrollment in College of Design
Analysis and application of scientific, systematic, and non-traditional problem-solving and problem-seeking techniques.

ARTGR 477: Graphic Design Practicum
(0-6) Cr. 3.
Prereq: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470
Graphic design outreach and problem solving. Individual and group projects for non-profit clients selected by the instructor.

ARTGR 478: Design for E-Commerce/Graphic Applications
(Dual-listed with ARTGR 578). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470. Graduate: Graduate enrollment in College of Design
The development of advanced and experimental web design for the applications of e-commerce, education and the communication of visual information.

ARTGR 479: Wayfinding Design
(Dual-listed with ARTGR 579). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470. Graduate: Graduate enrollment in College of Design
Study of the navigational challenges of built environments and outdoor spaces, including site analysis, development of navigational plans, and design of wayfinding sign systems. Issues of function, accessibility, legibility, and fabrication are considered.

ARTGR 480: Graphic Design Internship
(3-0) Cr. 3. SS.
Prereq: ARTGR 377, 12 credits in graphic design; permission of instructor, registration in advance of enrollment
Graphic design experience in an off-campus professional environment.

ARTGR 481: Graphic Design Professional Practices
(3-0) Cr. 3. S.
Prereq: Credit or concurrent enrollment in ARTGR 470
Professional design management: ethics, setting up a new business, client/designer relationships, contractual options, billing practices, and effective operating procedures.

ARTGR 482: Professional Presentation
(0-4) Cr. 2. S.
Prereq: ARTGR 470 and concurrent enrollment in ARTGR 471
Exploration and development of the graphic design portfolio and resume in electronic, print, and photographic form.

ARTGR 484: Selected Studies in Graphic Design
(Dual-listed with ARTGR 584). Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Graduate classification in the College of Design
Special issues related to graphic design. Topics vary each time offered.

ARTGR 490: Independent Study
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTGR 490A: Independent Study: Theory, Criticism, and Methodology
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTGR 490B: Independent Study: Two-Dimensional Design
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTGR 490C: Independent Study: Three-Dimensional Design
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTGR 490H: Independent Study: Honors
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTGR 490I: Internship/Cooperative (in-depth experience other than ArtGr 480)
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related graphic design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTGR 491: Publication Design: Magazines
(Dual-listed with ARTGR 591). (0-6) Cr. 3.
Prereq: Graduate enrollment in College of Design
The philosophy, concepts and structures of magazine design.

ARTGR 492: Publication Design: Books
(Dual-listed with ARTGR 592). (0-6) Cr. 3.
Prereq: Graduate enrollment in College of Design
The philosophy, concepts and structures of book design.

ARTGR 493: Workshop
Cr. 1-3. Repeatable.
Prereq: Evidence of satisfactory experience in area of specialization
Intensive 2 to 4 week studio exploration. Topics vary each time offered.

ARTGR 494: Graphic Design in Europe Seminar
(1-0) Cr. 1.
Prereq: Permission of instructor and planned enrollment in ARTGR 495.
Cultural and historical aspects of art and design in Western Europe in preparation for study abroad. Area of study varies each time offered. Offered on a satisfactory-fail basis only.

ARTGR 495: Graphic Design in Europe
(Dual-listed with ARTGR 595). Cr. 3. SS.
Prereq: ARTGR 494, permission of instructor
International study abroad program in western Europe. Visits to design studios, art museums, and educational facilities.

ARTGR 496: Graphic Design Field Study
Cr. R. Repeatable.
Prereq: Concurrent enrollment in a graphic design studio and permission of instructor.
Study and tours of museums, galleries, artist and/or designer studios and other areas of interest within art and design. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

ARTGR 563: 3D Motion Graphics
(Dual-listed with ARTGR 463). (0-6) Cr. 3. S.
Prereq: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470
3D visualization in a Motion Graphics context. Emphasis on design in 3D computer animation as it relates to various electronic media.

ARTGR 564: Digital Imaging
(Dual-listed with ARTGR 464). (0-6) Cr. 3. F.
Prereq: Concurrent enrollment in ARTGR 370, ARTGR 371 or ARTGR 470.
Studio in experimental techniques using the digital drawing tablet combined with manual drawing mediums, exploring the digital tablet, scanner, and camera as ways to collect and make images, conceptual and compositional development of digital techniques and software, and connecting digital techniques to visual processes and ideation. Students will have a better understanding of different ways of working digitally while exploring image-making processes.

ARTGR 570: Advanced Studies in Visual Communication
(0-6) Cr. 3. F.
Prereq: Graduate classification in College of Design
Theory and investigation of systems, structures, principles of visual organization, and typography for communication. Studio problems will be influenced by social, cultural, environmental, or technological factors.

ARTGR 571: Signs, Symbols, Images
(0-6) Cr. 3. S.
Prereq: Graduate Classification in College of Design
Investigation and application of signs, symbols and semiotic theory for communication. Studio problems influenced by social, cultural, environmental, or technological factors.

ARTGR 572: Photography and Narrative Message
(Dual-listed with ARTGR 472). (0-6) Cr. 3.
Prereq: Enrollment in ARTGR 370, ARTGR 371, ARTGR 470, or ARTGR 471
Photography as a tool for creating conceptually-driven images and metaphors. Emphasis is on photography as an evocative storytelling device for a range of audiences and design applications. Compositional and technical aspects are explored to ensure successful interpretation of the photograph's intended message.

ARTGR 573: Multimedia Design
(Dual-listed with ARTGR 473). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470 Graduate: graduate enrollment in College of Design
The design of visual, aural and textual communication for electronic media.

ARTGR 574: Exhibition Design
(Dual-listed with ARTGR 474). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470 Graduate: graduate enrollment in College of Design
Visual communication applied to exhibition design focusing on educational or interactive museum exhibitions, trade show booth design, and modular unit design for traveling exhibitions. Translation of graphic information to a three-dimensional space.

ARTGR 575: Advanced Typography
(Dual-listed with ARTGR 475). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470 Graduate: graduate classification in College of Design
Typographic theory exploring traditional and non-traditional forms, both historical and contemporary typographic achievements.

ARTGR 576: Graphic Design Methodology
(Dual-listed with ARTGR 476). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371 or ARTGR 470 Graduate: graduate enrollment in College of Design
Analysis and application of scientific, systematic, and non-traditional problem-solving and problem-seeking techniques.

ARTGR 578: Design for E-Commerce/Graphic Applications
(Dual-listed with ARTGR 478). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470. Graduate: Graduate enrollment in College of Design
The development of advanced and experimental web design for the applications of e-commerce, education and the communication of visual information.

ARTGR 579: Wayfinding Design
(Dual-listed with ARTGR 479). (0-6) Cr. 3.
Prereq: Undergraduate: Concurrent enrollment in ARTGR 370, ARTGR 371, or ARTGR 470. Graduate: Graduate enrollment in College of Design
Study of the navigational challenges of built environments and outdoor spaces, including site analysis, development of navigational plans, and design of wayfinding sign systems. Issues of function, accessibility, legibility, and fabrication are considered.

ARTGR 584: Selected Studies in Graphic Design
(Dual-listed with ARTGR 484). Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Graduate classification in the College of Design
Special issues related to graphic design. Topics vary each time offered.

ARTGR 587: Graphic Design History/Theory/ Criticism I
(Dual-listed with ARTGR 387). (3-0) Cr. 3. F.
Late nineteenth century to the 1990s. This course will explore the cultural, social, political, industrial, and technological forces that have influenced the practice of graphic design in Britain, Europe, and the United States. Students will study the historical issues and problems facing designers, their clients, and their publics.

ARTGR 588: Graphic Design History/Theory/ Criticism II
(Dual-listed with ARTGR 388). (3-0) Cr. 3. S.
Critical issues that affect the contemporary practice of graphic design as it relates to the United States. Students will study a variety of issues that include, but are not exclusive to, new media, gender, class, design and the public sphere, design as social action, postmodern design theory, sustainability, and ethical practice.
Meets U.S. Diversity Requirement

ARTGR 589: Design and Ethics
(Cross-listed with HCI). (3-0) Cr. 3. F.S.
Prereq: Graduate classification or permission of instructor.
Issues in ethics and decision-making as they relate to technology, design, design research, HCI, and the design industry.

ARTGR 590: Special Topics
Cr. arr.
Prereq: Bachelor's degree in graphic design, or evidence of satisfactory equivalency in specialized area
Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTGR 590A: Special Topics: Theory, Criticism, and Methodology
Cr. arr.
Prereq: Bachelor's degree in graphic design, or evidence of satisfactory equivalency in specialized area
Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTGR 590B: Special Topics: Two-Dimensional Design
Cr. arr.
Prereq: Bachelor's degree in graphic design, or evidence of satisfactory equivalency in specialized area
Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTGR 590C: Special Topics: Three-Dimensional Design
Cr. arr.
Prereq: Bachelor's degree in graphic design, or evidence of satisfactory equivalency in specialized area
Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTGR 591: Publication Design: Magazines
(Dual-listed with ARTGR 491). (0-6) Cr. 3.
Prereq: Graduate enrollment in College of Design
The philosophy, concepts and structures of magazine design.

ARTGR 592: Publication Design: Books
(Dual-listed with ARTGR 492). (0-6) Cr. 3.
Prereq: Graduate enrollment in College of Design
The philosophy, concepts and structures of book design.

ARTGR 593: Workshop
Cr. 1-3. Repeatable.
Prereq: Graduate classification; evidence of satisfactory experience in area of specialization
Intensive 2 to 4 week studio exploration. Topics vary each time offered.

ARTGR 595: Graphic Design in Europe
(Dual-listed with ARTGR 495). Cr. 3. SS.
Prereq: ARTGR 494, permission of instructor
International study abroad program in western Europe. Visits to design studios, art museums, and educational facilities.

ARTGR 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

ARTGR 611: Teaching in Higher Education and Design Practice
(3-0) Cr. 3.
Prereq: Graduate classification
Introduction to teaching methods, curriculum design, project development, and business strategies for Design Education and Professional Practice.

ARTGR 672: Graphic Design and Human Interaction
(0-6) Cr. 3. F.S.
Prereq: ARTGR 570, ARTGR 571, and graduate enrollment in College of Design or permission of instructor
The theory and investigation of experience design as it applies to human interactions in contemporary society and culture. Studio problems may involve such areas as: exhibition design, electronic interface design, wayfinding, package design, and publication design.

ARTGR 672A: Usability
(0-6) Cr. 3.
Prereq: ARTGR 570, ARTGR 571, and graduate enrollment in College of Design or permission of instructor
The exploration and design of interface/interaction with products, systems, and technologies.

ARTGR 672B: Design for Behavioral Change.
(0-6) Cr. 3.
Prereq: ARTGR 570, ARTGR 571, and graduate enrollment in College of Design or permission of instructor
The exploration and design of educational experiences and artifacts as they relate to the social, emotional, and behavioral aspects of society.

ARTGR 672C: Consumer Experience Design and Branding.
(0-6) Cr. 3.
Prereq: ARTGR 570, ARTGR 571, and graduate enrollment in College of Design or permission of instructor
The theory and investigation of experience design as it applies to human interactions in contemporary society and culture. Studio problems may involve such areas as: exhibition design, electronic interface design, wayfinding, package design, and publication design.

ARTGR 690: Advanced Topics
Cr. arr. Repeatable.

ARTGR 698: Current Issues in Graphic Design
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: Graduate enrollment in College of Design or permission of instructor
Selected issues in contemporary graphic design. Topics and readings vary each time offered.

ARTGR 699: Research-Thesis
Cr. arr. Repeatable.

Industrial Design

http://www.design.iastate.edu/industrialdesign/index.php

B.I.D. Bachelor of Industrial Design Students in this program take a carefully defined sequence of courses developed to give them exposure and practice in the areas of theory and skill required by industrial design. These include drawing, form development, history, creative thinking, engineering principles, research, design methodology, human factors, computer-aided design, manufacturing and commercial factors. In their third year, students will select electives from concentration tracks arranged around specialty areas and current issues in the profession. The upper level studio classes are reserved for study abroad, internships, and sponsored projects with students from other departments and colleges.

Curriculum in Industrial Design

The Curriculum in Industrial Design leads to a 132.5 credit undergraduate Bachelor of Industrial Design including the 30.5 credit core Design Program.

Admission into the professional program depends upon available resources and is subject to the approval of a faculty committee at the completion of the Core Design Program. Applicants are reviewed on the basis of academic performance, a portfolio of original work, and a written essay.

Transfer students with studio credits from other programs, colleges, and universities must present for departmental review a portfolio of work done in those courses in order to have the credits apply toward studio requirements. Students are required to present this portfolio upon admission and prior to registration for classes. Arrangements for this process must be made with department advisors.

A 45 graduate credit post-professional graduate program is also offered leading to the degree Master of Industrial Design. (NOTE: Applicants without a degree or background in industrial design may be required to complete up to 18 additional credits of coursework.)

Total Degree Requirements: 132.5 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communications: 10 cr.

ENGL 150	Critical Thinking and Communication (*)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (*)	3
LIB 160	Information Literacy	1
One of the following:		3
COMST 101	Introduction to Communication Studies	
COMST 102	Introduction to Interpersonal Communication	
CMDIS 286	Communicating with the Deaf	
SP CM 110	Listening	
SP CM 212	Fundamentals of Public Speaking	
THTRE 251	Acting I	
Total Credits		10

* with a C or better

Humanities: 6 cr.
6 cr. from program curriculum sheet

Social Sciences: 6 cr.
6 cr. from program curriculum sheet

Math/Physics/Biol.Sciences: 6 cr.
6 cr. from program curriculum sheet

General Education Courses: 9 cr.
6 cr. of course level 300-400 from program curriculum sheet: complete 3 cr. from department curriculum sheet.

College of Design Core: 11.5 cr.

DSN S 102	Design Studio I	4
DSN S 115	Design Collaborative Seminar	0.5-1
or DSN S 110	Design Exchange Seminar I	
DSN S 131	Design Representation	4
DSN S 183	Design Cultures	3
Total Credits		11.5-12

History, Theory and Criticism: 15 cr.

IND D 231	Introduction to Industrial Design	3
IND D 387	History of Industrial Design I	3
IND D 388	History of Industrial Design II	3
Two courses from the approved course list; must include one 300 level or higher.		6

Industrial Design: 60 cr.

IND D 201	Industrial Design Studio I	6
IND D 202	Industrial Design Studio II	6
IND D 232	Creative Thinking for Industrial Design	3
ARTID 251	Human Factors in Design	3
ENGR 260	Engineering: Getting from Thought to Thing	3
ENGR 270	Survey of How Things Work	3
IND D 301	Industrial Design Studio III	6
IND D 332	Design Research Methods	3
IND D 334	Materials and Processes for Industrial Design	3
IND D 341	Computer Aided Industrial Design I	3
IND D 499	Senior Project	6
IND D 543	Portfolio and Professional Practice	3
Two of the following:		12
IND D 397	Industrial Design Internship	
IND D 495	Study Abroad Option	
IND D 507	Industrial Design Practicum	
Total Credits		60

Concentration track electives: 9 cr.
Sequence of electives assembled to create a focused area of study.

See also: a 4-year plan of study grid showing course template by semester.

Industrial Design

First Year

Fall	Credits	Spring	Credits
DSN S 102 or DSN S 131	4	DSN S 102 or DSN S 131	4
DSN S 183 or General Education	3	DSN S 183 or General Education	3
ENGL 150 or General Education	3	ENGL 150 or General Education	3
DSN S 110 or DSN S 115	0.5-1.0	General Education	3
General Education	3	General Education	3
General Education	3	LIB 160	1
	16.5-17		17

Second Year

Fall	Credits	Spring	Credits
IND D 201	6	IND D 202	6
IND D 231	3	IND D 232	3
ENGR 260	3	IND D 388	3

ARTID 251	3 ENGR 270	3	
IND D 387	3 IND D 334	3	
	18	18	

Third Year

Fall	Credits Spring	Credits Summer	Credits
IND D 301	6 IND D option studio	6 Study Abroad	6
IND D 332	3 Elective	3 Elective	3
IND D 341	3 Elective	3	
Elective	3 Elective	3	
	15	15	9

Fourth Year

Fall	Credits Spring	Credits
IND D option studio	6 IND D 499	6
Elective	3 IND D 543	3
Elective	3 Elective	3
Gen Ed or Elective	3 Gen Ed or Elective	3
	15	15

Graduate Study

The Master of Industrial Design (M.I.D.)

Innovation requires breaking boundaries and making connections between diverse disciplines. As a creative profession, industrial design deals with the design of innovative, sustainable and durable solutions for people, nonhumans, economy and society which may take many forms from tangible artifacts to expansive system designs. The Master of Industrial Design (M.I.D.) program at Iowa State University specifically emphasizes strategy and innovation with a strong focus on empathetic human-centered design research. It is centralized on the creation and application of new knowledge through in-depth investigations culminating in a written thesis. At the same time, students expand their design practice skills using innovative methodologies, collaboratively throughout the entire design process. Students explore, generate, transfer and implement multidisciplinary information and technologies into foundational knowledge for the discipline of industrial design.

The M.I.D. is traditionally recognized as a terminal degree in industrial design. The graduate program is designed to offer significant mix of skills and experiences, including faculty-directed research programs, internships, international travel, industry-sponsored coursework and design teaching experience. The graduate research focuses on three main areas: 1) Innovation through Design, 2) Design as Strategy, and 3) Human-Centered Design. These areas are defined by the existing faculty members' research and creative activities, and focus on developing a new type of industrial designer mastering in any one of these specializations. Program faculty have extensive expertise in design thinking, human-centered research methods, cultural issues, product realization, design management, eco-design, social responsibility, and entrepreneurship.

The M.I.D. is a 63-credit study, distributed across three consecutive years. Applicants are required to have design and/or engineering degrees from accredited institutions or relevant industry experience.

M.I.D. Program Philosophy

The goal of the Industrial Design graduate program is to create an agile program that addresses current and emerging issues in design strategy, innovation and human-centered design. Its position, in one of the most comprehensive design colleges in the country, facilitates the integration of methodologies and skillsets from multiple disciplines. Additionally, ties to the nationally ranked College of Engineering, the College of Business and industry collaborators create some truly unique degree specializations. Students are able to explore advanced concepts in such areas as extended manufacturer responsibility, supply chain and logistics, international vendor relations, advanced materials and biopolymers, and alternative business models.

Curriculum Outline

First Year

Fall	Credits Spring	Credits
IND D 501 rotating faculty; course directly related to teaching faculty's research	6 IND D 502 rotating faculty; course directly related to teaching faculty's research	6
IND D 533X Human-Centered Research Methods	3 PSYCH 501/508/522 or RESEV 554/580 (qualitative research methods)	3
MGMT 502/503/504 (organizational/strategic management)	3 RESEV 552/553quantitative research methods	3
IND D 511	1 IND D 511	1
	13	13

Second Year

Fall	Credits Spring	Credits
IND D 503 (vertical studio with juniors)	6 IND D 504 (vertical sponsored studio)	6
IND D 632	3 IND D 632	3

GR ST 529	3	IND D 540	3
IND D 511	1		
	13		12

Third Year

Fall	Credits	Spring	Credits
IND D 699	6	IND D 699	6
IND D 543	3	Elective	3
Elective	3	Elective	3
	12		12

Summer: Study Abroad/Internship/Research Assistantship (optional)

Courses primarily for undergraduates:

IND D 201: Industrial Design Studio I
(0-12) Cr. 6. F.
Prereq: Admission to the industrial design program, enrollment in IND D 231.
Product scale form development and visual communication.

IND D 202: Industrial Design Studio II
(0-12) Cr. 6. S.
Prereq: IND D 201
Principles of structure and function in products.

IND D 231: Introduction to Industrial Design
(3-0) Cr. 3. F.
Prereq: DSN S 102 and DSN S 131, enrollment in 201; admission to the industrial design program through department review or permission of instructor.
The history, definition, scope, and basic principles of industrial design. Overview of technical, artistic, and sociological context of the profession.

IND D 232: Creative Thinking for Industrial Design
(3-0) Cr. 3. S.
Prereq: IND D 231
Exploration of strategies, methods, and processes associated with creative thinking skills and problem solving. Discussion of the nature of creativity and its implications in different contexts that cross content boundaries.

IND D 260: Engineering: Getting from Thought to Thing
(Cross-listed with ENGR). (3-0) Cr. 3. F.S.
What is engineering, technology and their roles in society? Investigation of engineering methods through case studies of everyday objects. Explore questions about the impact of technology in society. Apply engineering methods to design and failure analysis.

IND D 270: Survey of How Things Work
(Cross-listed with ENGR). (3-0) Cr. 3. F.S.
Removing mysteries surrounding science and technology. Identify key concepts from applied science and technology to obtain better understanding on how things work. Review and explain the principles behind the technologies which define our modern way of life. A survey of broad range of technology could include: cell phones, GPS, radio, television, computers, ultrasound, microwave ovens, automobile, bioengineering and other industrial and consumer technologies. Common day technology examples illustrating scientific knowledge and applications.

IND D 301: Industrial Design Studio III
(0-12) Cr. 6. F.
Prereq: IND D 202
Systematic design methodology and integration of creative thinking techniques.

IND D 302: Industrial Design Studio IV
(0-12) Cr. 6. F.S.
Prereq: IND D 301 or permission of instructor
Exploration of commercial factors in industrial design.

IND D 332: Design Research Methods
(3-0) Cr. 3. F.
Prereq: IND D 231 or permission of instructor.
Survey of qualitative and quantitative methods with an emphasis on contextual user-centered research. Integration of user data collection, visualization, and synthesis as a source for design. Experience of a small-scale research practice related to industrial design.

IND D 334: Materials and Processes for Industrial Design
(3-0) Cr. 3. S.
Prereq: IND D 201 and IND D 231.
Introduction to materials and manufacturing methods for mass production and distribution of products.

IND D 341: Computer Aided Industrial Design I
(0-6) Cr. 3. F.S.
Prereq: IND D 301
Emphasis on the computer as an industrial design and visualization tool.

IND D 351: Applied Human Factors Lab
(0-1) Cr. 1. F.
Prereq: IND D 231 and enrollment in ARTID 251
Theory and application of human factors issues in the industrial design field, specifically their impact on the relationship of the user, the product, and the product systems.

IND D 387: History of Industrial Design I
(3-0) Cr. 3. F.
Prereq: 30 credits earned at ISU
Historical perspective of industrial objects starting at the Industrial Revolution 1830 to 1960. Discussion of social, political, cultural and technological context for industrial design.
Meets U.S. Diversity Requirement

IND D 388: History of Industrial Design II
(3-0) Cr. 3. S.
Prereq: 30 credits earned at ISU.
Historical perspective of industrial objects 1960 to present. Discussion of social, political, cultural and technological context for industrial design.

IND D 397: Industrial Design Internship
(0-12) Cr. 6. F.S.SS.
Prereq: IND D 202, 18 credits in industrial design, permission of instructor.
Professional industrial design, off-campus experience.

IND D 401: Industrial Design Studio
(0-12) Cr. 6. F.S.
Prereq: IND D 301 or permission of instructor
Advanced topics focused on industrial design applications. Topics vary each time offered.

IND D 490: Special Topics
Cr. arr. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Advanced topics focused on industrial design applications. Topics vary each time offered. A. Theory, Criticism, Methodology B. Experimental Techniques C. Three Dimensional Design D. Distributed Collaboration.

IND D 490A: Special Topics: Theory, Criticism, Methodology
Cr. arr. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Advanced topics focused on industrial design applications. Topics vary each time offered.

IND D 490B: Special Topics: Experimental Techniques
Cr. arr. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Advanced topics focused on industrial design applications. Topics vary each time offered.

IND D 490C: Special Topics: Three-Dimensional Design
Cr. arr. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Advanced topics focused on industrial design applications. Topics vary each time offered.

IND D 490D: Special Topics: Distributed Collaboration
Cr. arr. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Advanced topics focused on industrial design applications. Topics vary each time offered.

IND D 495: Study Abroad Option
(0-12) Cr. 6. F.S.SS.
Prereq: IND D 202 and permission of instructor
International study abroad program. Visits to design studios, showrooms, museums and manufacturing facilities.

IND D 499: Senior Project
(0-12) Cr. 6. S.
Prereq: IND D 495 or IND D 507 and senior standing
Advanced practice in specialized area of industrial design. Topics vary.

Courses primarily for graduate students, open to qualified undergraduates:

IND D 501: Industrial Design Studio Intensive I
(0-12) Cr. 6. F.
Prereq: Admission into the Graduate Intensive Track or graduate standing in the industrial design program.
Basic concepts and techniques for industrial design. Emphasis on form development, structure, function and communication.

IND D 502: Industrial Design Studio Intensive II
(0-12) Cr. 6. S.
Prereq: Admission into the Graduate Intensive Track or graduate standing in the industrial design program.
Advanced concepts and techniques for industrial design. Emphasis on systematic design methodology and commercial factors, and visual and verbal communication of design problems and solutions.

IND D 503: Industrial Design Studio I
(0-12) Cr. 6. F.
Prereq: Admission to the industrial design graduate program or completion of Graduate Intensive Track.
Advanced, project-based application of industrial design concepts and techniques.

IND D 504: Industrial Design Studio II
(0-12) Cr. 6. S.
Prereq: IND D 502.
Advanced, project based application of industrial design concepts and techniques, with an emphasis on service and system design, and its implications for the community.

IND D 507: Industrial Design Practicum
(0-12) Cr. 6. F.S.
Prereq: Evidence of satisfactory experience in area of specialization; admitted by application and written permission of instructor only.
Studio project focused on topics generated with external partners. Topics vary.

IND D 511: Colloquium
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Admission into the Graduate Intensive Track or graduate standing in the industrial design program.
Presentation and discussion of creative activity carried out in various design disciplines and their relationship to industrial design. Seminar sessions focusing on exemplary pieces of design research undertaken by faculty and graduate students in the design field.

IND D 532: Design Thinking
(3-0) Cr. 3. S.
Prereq: Admission into the Graduate Intensive Track or graduate standing in the industrial design program, or permission of instructor.
Exploration of problem-solving methods for systems, products, and processes across all contexts. Strategies for problem-solution co-evolution process, with a focus on collaborative and interdisciplinary design to investigate real-world problems and opportunities.

IND D 534: Product Realization for Industrial Design
(3-0) Cr. 3. S.
Prereq: Admission into the Graduate Intensive Track or graduate standing in the industrial design program.
Introduction to materials and manufacturing methods for products. Exploration of emerging materials and new applications.

IND D 540: Visual Communication for Industrial Design
(0-6) Cr. 3. F.
Prereq: Admission into the Graduate Intensive Track or graduate standing in the industrial design program.
Exploration of multiple visual communication techniques used in industrial design and product development.

IND D 541: Computer Aided Industrial Design
(0-6) Cr. 3. F.S.
Prereq: Completion of industrial design studio or permission of instructor.
Exploration of the computer as an industrial design and visualization tool. Advanced concepts in computer to machine interface for manufacture.

IND D 543: Portfolio and Professional Practice
(1-4) Cr. 3. F.S.
Prereq: Advanced standing in the industrial design program.
Discussion of industrial design practice and career planning. Development and preparation of personal promotional materials for a range of media.

IND D 551: Human Factors
(3-0) Cr. 3. S.
Prereq: IND D 532
Human factors issues and the study of relationships between the user, the product, and the human body and its physical functions. Investigations of bio-mechanics, anthropometry, instrumental displays and control, and their measurement as they relate to the design process.

IND D 590: Special Topics
(1-4) Cr. 3. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Advanced topics focused on industrial design applications. Topics include theory, criticism, methodology, experimental techniques, three dimensional design, distributed collaboration.

IND D 592: Special Projects
Cr. arr. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
Planned projects in topics related to theory, criticism, methodology, experimental techniques, three dimensional design, distributed collaboration.

IND D 595: Study Abroad Option
(0-12) Cr. 6. Repeatable. F.S.SS.
Prereq: Completion of industrial design studio or permission of instructor.
International study abroad program. Visits to design studios, showrooms, museums and manufacturing facilities.

IND D 597: Internship
(0-12) Cr. 6. Repeatable. F.S.SS.
Prereq: Completion of Industrial design studio or permission of instructor.
Professional industrial design, off-campus experience.

Courses for graduate students:

IND D 601: Graduate Project I
(0-12) Cr. 6. F.
Prereq: IND D 632
Advanced creative component in specialized area of focus within industrial design. Culminates in a development plan and supporting documentary.

IND D 602: Graduate Project II
(0-12) Cr. 6. S.
Prereq: IND D 601
Advanced creative component in specialized area of focus within industrial design. Culminates in a physical or digital artifact and supporting documentation.

IND D 631: Design Research Methods
(3-0) Cr. 3. F.
Prereq: Admission into the Graduate Intensive Track, graduate standing in the industrial design program, or permission of instructor.
Cross-disciplinary research methods to examine the impact of industrial design on humans, environments, and social contexts. Examination and critique of current research methods employed in the field, and application of a selection of these methods to a variety of research questions.

IND D 632: Thesis Preparation
(3-0) Cr. 3. S.
Prereq: IND D 631
Exploration and formulation of graduate thesis or project topics, with proposed studies and investigations. Introduction to structuring a design research prospectus and university requirements for graduation. Determine Faculty Committee and Program of Study and file forms with Graduate College.

IND D 699: Thesis
(0-12) Cr. 6. Repeatable. F.S.SS.
Prereq: IND D 632
Advanced research component in specialized area of focus within industrial design. Culminates in a thesis document.

Integrated Studio Arts

http://www.design.iastate.edu/artvisualculture/index.php

The Department of Art and Visual Culture offers degree programs focused on visual art and visual culture and offers courses in art history, studio arts and art education. Degree offerings include the Bachelor of Arts in Art and Design, Bachelor of Fine Arts in Integrated Studio Arts and the Master of Fine Arts in Integrated Visual Arts.

Undergraduate Study

B.F.A. Integrated Studio Arts

Students select from studio options including ceramics, digital media, drawing, furniture design, illustration, jewelry and metalsmithing, scientific illustration, two- and three-dimensional mixed media, painting, photography, printmaking, textiles, and new genres. Over the four-year course of study students will develop a portfolio and prepare for a professional practice in the visual arts. This concentration engages aesthetics, visual problem-solving, critical thinking, and skill development, drawing on contemporary developments, historical and cultural theory, and studio practice.

Transfer students with studio credits from other colleges and universities must present a portfolio of work created in those courses to determine if these credits can be applied toward specific studio requirements. Students are required to present this portfolio upon admission and prior to registration for classes. Arrangements for this process must be made with department advisers.

The department offers no minor but participates in the undergraduate minors in Classical Studies, Critical Studies in Design, Design Studies and Digital Media.

Undergraduate Curriculum

The Curriculum in Integrated Studio Arts leads to a 126.5 credit undergraduate Bachelor of Fine Arts in Integrated Studio Arts. Admission into the program requires the completion of at least 30.0 credits, including the following courses: DSN S 102, 110 or 115, 131, and 183; 6 credits of Social Sciences/Humanities; 6 credits Math/Science; ENGL 150 (or test-out credit); LIB 160. Review of the student's portfolio and essay will also be significant factors.

Admission into the professional program is subject to the approval of a faculty committee following the completion of the College of Design Core Program. Applicants are reviewed on the basis of academic performance, a portfolio of original work, and a written essay.

Total Degree Requirement: 126.5 cr.
Only 65 cr. from a two-year institution can apply, and may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communication: 10 cr.
(C or better grade)

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
One course from the following:		3
COMST 101	Introduction to Communication Studies	
COMST 102	Introduction to Interpersonal Communication	
CMDIS 286	Communicating with the Deaf	
SP CM 212	Fundamentals of Public Speaking	
Total Credits		10

Humanities: 6 cr.
6 cr. from program curriculum sheet.

Social Sciences: 6 cr.
6 cr. from program curriculum sheet.

Math/Physics/Biol. Sciences: 6 cr.
6 cr. from program curriculum sheet.

General Education Courses: 9 cr.

6 credits of course levels 300-400 from department curriculum sheet		6
3 credits from department curriculum sheet		3
Total Credits		9

College of Design Core: 11.5-12 cr.

DSN S 102	Design Studio I	4
DSN S 115	Design Collaborative Seminar	0.5-1
or DSN S 110	Design Exchange Seminar I	
DSN S 131	Design Representation	4
DSN S 183	Design Cultures	3
Total Credits		11.5-12

Integrated Studio Arts Core: 31 cr.

ARTIS 202	Studio Fundamentals: Wood	2
ARTIS 203	Studio Fundamentals: Jewelry/Metalsmithing	2
ARTIS 204	Studio Fundamentals: Ceramics	2
ARTIS 206	Studio Fundamentals: Printmaking	2
ARTIS 210	Studio Fundamentals: Photo	2
ARTIS 212	Studio Fundamentals: Computers	2
ARTIS 213	Studio Fundamentals: Painting	2
ARTIS 214	Studio Fundamentals: Textiles	2
ARTIS 208	Color	3
ARTIS 230	Drawing II	3
ARTIS 310	Sources and Methods of Visual Design	3
ART H 280	History of Art I	3
ART H 281	History of Art II	3
Total Credits		31

ISA Concentration: 24 cr.
Eight courses from ARTIS studio offerings. Advisers will assist students in developing their studio concentration plan.

Art History: 9 cr.
At least 6 cr. from Art H 300+ course level.

Professional Practice: 3 cr.

ARTIS 399	BFA Professional Practice	2
ARTIS 499	BFA Exhibition	1
Total Credits		3

Electives: 11 cr.

Post-Baccalaureate Undergraduate Certificate

Iowa State's Post-Baccalaureate Undergraduate Certificate program in Integrated Studio Arts (ISA) prepares students for either graduate study or career advancements by providing a focused environment for advancing your aesthetic, technical, creative and conceptual skills. While a bachelor's degree in visual arts is not required, a strong portfolio of artwork and a written statement of purpose are required for admission. Download application requirements (http://archive.design.iastate.edu/imgFolder/files/Postbaccalaureate_ISA_2016-17.pdf) (PDF) or view online. (http://archive.design.iastate.edu/integratedstudioarts/certificate.php#appreqs)

Curriculum

As a post-baccalaureate student, you will work with a faculty adviser to create a tailored 25-credit program of study including:

- 15 credits of 300/400-level Integrated Studio courses
- Six (6) credits of 300/400-level art history courses
- Three-credit elective selected from a list of options
- One-credit capstone exhibition course

For the capstone experience, you will be expected to produce an artist's statement and a written assessment of your learning that will be reviewed, along with your art, by the arts faculty.

This 25-credit certificate program must be completed in two (2) years. Students interested in developing a body of work for admission to graduate school or for professional practice will be ideal candidates.

Application Requirements

To apply for this program, please submit the following materials.

1. Digital portfolio in PowerPoint format:
   — Twenty (20) images of recent work with no more than four (4) of the 20 images being details
   — Descriptions on each PPT image slide need to include title, date, size and medium
2. One-page statement of intent
3. Current resume
4. Name and contact information of three (3) references

Application Deadlines

Contact the College of Design for application deadlines.

Ingrid Lilligren, Professor and Chair
Department of Art and Visual Culture
Upload to CyBox (email ililligr@iastate.edu for access to upload your application)

Questions?

Contact Ingrid Lilligren (ililligr@iastate.edu?subject=Post-Baccalaureate Undergraduate Certificate in ISA), Professor and Chair, Department of Art and Visual Culture.

Integrated Studio Arts. B.F.A.

First Year

Fall	Credits	Spring	Credits
DSN S 102 or DSN S 131	4	DSN S 102 or DSN S 131	4
DSN S 183 or General Education	3	DSN S 183 or General Education	3
ENGL 150 or General Education	3	ENGL 150 or General Education	3
DSN S 110 or DSN S 115	0.5-1	General Education	3
General Education	3	General Education	3
General Education	3	LIB 160	1
	16.5-17		17

Second Year

Fall	Credits	Spring	Credits
ART H 280 (fall only)	3	ART H 281 (spring only)	3
ARTIS 208 (or 230)	3	ARTIS 230 (or 208)	3
ARTIS Studio Fundamentals	2	ARTIS Studio Fundamentals	2
ARTIS Studio Fundamentals	2	ARTIS Studio Fundamentals	2
ARTIS Studio Fundamentals	2	ARTIS Studio Fundamentals	2
ARTIS Studio Fundamentals	2	ARTIS Studio Fundamentals	2
ENGL 250 (or General Education)	3	ENGL 250 (or General Education)	3
	17		17

Third Year

Fall	Credits	Spring	Credits
ARTIS 310	3	ARTIS Studio Option	3
ARTIS Studio Option	3	ARTIS Studio Option	3
ARTIS Studio Option	3	ARTIS Studio Option	3
ART H 300 level or above	3	ART H 300 level or above	3
General Education	3	ARTIS 399	2
		DSN S 301 (Rome option only)	1
		ARTIS 494 (Rome option only)	1
	15		16

Fourth Year

Fall	Credits	Spring	Credits
ARTIS Studio Option	3	ARTIS Studio Option	3
ART H 300 level or above	3	ARTIS 499	1
General Education	3	General Education	3
Elective	3	Elective	3
		Elective	2
	15		15

Admission into the BFA in Integrated Studio Arts requires the completion of 30.0 credits including the following courses DSN S 102, 131, 183, 110 or 115, 6 credits in Social Science/Humanities, 6 credits Math/Science, ENGL 150, LIB 160. A portfolio review and essay will also be significant factors.

Graduate Study

The department offers the Master of Fine Arts (M.F.A.) in Integrated Visual Arts. The M.F.A. curriculum in Integrated Visual Arts requires a minimum of 60 credits. The program of study includes seminar classes, a studio concentration, history and criticism courses, elective courses outside the department or area of study and the completion of a thesis exhibition and thesis.

M.F.A. graduates in Integrated Visual Arts link traditional studio disciplines with interdisciplinary studies. Graduates are prepared as visual artists to enter studio practice, business, higher education or new interdisciplinary fields. The M.F.A. is recognized as the terminal degree. A required thesis exhibition is composed of two parts: a substantial exhibition; and a written statement that describes the development of the work in the exhibition, its objectives, and its historical and cultural points of reference. A thesis may be an appropriate alternative, but some portion of the work should entail an element of design problem-solving in the form of a visual product.

Studio Courses: 39 cr.

Courses numbered ARTIS	27
Studio Courses outside of ISA	6
Thesis/Orals	6

Seminar Courses: 6 or 7 cr.

(students take 3 sections of ARTIS 571 or 2 sections of ARTIS 571 and ARTIS 511)

Graduate Seminar ARTIS 571		2 credits each section
ARTIS 571A	Critique Seminar: Grants, Residencies, Exhibitions	2
ARTIS 571B	Critique Seminar: Entrepreneurialism	
ARTIS 571C	Critique Seminar: Critique and Creative Process	

Seminar in Teaching: ARTIS 511	3

Art History/Theory/Criticism: 12 cr.

ART H 501 required	3
Art History courses	9

Related Courses (outside of IVA program): 3 cr.

Total: 60 or 61 cr.

Courses primarily for undergraduates:

ARTIS 201: Creative Visual Thinking

(0-6) Cr. 3. F.S.

Exploration of the nature of visual perception in relation to issues of visual communication, problem solving, envisioning information, and visual thinking. Studio assignments to be digitized and sent to instructor electronically for evaluation and critique.

ARTIS 202: Studio Fundamentals: Wood

(0-8) Cr. 2. F.S.

Prereq: Open to all students; sophomore level and above. Required of all ISA BFA majors

Half-semester course. Introduction to wood's physical properties, its potential as an expressive medium, and basic wood working hand tools and techniques.

ARTIS 203: Studio Fundamentals: Jewelry/Metalsmithing

(0-8) Cr. 2. F.S.

Prereq: Open to all students; sophomore level and above. Required of all ISA BFA majors

Half semester course. Introduction to basic jewelry/metals design and fabrication. Forming, texturing, and joining techniques (soldering/riveting) will be explored and applied to two projects.

ARTIS 204: Studio Fundamentals: Ceramics

(0-8) Cr. 2. F.S.

Prereq: Open to all students, sophomore level and above. Required of all ISA BFA majors

Half-semester course providing an introduction to ceramic techniques including hand-building, high fire and low fire glaze applications and expressive approaches that will be applied to two projects. The emphasis is on creative communication through ceramics.

ARTIS 206: Studio Fundamentals: Printmaking

(0-8) Cr. 2. F.S.

Prereq: Open to all students, sophomore level and above. Required of all ISA BFA majors.

Introduction to relief, monoprint, lithographic and intaglio printing as methods for visual communication and expression.

ARTIS 208: Color

(0-6) Cr. 3. F.S.

Prereq: Open to all students, sophomore level and above. Required for all ISA BFA majors.

Introduction to Color Theory and applications. Exploration of additive and subtractive color systems using various media as methods for visual communication and expression.

ARTIS 210: Studio Fundamentals: Photo

(0-8) Cr. 2. F.S.

Prereq: Open to all students, sophomore level and above. Required of all ISA BFA majors.

Introduction to film camera operation and traditional black and white darkroom methods for visual communication and creative expression. Film cameras required for class but may be checked out for short periods during semester.

ARTIS 212: Studio Fundamentals: Computers

(0-8) Cr. 2. F.S.

Prereq: Open to all students, sophomore level and above. Required of all ISA BFA majors.

Half-semester course. Introduction to digital media tools and concepts through the use of Adobe PhotoShop and Illustrator to create two dimensional and time-based artworks.

ARTIS 213: Studio Fundamentals: Painting

(0-8) Cr. 2. F.S.

Prereq: Open to all students, sophomore level and above. Required of all ISA BFA majors.

Half-semester course. Introduction to preparation of painting grounds, color mixing, manipulation of paint and pictorial space as methods for visual communication and expression.

ARTIS 214: Studio Fundamentals: Textiles

(0-8) Cr. 2. F.S.

Prereq: Open to all students, sophomore level and above. Required of all ISA BFA majors.

Half semester course. Introduction to two-dimensional and three-dimensional textile techniques used for visual communication and expression.

ARTIS 227: Introduction to Creative Digital Photography
(0-6) Cr. 3.
Prereq: DSN S 102, DSN S 131 and DSN S 183 or permission of instructor.
This course will include the functions and operations of the digital camera, scanning and other image input devices, digital image manipulation, software usage and support, color management and printing, presentation of images, compositional dynamics and the development of "seeing" as a medium of design, expression, and communication. Students should have access to a good or high quality digital camera with the ability to separately adjust shutter speed, f/stop and exposure, a laptop with updated Adobe Photoshop software, and enough digital storage for all class assignments.

ARTIS 227H: Introduction to Creative Digital Photography: Honors
(0-6) Cr. 3-4.
Prereq: DSN S 102, DSN S 131 and DSN S 183
This course will include the functions and operations of the digital camera, scanning and other image input devices, digital image manipulation, software usage and support, color management and printing, presentation of images, compositional dynamics and the development of "seeing" as a medium of design, expression, and communication. Students should have access to a good or high quality digital camera with the ability to separately adjust shutter speed, f/stop and exposure, a laptop with updated Adobe Photoshop software, and enough digital storage for all class assignments.

ARTIS 229: Introduction to Darkroom Photography
(0-6) Cr. 3.
Prereq: DSN S 102, DSN S 131 and DSN S 183 or permission of instructor
Photography as a creative medium of art, design, expression and communication. Camera techniques and black and white wet lab processing taught. Alternative processes explored as time permits. 35 mm camera with manual exposure controls is required.

ARTIS 229H: Introduction to Darkroom Photography, Honors
(0-6) Cr. 3-4.
Prereq: DSN S 102, DSN S 131 and DSN S 183 or permission of instructor
Photography as a creative medium of art,design, expression and communication. Camera techniques and black and white wet lab processing taught. Alternative processes explored as time permits. 35 mm camera with manual exposure controls is required.

ARTIS 230: Drawing II
(0-6) Cr. 3. F.S.
Prereq: DSN S 102, DSN S 183 and DSN S 131
A continuation of DSN S 131 (Design Representation). Further development of perceptual drawing skills from a variety of subject matter. Continued practice with drawing materials and techniques with emphasis on tonal and color media.

ARTIS 233: Watercolor Painting
(0-6) Cr. 3.
Prereq: ARTIS 230
Fundamentals of painting using water-based media applied to observation-based painting. Subject matter may include working from actual or two-dimensional references of still life, landscape, architectural space, and the human form.

ARTIS 233H: Watercolor Painting: Honors
(0-6) Cr. 3-4.
Prereq: ARTIS 230
Fundamentals of painting using water-based media applied to observation-based painting. Subject matter may include working from actual or two-dimensional references of still life, landscape, architectural space, and the human form.

ARTIS 238: Painting I
(0-6) Cr. 3. F.S.
Prereq: ARTIS 230
Fundamentals of painting using acrylic and oil media applied to observation-based painting. Subject matter may include working from actual or two-dimensional references of still life, landscape, and the human form.

ARTIS 238H: Painting I: Honors
(0-6) Cr. 3-4. F.S.
Prereq: ARTIS 230
Fundamentals of painting using acrylic and oil media applied to observation-based painting. Subject matter may include working from actual or two-dimensional references of still life, landscape, and the human form.

ARTIS 305: Collage, Assemblage, and Found Object
(Dual-listed with ARTIS 505). (0-6) Cr. 3. Repeatable.
Prereq: 6 credits of 200 level studio or permission of instructor
Using techniques of the collage and assemblage, this course will explore the significance of recycling, sustainable methods of art making, and thrift-store culture as medium and subject matter for artists. Through selected readings, slide presentations, and studio activities, we will address the environmental cause and effect of materials and methods, consumption and waste, and one's personal responsibility as stewards for the planet we share. Emphasis will be on conceptual development.

ARTIS 308: Computer Modeling, Rendering and Virtual Photography
(0-6) Cr. 3.
Prereq: ARTIS 230 or permission of instructor
Introduction to 3D modeling using computer and available software. Modeling, texturing, lighting, and rendering with respect to 3D object and still scene creation.

ARTIS 308H: Computer Modeling, Rendering and Virtual Photography,:Honors
(0-6) Cr. 3-4.
Prereq: ARTIS 230 or permission of instructor
Introduction to 3D modeling using computer and available software. Modeling, texturing, lighting, and rendering with respect to 3D object and still scene creation.

ARTIS 310: Sources and Methods of Visual Design
(1-4) Cr. 3.
Study and application of methods used by contemporary artists for the purpose of generating ideas for new work. Field trip.

ARTIS 311: Contemporary Issues in Studio Art
Cr. 3.
Exploration of issues and directions in current art. Readings, discussions, and studio research projects to build an experimental and applied knowledge base for understanding each student's place in the contemporary art world.

ARTIS 319: Studio Furniture
(3-0) Cr. 3. F.
Overview of American studio furniture since 1940 including noted makers, important examples, and diverse approaches. Discussion of workmanship and the principles of furniture design. Field trip.

ARTIS 320: Introduction to Furniture Design
(0-6) Cr. 3.
Prereq: ARTIS 202 or permission of instructor.
Design and production of basic furniture forms in wood. Introduction to power tools. Develop an individual design process including an understanding of scale and proportion. Develop a deeper understanding of wood and the social and environmental implications of choices in regards to materials and processes used in furniture production.

ARTIS 320H: Introduction to Furniture Design: Honors
(0-6) Cr. 3-4.
Prereq: ARTIS 202 or permission of instructor.
Design and production of basic furniture forms in wood. Introduction to power tools. Develop an individual design process including an understanding of scale and proportion. Develop a deeper understanding of wood and the social and environmental implications of choices in regards to materials and processes used in furniture production.

ARTIS 322: Intermediate Ceramics Studio
(0-6) Cr. 3.
Prereq: ARTIS 204
Investigation of expressive forms and techniques in ceramics; introduction to throwing on the wheel, to exploration of utilitarian and sculptural approaches in the medium, and to glaze-making research and electric kiln firing.

ARTIS 322H: Intermediate Ceramics Studio: Honors
(0-6) Cr. 3-4.
Prereq: ARTIS 204
Investigation of expressive forms and techniques in ceramics; introduction to throwing on the wheel, to exploration of utilitarian and sculptural approaches in the medium, and to glaze-making research and electric kiln firing.

ARTIS 323: Scientific Illustration Principles and Techniques
(Cross-listed with BPM I). (0-6) Cr. 3. Repeatable.
Prereq: 6 credits in art and design and 3 credits in biological sciences
Studio basics and professional techniques in black & white, continuous tone, and color. Emphasis on tools, materials, and rendering.

ARTIS 324: Jewelry/Metalsmithing II
(0-6) Cr. 3.
Prereq: ARTIS 203 or permission of instructor
Continued study of traditional and contemporary metalsmithing fabrication techniques applicable to jewelry and object construction, including container forms. Emphasis on design, modeling and rendering techniques and progressive skill development. Basic stone setting and lost wax casting introduced.

ARTIS 324H: Jewelry/Metalsmithing II: Honors
(0-6) Cr. 3-4.
Prereq: ARTIS 203 or permission of instructor
Continued study of traditional and contemporary metalsmithing fabrication techniques applicable to jewelry and object construction, including container forms. Emphasis on design, modeling and rendering techniques and progressive skill development. Basic stone setting and lost wax casting introduced.

ARTIS 325: Integrated Studio Arts Seminar
(2-0) Cr. 2. Repeatable, maximum of 6 credits.
Prereq: Open to ISA BFA majors
Contemporary issues in studio arts explored through lectures, presentations and critiques.

ARTIS 326: Illustration and Illustration Software
(Cross-listed with BPM I). (0-6) Cr. 3. Repeatable.
Prereq: ARTIS 323
Application of painting, drawing, and image making techniques to communication. Development of technical abilities using illustration software. Digital and print production techniques.

ARTIS 327: Illustration as Communication
(Cross-listed with BPM I). (0-6) Cr. 3.
Prereq: ARTIS 326
Studio problems in illustration emphasizing composition and communication. Problem solving methodologies.

ARTIS 329: Creative Photography
(0-6) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ARTIS 210 or ARTIS 229 or permission of instructor
Continuation and expansion of concepts and processes from introductory photography. The class begins with advanced film camera techniques and experimentation with medium format cameras. It then moves into digital and color photography while also addressing output and presentation. Emphasis will be on the use of photography for visual communication and creative expression.

ARTIS 329H: Creative Photography, Honors
(0-6) Cr. 3-4. Repeatable, maximum of 6 credits.
Prereq: ARTIS 210 or ARTIS 229 or permission of instructor
Continuation and expansion of concepts and processes from introductory photography. The class begins with advanced film camera techniques and experimentation with medium format cameras. It then moves into digital and color photography while also addressing output and presentation. Emphasis will be on the use of photography for visual communication and creative expression.

ARTIS 330: Drawing III: Life Drawing
(0-6) Cr. 3. Repeatable.
Prereq: ARTIS 230
Drawing from the human figure.

ARTIS 330H: Drawing III: Life Drawing, Honors
(0-6) Cr. 3-4. Repeatable.
Prereq: ARTIS 230
Drawing from the human figure.

ARTIS 331: Alternative materials for Artist/Designer
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 200 level ISA studio courses, or permission of instructor
Exploration of alternative materials (primarily non-metallics, both natural and manufactured) applicable to the design and creation of small designed objects and adornment. Students will learn additive and reductive processes, experiment with found object inclusion, rubber mold-making, and resin casting. A series of finished pieces will result. Open to all majors in the College of Design.

ARTIS 335: Three-Dimensional Studio
(Cross-listed with ARCH). (1-4) Cr. 3. Repeatable, maximum of 6 credits.
This course deals with three dimensional problems in visual invention, organization, and expression emphasizing creative manipulation of tools, materials, and techniques as means for three dimensional thinking. Projects cover the additive (modeling), subtractive (carving), substitutional (casting) as well as constructive techniques.

ARTIS 337: Application of Scientific Illustration Techniques
(Cross-listed with BPM I). (0-6) Cr. 3. Repeatable, maximum of 6 credits. S.
Prereq: ARTIS 327
Rendering techniques applied to different types of biological and scientific subjects emphasizing communication. The use of traditional and digital media. Term project required.

ARTIS 338: Painting II
(0-6) Cr. 3. Repeatable.
Prereq: ARTIS 238 or ARTIS 213 and ARTIS 230
Painting using acrylic and oil media; composition and expression.

ARTIS 338H: Painting II: Honors
(0-6) Cr. 3-4. Repeatable.
Prereq: ARTIS 238 or ARTIS 213 and ARTIS 230
Painting using acrylic and oil media; composition and expression.

ARTIS 345: Woven Textile Structures
(0-6) Cr. 3. Repeatable.
Prereq: ARTIS 214 or permission of instructor
Introduction to woven textile construction using commercial and hand-dyed yarns. Emphasis on technical development of weaving as a means for personal expression as well as an understanding of its role within the applied arts.

ARTIS 345H: Woven Textile Structures, Honors
(0-6) Cr. 3-4. Repeatable.
Prereq: ARTIS 214 or permission of instructor
Introduction to woven textile construction using commercial and hand-dyed yarns. Emphasis on technical development of weaving as a means for personal expression as well as an understanding of its role within the applied arts.

ARTIS 346: Textile Surface Design
(0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 214 or permission of instructor
Exploration of hand-dyeing and discharge methods on fabric to create complex surfaces. A variety of surface embellishment techniques will be introduced. Emphasis on technical skill development and research, as well as creative use of textile surface design techniques for artistic expression.

ARTIS 346H: Textile Surface Design: Honors
(0-6) Cr. 3-4. Repeatable.
Prereq: ARTIS 214 or permission of instructor.
Exploration of hand-dyeing and discharge methods on fabric to create complex surfaces. A variety of surface embellishment techniques will be introduced. Emphasis on technical skill development and research, as well as creative use of textile surface design techniques for artistic expression.

ARTIS 347: Printed Textile Design
(0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 214 or permission of instructor
Textile hand-printing methods on fabric including block, stencil and screen-printing using dyes, discharging agents and pigments. Digital printing on fabric will be introduced. Experimental printing methods will also be explored. Emphasis on research and development of surface design techniques as a means for personal expression.

ARTIS 347H: Printed Textile Design: Honors
(0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 214 or permission of instructor
Textile hand-printing methods on fabric including block, stencil and screen-printing using dyes, discharging agents and pigments. Digital printing on fabric will be introduced. Experimental printing methods will also be explored. Emphasis on research and development of surface design techniques as a means for personal expression.

ARTIS 356: Relief Printmaking: Digital/Traditional
(Dual-listed with ARTIS 556). (0-6) Cr. 3-4. Repeatable, maximum of 6 credits. F.S.
Prereq: ARTIS 206 and ARTIS 230
In-depth exploration of digital or traditional design and block cutting processes (computer/laser cutter/CNC router or drawing/chisels). Use relief printmaking to create a unified body of prints from those blocks. Emphasis is on experimental and creative use of printmaking with study of contemporary trends.

ARTIS 356H: Relief Printmaking: Digital/Traditional, Honors
(0-6) Cr. 3-4. Repeatable, maximum of 6 credits. F.S.
Prereq: ARTIS 206 and ARTIS 230
Explore the techniques and aesthetic qualities of black and white and color relief printmaking with woodcuts, computer/laser cutter/CNC router blocks, or photopolymer plates. Emphasis is on experimental and creative use of printmaking with study of contemporary trends.

ARTIS 357: Intaglio and Monotype Printmaking: Digital / Traditional
(Dual-listed with ARTIS 557). (0-6) Cr. 3-4. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 206 and 230
Explore the techniques and aesthetic qualities of black and white and color intaglio printmaking primarily through etching, aquatint, laser-cut plates and collagraph processes. Students will generate imagery through traditional drawing, collage and digital processes. Unique, one-of-a-kind black and white and color prints from Plexiglas will also be introduced. Emphasis is on experimental and creative use of printmaking for artistic expression.

ARTIS 357H: Intaglio and Monotype Printmaking: Digital / Traditional, Honors
(Dual-listed with ARTIS 557H). (0-6) Cr. 3-4. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 206 and ARTIS 230
Explore the techniques and aesthetic qualities of black and white and color intaglio printmaking primarily through etching, aquatint, laser-cut plates and collagraph processes. Students will generate imagery through traditional drawing, collage and digital processes. Unique, one-of-a-kind black and white and color prints from Plexiglas will also be introduced. Emphasis is on experimental and creative use of printmaking for artistic expression.

ARTIS 358: Lithography: Digital / Traditional
(Dual-listed with ARTIS 558). (0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 206 and credit or enrollment in ARTIS 230
Examine the techniques and aesthetic qualities of lithography primarily through hand-drawn and photographic plates. Students may generate imagery through traditional drawing, collage or digital processes. Emphasis is on experimental and creative use of printmaking for artistic expression. For those taking the course for a second semester, focus is on stone lithography and increased work with color.

ARTIS 358H: Lithography: Digital / Traditional, Honors
(0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 206 and credit or enrollment in ARTIS 230
Examine the techniques and aesthetic qualities of lithography primarily through hand-drawn and photographic plates. Students may generate imagery through traditional drawing, collage or digital processes. Emphasis is on experimental and creative use of printmaking for artistic expression. For those taking the course for a second semester, focus is on stone lithography and increased work with color.

ARTIS 360: Sustainable Design and Fabrication of Furniture
(0-6) Cr. 3. F.S.
An introduction to issues of design and fabrication of furniture focusing on sustainability. Exploration of the effect of consumers on design and how this affects our environment and our global society.

ARTIS 362: Artists, Designers and Sustainable Development
(0-6) Cr. 3. S.
Prereq: Junior level standing in the University
The artist/designer's role in sustainable development with a focus on cultural understanding of the collaborating communities. Class discussion, visual exercises, and the creation of creative collaborative service-learning projects such as product design, habitat design, and visual arts projects. Preorientation for travel to Ghana in ARTIS 363. Meets International Perspectives Requirement.

ARTIS 363: Studio Abroad: Ghana
(0-6) Cr. 3. SS.
Prereq: ARTIS 362
Traveling studio to Ghana, West Africa; an experiential tour of arts and history combined with design focused collaborative service-learning projects. Projects may include product development, design consultation, sustainable building design, and learning and teaching of visual arts. Student teams will develop projects in partnership with Ghanaians. Meets International Perspectives Requirement.

ARTIS 399: BFA Professional Practice
(2-0) Cr. 2. S.
Prereq: Junior classification in ISA BFA curriculum.
Introduction to professional practices including development of portfolio (visual and written components). Lecture and presentation topics include applying to graduate school, internships, applying for jobs, grants/funding opportunities, professional networking, exhibition opportunities, and best practices for studio artists. Half-semester course. Required of all ISA majors.

ARTIS 407: Principles of 3D Character Animation
(Dual-listed with ARTIS 507). (0-6) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of character animation. Prior knowledge of modeling, lighting, texturing and rendering with available software is assumed.

ARTIS 407H: Principles of 3D Character Animation: Honors
(Dual-listed with ARTIS 507H). (0-6) Cr. 3-4. Repeatable, maximum of 9 credits.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of character animation. Prior knowledge of modeling, lighting, texturing and rendering with available software is assumed.

ARTIS 408: Principles of 3D Animation
(0-6) Cr. 3. Repeatable.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of animation. Prior knowledge of modeling, lighting, texturing, animation and rendering with computer and available software is assumed.

ARTIS 408H: Principles of 3D Animation: Honors
(0-6) Cr. 3-4. Repeatable.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of animation. Prior knowledge of modeling, lighting, texturing, animation and rendering with computer and available software is assumed.

ARTIS 409: Computer/Video Game Design and Development
(Dual-listed with ARTIS 509). (0-6) Cr. 3. Repeatable, maximum of 12 credits.
Prereq: Permission of instructor. Programming emphasis: COM S 227, COM S 228, COM S 229 or equivalent in engineering; art or graphics emphasis: ARTIS 230 and ARTIS 308; writing emphasis: an English course in creative writing or writing screen plays; business or marketing students: Junior classification
Independent project based creation and development of "frivolous and non-frivolous" computer games in a cross-disciplinary team. Projects require cross-disciplinary teams. Aspects of Indie development and computer/video game history will be discussed.

ARTIS 420: Advanced Furniture Design
(Dual-listed with ARTIS 520). (0-6) Cr. 3-4. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 320
Design and creation of more complex furniture forms with consideration of precedents and innovative techniques and approaches. Continued development of a unique personal approach to the design and making of furniture. Refine your sensitivity to wood and understand the social and environmental implications of various materials used in furniture design and production.

ARTIS 420H: Advanced Furniture Design: Honors
(Dual-listed with ARTIS 520H). (0-6) Cr. 3-4. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 320
Design and creation of more complex furniture forms with consideration of precedents and innovative techniques and approaches. Continued development of a unique personal approach to the design and making of furniture. Refine your sensitivity to wood and understand the social and environmental implications of various materials used in furniture design and production.

ARTIS 422: Ceramics Studio
(Dual-listed with ARTIS 522). (0-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 322 for enrollment in ARTIS 422; graduate standing or permission of instructor for enrollment in ARTIS 522
Creation of a body of work in personal ceramic forms and unique surface treatments. Gas Kiln firings, research into contemporary ceramic artists and development of a body of increasingly skilled work are emphasized. Students are expected to be capable of independent studio work and take responsibility for kiln firings.

ARTIS 422H: Ceramics Studio: Honors
(0-6) Cr. 3-4. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 322 for enrollment in ARTIS 422; graduate standing or permission of instructor for enrollment in ARTIS 522
Creation of a body of work in personal ceramic forms and unique surface treatments. Gas Kiln firings, research into contemporary ceramic artists and development of a body of increasingly skilled work are emphasized. Students are expected to be capable of independent studio work and take responsibility for kiln firings.

ARTIS 424: Jewelry/Metalsmithing III
(Dual-listed with ARTIS 524). (0-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 324 or permission of instructor
Emphasis on metal fabrication and hollow construction techniques applicable to jewelry, functional objects and sculptural art forms. Processes introduced include raising, forming, and anticlastic shell forming techniques. Introduction to mechanisms and tool making. Advanced students are encouraged to integrate alternative materials and technologies. A focus is placed on independent research, professional engagement and portfolio development.

ARTIS 424H: Jewelry/Metalsmithing III: Honors
(Dual-listed with ARTIS 524H). (0-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 324 or permission of instructor
Emphasis on metal fabrication and hollow construction techniques applicable to jewelry, functional objects and sculptural art forms. Processes introduced include raising, forming, and anticlastic shell forming techniques. Introduction to mechanisms and tool making. Advanced students are encouraged to integrate alternative materials and technologies. A focus is placed on independent research, professional engagement and portfolio development.

ARTIS 429: Advanced Photography
(Dual-listed with ARTIS 529). (0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 329
Independent, advanced work in traditional alternative and/or digital photographic processes. Emphasis is on development of a unified body of work and research into contemporary photographers and aesthetic concern.

ARTIS 429H: Advanced Photography: Honors
(0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 329
Independent, advanced work in traditional alternative and/or digital photographic processes. Emphasis is on development of a unified body of work and research into contemporary photographers and aesthetic concern.

ARTIS 430: Drawing IV
(Dual-listed with ARTIS 530). (0-6) Cr. 3. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 330
Figurative and/or non-figurative drawing with advanced work in media, composition, and theory.

ARTIS 430H: Drawing IV: Honors
(0-6) Cr. 3-4. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 330
Figurative and/or non-figurative drawing with advanced work in media, composition, and theory.

ARTIS 432: Sequential Narrative Drawing
(Dual-listed with ARTIS 532). (0-6) Cr. 3. S.
Prereq: For ARTIS 432: DSN S 131, plus ARTIS 230, ARTIS 330, or instructor permission. For ARTIS 532, Graduate classification or instructor permission.
Studio course in drawing focusing on the fundamentals of communicating a narrative through sequential images in a variety of applications. Emphasis will be placed on visual research, ideation, concept art and process sketching.

ARTIS 438: Painting III
(Dual-listed with ARTIS 538). (0-6) Cr. 3. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 338
Figurative and non-figurative painting with advanced work in media, composition, and theory.

ARTIS 438H: Painting III: Honors
(0-6) Cr. 3-4. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 338
Figurative and non-figurative painting with advanced work in media, composition, and theory.

ARTIS 447: Printed Textile Design
(Dual-listed with ARTIS 547). (0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 347 or permission of instructor.
Exploration of hand-printing methods on fabric including block, stencil, and screen-printing using dyes, discharging agents, and pigments. Individualized research and development of surface design techniques as means for personal expression.

ARTIS 448: Digital Textile Design
(Dual-listed with ARTIS 548). (0-6) Cr. 3. Repeatable. F.S.
Prereq: Junior classification in either College of Design or Apparel, Merchandising, Design
This hands-on studio course will allow students to explore digital printing technology and its application to textile design for those working within industry as well as independent studio practitioners. Digital design development includes pattern repeats and photo manipulation to create unique textile designs for fashion, interior and fine art applications.

ARTIS 458: Advanced Printmaking
(0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 356, ARTIS 357, or ARTIS 358, and permission of instructor
Independent, advanced work in printmaking processes. Emphasis is on development of a unified body of work and research into contemporary artists.

ARTIS 458H: Advanced Printmaking: Honors
(0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 356, ARTIS 357, or ARTIS 358, and permission of instructor
Independent, advanced work in printmaking processes. Emphasis is on development of a unified body of work and research into contemporary artists.

ARTIS 473: Video Art
(Dual-listed with ARTIS 573). (0-6) Cr. 3.
Prereq: ARTIS 212 or permission of instructor for enrollment in ARTIS 473; graduate standing or permission of instructor for enrollment in ARTIS 573
Usage of professional video editing software and application of best practices for video production and post-production to realize original artworks. Creation of narrative and non-narrative videos and site specific video installations. Prominent examples in the history of video art provide context for the coursework. Non-repeatable for graduate students.

ARTIS 475: Interactive Art
(0-6) Cr. 3.
Prereq: ARTIS 212 or Permission of Instructor.
Create software and integrate the sensors required to create interactive artworks, video games, and installations. Prominent examples in the history of interactive art provides context for the coursework.

ARTIS 482: Selected Topics in Studio Art
(Dual-listed with ARTIS 582). Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Special issues related to studio art. Topics vary each time offered.

ARTIS 490: Independent Study
Cr. 1-6. Repeatable. F.S.SS.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed craft design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490B: Independent Study: Ceramics
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490C: Independent Study: Computer Art and Design
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490D: Independent Study: Drawing
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490E: Independent Study: Textiles
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490F: Independent Study: Illustration
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490G: Independent Study: Metals
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490H: Independent Study: Honors
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490I: Independent Study: Painting
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490J: Independent Study: Photography
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490K: Independent Study: Printmaking
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490L: Independent Study: Furniture
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 490M: Independent Study: Mixed Media
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTIS 491: Post Baccalaureate Capstone Course
Cr. 1. F.S.
Prereq: Enrollment in Post Baccalaureate Program.
Exhibition of artwork completed in the Post Baccalaureate program, required for fulfillment of certificate. Offered on a satisfactory-fail basis only.

ARTIS 493: Workshop
Cr. 1-3. Repeatable. SS.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493B: Workshop: Ceramics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493C: Workshop: Computer Art and Design
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493D: Workshop: Drawing
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493E: Workshop: Textiles
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493F: Workshop: Illustration
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493G: Workshop: Metals
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493H: Workshop: Honors
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493I: Workshop: Painting
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493J: Workshop: Photography
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493K: Workshop: Printmaking
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493L: Workshop: Furniture
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 493M: Workshop: Mixed Media
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 494: Integrated Studio Arts in Europe Seminar
(1-0) Cr. 1.
Prereq: Permission of instructor and planned enrollment in ARTIS 495
Cultural and historical aspects of art and design in Western Europe in preparation for study abroad. Area of study varies each time offered. Offered on a satisfactory-fail basis only. Offered on a satisfactory-fail basis only.
Meets International Perspectives Requirement.

ARTIS 495: Integrated Studio Arts in Europe
(Dual-listed with ARTIS 595). Cr. 3.
Prereq: Graduate classification, ARTIS 494 or equivalent, permission of instructor
International study abroad program in western Europe. Visits to design studios, art museums, and educational facilities. Related activities depending on specific area of study which may vary each time offered.
Meets International Perspectives Requirement.

ARTIS 496: Art and Design Field Study
Cr. R. Repeatable.
Prereq: Concurrent enrollment in an art and design studio or integrated studio arts course and permission of instructor
Study and tours of museums, galleries, artist and/or designer studios and other areas of interest within art and design. Offered on a satisfactory-fail basis only.

ARTIS 497: Studio Internship
Cr. 1-6. Repeatable, maximum of 6 credits.
Prereq: Advanced classification in a department curriculum
Written approval of supervising instructor and department chair on required form in advance of semester of enrollment. Supervised experience with a cooperating artist or studio. Offered on a satisfactory-fail basis only.

ARTIS 499: BFA Exhibition
(1-0) Cr. 1. S.
Prereq: ARTIS 399 and senior classification in the ISA BFA Curriculum.
Capstone experience for the BFA degree, including the refinement of a final portfolio (visual and written components). Guest lecturers cover range of topics relevant to the professional practice of art and design. Course culminates in the planning, design and installation of the BFA group exhibition in a formal gallery setting. Half-semester course. Required of all ISA majors.

Courses primarily for graduate students, open to qualified undergraduates:

ARTIS 505: Collage, Assemblage, and Found Object
(Dual-listed with ARTIS 305). (0-6) Cr. 3. Repeatable.
Prereq: 6 credits of 200 level studio or permission of instructor
Using techniques of the collage and assemblage, this course will explore the significance of recycling, sustainable methods of art making, and thrift-store culture as medium and subject matter for artists. Through selected readings, slide presentations, and studio activities, we will address the environmental cause and effect of materials and methods, consumption and waste, and one's personal responsibility as stewards for the planet we share. Emphasis will be on conceptual development.

ARTIS 507: Principles of 3D Character Animation
(Dual-listed with ARTIS 407). (0-6) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of character animation. Prior knowledge of modeling, lighting, texturing and rendering with available software is assumed.

ARTIS 507H: Principles of 3D Character Animation: Honors
(Dual-listed with ARTIS 407H). (0-6) Cr. 3-4. Repeatable, maximum of 9 credits.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of character animation. Prior knowledge of modeling, lighting, texturing and rendering with available software is assumed.

ARTIS 508: Computer Aided Animation and Visualization
(0-6) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ARTIS 408 or graduate classification and permission of instructor
Further investigations begun in ARTIS 408. Attention given to the workflow and management of creating animation and visualizations.

ARTIS 509: Computer/Video Game Design and Development
(Dual-listed with ARTIS 409). (0-6) Cr. 3. Repeatable, maximum of 12 credits.
Prereq: Permission of instructor. Programming emphasis: COM S 227, COM S 228, COM S 229 or equivalent in engineering; art or graphics emphasis: ARTIS 230 and ARTIS 308; writing emphasis: an English course in creative writing or writing screen plays; business or marketing students: Junior classification
Independent project based creation and development of "frivolous and non-frivolous" computer games in a cross-disciplinary team. Projects require cross-disciplinary teams. Aspects of Indie development and computer/video game history will be discussed.

ARTIS 511: Seminar in Teaching
(3-0) Cr. 3.
Prereq: Graduate classification
Readings and discussion of university level design education issues, studio/classroom observation, development of a teaching philosophy, lesson planning and presentation.

ARTIS 520: Advanced Furniture Design
(Dual-listed with ARTIS 420). (0-6) Cr. 3-4. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 320
Design and creation of more complex furniture forms with consideration of precedents and innovative techniques and approaches. Continued development of a unique personal approach to the design and making of furniture. Refine your sensitivity to wood and understand the social and environmental implications of various materials used in furniture design and production.

ARTIS 520H: Advanced Furniture Design: Honors
(Dual-listed with ARTIS 420H). (0-6) Cr. 3-4. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 320
Design and creation of more complex furniture forms with consideration of precedents and innovative techniques and approaches. Continued development of a unique personal approach to the design and making of furniture. Refine your sensitivity to wood and understand the social and environmental implications of various materials used in furniture design and production.

ARTIS 522: Ceramics Studio
(Dual-listed with ARTIS 422). (0-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 322 for enrollment in ARTIS 422; graduate standing or permission of instructor for enrollment in ARTIS 522
Creation of a body of work in personal ceramic forms and unique surface treatments. Gas Kiln firings, research into contemporary ceramic artists and development of a body of increasingly skilled work are emphasized. Students are expected to be capable of independent studio work and take responsibility for kiln firings.

ARTIS 524: Jewelry/Metalsmithing III
(Dual-listed with ARTIS 424). (0-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 324 or permission of instructor
Emphasis on metal fabrication and hollow construction techniques applicable to jewelry, functional objects and sculptural art forms. Processes introduced include raising, forming, and anticlastic shell forming techniques. Introduction to mechanisms and tool making. Advanced students are encouraged to integrate alternative materials and technologies. A focus is placed on independent research, professional engagement and portfolio development.

ARTIS 524H: Jewelry/Metalsmithing III: Honors
(Dual-listed with ARTIS 424H). (0-6) Cr. 3. Repeatable, maximum of 12 credits. F.S.
Prereq: ARTIS 324 or permission of instructor
Emphasis on metal fabrication and hollow construction techniques applicable to jewelry, functional objects and sculptural art forms. Processes introduced include raising, forming, and anticlastic shell forming techniques. Introduction to mechanisms and tool making. Advanced students are encouraged to integrate alternative materials and technologies. A focus is placed on independent research, professional engagement and portfolio development.

ARTIS 529: Advanced Photography
(Dual-listed with ARTIS 429). (0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 329
Independent, advanced work in traditional alternative and/or digital photographic processes. Emphasis is on development of a unified body of work and research into contemporary photographers and aesthetic concern.

ARTIS 530: Drawing IV
(Dual-listed with ARTIS 430). (0-6) Cr. 3. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 330
Figurative and/or non-figurative drawing with advanced work in media, composition, and theory.

ARTIS 532: Sequential Narrative Drawing
(Dual-listed with ARTIS 432). (0-6) Cr. 3. S.
Prereq: For ARTIS 432: DSN S 131, plus ARTIS 230, ARTIS 330, or instructor permission. For ARTIS 532, Graduate classification or instructor permission.
Studio course in drawing focusing on the fundamentals of communicating a narrative through sequential images in a variety of applications. Emphasis will be placed on visual research, ideation, concept art and process sketching.

ARTIS 538: Painting III
(Dual-listed with ARTIS 438). (0-6) Cr. 3. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 338
Figurative and non-figurative painting with advanced work in media, composition, and theory.

ARTIS 547: Printed Textile Design
(Dual-listed with ARTIS 447). (0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 347 or permission of instructor.
Exploration of hand-printing methods on fabric including block, stencil, and screen-printing using dyes, discharging agents, and pigments. Individualized research and development of surface design techniques as means for personal expression.

ARTIS 548: Digital Textile Design
(Dual-listed with ARTIS 448). (0-6) Cr. 3. Repeatable. F.S.
Prereq: Junior classification in either College of Design or Apparel, Merchandising, Design
This hands-on studio course will allow students to explore digital printing technology and its application to textile design for those working within industry as well as independent studio practitioners. Digital design development includes pattern repeats and photo manipulation to create unique textile designs for fashion, interior and fine art applications.

ARTIS 556: Relief Printmaking: Digital/Traditional
(Dual-listed with ARTIS 356). (0-6) Cr. 3-4. Repeatable, maximum of 6 credits. F.S.
Prereq: ARTIS 206 and ARTIS 230
In-depth exploration of digital or traditional design and block cutting processes (computer/laser cutter/CNC router or drawing/chisels). Use relief printmaking to create a unified body of prints from those blocks. Emphasis is on experimental and creative use of printmaking with study of contemporary trends.

ARTIS 557: Intaglio and Monotype Printmaking: Digital / Traditional
(Dual-listed with ARTIS 357). (0-6) Cr. 3-4. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 206 and 230
Explore the techniques and aesthetic qualities of black and white and color intaglio printmaking primarily through etching, aquatint, laser-cut plates and collagraph processes. Students will generate imagery through traditional drawing, collage and digital processes. Unique, one-of-a-kind black and white and color prints from Plexiglas will also be introduced. Emphasis is on experimental and creative use of printmaking for artistic expression.

ARTIS 557H: Intaglio and Monotype Printmaking: Digital / Traditional, Honors
(Dual-listed with ARTIS 357H). (0-6) Cr. 3-4. Repeatable, maximum of 9 credits. F.S.
Prereq: ARTIS 206 and ARTIS 230
Explore the techniques and aesthetic qualities of black and white and color intaglio printmaking primarily through etching, aquatint, laser-cut plates and collagraph processes. Students will generate imagery through traditional drawing, collage and digital processes. Unique, one-of-a-kind black and white and color prints from Plexiglas will also be introduced. Emphasis is on experimental and creative use of printmaking for artistic expression.

ARTIS 558: Lithography: Digital / Traditional
(Dual-listed with ARTIS 358). (0-6) Cr. 3. Repeatable. F.S.
Prereq: ARTIS 206 and credit or enrollment in ARTIS 230
Examine the techniques and aesthetic qualities of lithography primarily through hand-drawn and photographic plates. Students may generate imagery through traditional drawing, collage or digital processes. Emphasis is on experimental and creative use of printmaking for artistic expression. For those taking the course for a second semester, focus is on stone lithography and increased work with color.

ARTIS 558H: Lithography: Digital / Traditional, Honors
(Dual-listed with ARTIS 358H). (0-6) Cr. 3-4. Repeatable. F.S.
Prereq: ARTIS 206 and credit or enrollment in ARTIS 230
Examine the techniques and aesthetic qualities of lithography primarily through hand-drawn and photographic plates. Students may generate imagery through traditional drawing, collage or digital processes. Emphasis is on experimental and creative use of printmaking for artistic expression. For those taking the course for a second semester, focus is on stone lithography and increased work with color.

ARTIS 571A: Critique Seminar: Grants, Residencies, Exhibitions
(2-0) Cr. 2.
Prereq: Admission into graduate program in the College of Design
Ongoing critiques and dialog about progress of studio projects. Graduate students will learn to articulate their ideas from concept to creation. Emphasis will be on the examination of professional practices of artists.

ARTIS 571B: Critique Seminar: Entrepreneurialism
(2-0) Cr. 2.
Prereq: Admission into graduate program in the College of Design
Ongoing critiques and dialog about progress of studio projects. Graduate students will learn to articulate their ideas from concept to creation. Emphasis will be on the examination of creative business opportunities related to students' areas of interest.

ARTIS 571C: Critique Seminar: Critique and Creative Process
(2-0) Cr. 2. Repeatable, maximum of 4 credits.
Prereq: Admission into graduate program in the College of Design
Ongoing weekly critiques and dialog about sources, methods, and progress of studio projects. Graduate students will learn to articulate their ideas from concept to creation. The interaction of students at different levels in a broad spectrum of studio courses will reveal commonalities and connections between all of the visual arts, accelerating individual creative development.

ARTIS 573: Video Art
(Dual-listed with ARTIS 473). (0-6) Cr. 3.
Prereq: ARTIS 212 or permission of instructor for enrollment in ARTIS 473; graduate standing or permission of instructor for enrollment in ARTIS 573
Usage of professional video editing software and application of best practices for video production and post-production to realize original artworks. Creation of narrative and non-narrative videos and site specific video installations. Prominent examples in the history of video art provide context for the coursework. Non-repeatable for graduate students.

ARTIS 582: Selected Topics in Studio Art
(Dual-listed with ARTIS 482). Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Special issues related to studio art. Topics vary each time offered.

ARTIS 590: Special Topics

Cr. arr. F.S.SS.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590B: Special Topics: Ceramics

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590C: Special Topics: Computer Art and Design

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590D: Special Topics: Drawing

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590E: Special Topics: Textiles

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590F: Special Topics: Illustration

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590G: Special Topics: Metals

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590I: Special Topics: Painting

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590J: Special Topics: Photography

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590K: Special Topics: Printmaking

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590L: Special Topics: Furniture

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 590M: Special Topics: Mixed Media

Cr. arr.

Prereq: Bachelor degree in art and/or design, or evidence of satisfactory equivalency in specialized area

Written approval of instructor and department chair on required form in advance of semester of enrollment.

ARTIS 593: Workshop

Cr. 1-3. Repeatable. SS.

Prereq: Graduate classification and permission of instructor

Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593B: Workshop: Ceramics

Cr. 1-3. Repeatable.

Prereq: Graduate classification and permission of instructor

Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593C: Workshop: Computer Art and Design
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593D: Workshop: Drawing
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593E: Workshop: Textiles
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593F: Workshop: Illustration
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593G: Workshop: Metals
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593I: Workshop: Painting
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593J: Workshop: Photography
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593K: Workshop: Printmaking
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593L: Workshop: Furniture
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 593M: Workshop: Mixed Media
Cr. 1-3. Repeatable.
Prereq: Graduate classification and permission of instructor
Intensive 2 to 4 week studio exploration. Topics vary each time offered and may have prerequisites.

ARTIS 595: Integrated Studio Arts in Europe
(Dual-listed with ARTIS 495). Cr. 3.
Prereq: Graduate classification, ARTIS 494 or equivalent, permission of instructor
International study abroad program in western Europe. Visits to design studios, art museums, and educational facilities. Related activities depending on specific area of study which may vary each time offered. Meets International Perspectives Requirement.

Courses for graduate students:

ARTIS 605: Research Methods
(3-0) Cr. 3.
Prereq: Permission of instructor
Research strategies related to fine art and technology. Application of selected methods to specific issues.

ARTIS 607: Intermedia
(0-6) Cr. 3. F.S.
Prereq: Graduate classification and permission of instructor.
Exploration and application of media with various materials, methods and ideas.

ARTIS 697: Studio Internship
Cr. arr.
Prereq: Graduate classification and approval of POS committee
Supervised off-campus learning experience with a prominent artist, designer, or firm.

ARTIS 698: Current Issues in Studio Arts
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.
Prereq: Graduate classification and permission of instructor.
Selected issues in contemporary studio arts. Topics and readings vary each time offered.

ARTIS 699: Research
Cr. arr. Repeatable.
Research in Integrated Studio Arts.

ARTIS 699A: Research: Thesis
Cr. arr. Repeatable.
Research thesis.

ARTIS 699B: Research: Thesis-exhibition
Cr. arr. Repeatable.
Research exhibition.

Interior Design

http://www.design.iastate.edu/interiordesign/index.php

The department offers the degree Bachelor of Fine Arts (B.F.A.) in Interior Design.

B.F.A. Interior Design. Emphasis is on the student's application of design processes to creatively solve problems of the interior environment based on knowledge of human safety, functional utility, physical, psychological, and contextual fit. Graduates in interior design are competent in visual communication (sketching, drafting and computer aided design), design problem solving, space planning, lighting and color specification for interiors, finish and furniture selection, detailing interior construction and application of human factors. The curriculum is accredited by the Council for Interior Design Accreditation (CIDA) as providing professional level education

Transfer students with studio credits from other colleges and universities must present a portfolio of work done in those courses to determine if these credits can be applied toward specific studio requirements. Students are required to present their portfolio upon admission and prior to registration for classes. Arrangements for this process must be made with department advisers.

The department offers no minor but participates in the undergraduate minors in Critical Studies in Design, Design Studies, and Digital Media.

Curriculum in Interior Design

The Curriculum in Interior Design leads to a 129.5 credit undergraduate Bachelor of Fine Arts in Interior Design including a 30.5 credit Core Design Program.

Admission into the professional program depends upon available resources and is subject to the approval of a faculty committee at the completion of the Core Design Program. Applicants are reviewed on the basis of academic performance and a portfolio of original work.

A 34 graduate credit program is offered leading to the master of arts, for students planning to undertake professional or design research-orientated pursuits. (NOTE: Applicants without a previous undergraduate degree in interior design may be required to complete up to 40 additional credits of deficiency work).

A 60 graduate credit post-professional graduate program is also offered leading to the degree master of fine arts.

For more complete graduate program descriptions see Graduate Study under Interior Design in the Courses and Programs section.

Consideration for admission into the undergraduate Interior Design curriculum requires completion of the 30.5 credit Core Design Program, including the following courses:

DSN S 102	Design Studio I	4
DSN S 115	Design Collaborative Seminar	0.5
or DSN S 110	Design Exchange Seminar I	
DSN S 131	Design Representation	4
DSN S 183	Design Cultures	3
Six credits of Social Science/Humanities		6
Six credits of Math/Science		6
ENGL 150	Critical Thinking and Communication	3
or ENGL 250	Written, Oral, Visual, and Electronic Composition	
LIB 160	Information Literacy	1

Admission is based on department resources and will be determined by a formal review at the end of the Core Design Program.

Transfer students with studio credits from other programs, colleges, and universities must present for departmental review a portfolio of work done in those courses in order to have the credits apply toward studio requirements. Students are advised to present portfolio upon admission and prior to registration for classes. Arrangements for this process must be made with department advisers.

Total Degree Requirement: 129.5 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA average; Completion of all requirements listed below.

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communication: 10 cr.
(C or better grade)

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
One course from the following:		3
COMST 101	Introduction to Communication Studies	
COMST 102	Introduction to Interpersonal Communication	
CMDIS 286	Communicating with the Deaf	
SP CM 212	Fundamentals of Public Speaking	arr*
Total Credits		10

Humanities: 6 cr.
6 cr. from program curriculum sheet.

Social Sciences: 6 cr.
6 cr. from program curriculum sheet.

Math/Physics/Biol. Sciences: 6 cr.

One of the following:		3
MATH 104	Introduction to Probability	
MATH 105	Introduction to Mathematical Ideas	
MATH 140	College Algebra	
or MATH 15(	Discrete Mathematics for Business and Social Sciences	
Three credit hours from program curriculum sheet.		3
Total Credits		6

General Education Courses: 9 cr.
9 cr. from program curriculum sheet; 6 cr. of course level 300-400.

College of Design Core: 11.5 cr.

DSN S 102	Design Studio I	4
DSN S 115	Design Collaborative Seminar	0.5
or DSN S 110	Design Exchange Seminar I	
DSN S 131	Design Representation	4
DSN S 183	Design Cultures	3
Total Credits		11.5

General Design History: 6 cr.
Select 6 cr. from any College of Design history courses.

Interior Design: 63 cr.

ARTID 250	Fundamentals of Interior Design	2
ARTID 251	Human Factors in Design	3
ARTID 261	Graphic Communication for Interior Design I	3
ARTID 263	Graphic Communication for Interior Design II	3
ARTID 265	Interior Design Studio I	4
ARTID 267	Interior Design Studio II	4
ARTID 259	Sophomore Field Study	R
ARTID 350	Interior Finish Materials and Systems	3
ARTID 351	Interior Health and Safety Systems	3
ARTID 352	Interior Environmental Control Systems	3
ARTID 353	Interior Building Systems and Details	3
ARTID 355	Interior Design History/Theory/Criticism I	3
ARTID 356	Interior Design History/Theory/Criticism II	3
ARTID 359	Junior Field Study	R
Interior Design Internship Seminar taken during Sophomore and Junior years		1
ARTID 360	Sophomore Interior Design Internship Seminar	1
ARTID 365	Interior Design Studio III	4
ARTID 367	Interior Design Studio IV	4-5
ARTID 459	Senior Field Study	R
ARTID 460	Interior Design Internship	3
ARTID 461	Interior Design Professional Practices	2
ARTID 465	Interior Design Studio V	4
ARTID 467	Interior Design Studio VI	4
or DSN S 546	Interdisciplinary Design Studio	
ARTID 569	Advanced Studies in Interior Design	3
Total Credits		63-64

Studio/Business Option: 6 cr.
6 cr. from program curriculum sheet.

Electives: 6 cr.
Complete electives sufficient to complete graduation requirements.

Interior Design, B.F.A.

Freshman

Fall	Credits	Spring	Credits
DSN S 102 or DSN S 131	4	DSN S 102 or DSN S 131	4
DSN S 115	0.5	DSN S 183 or Gen Edu	3
DSN S 183 or Gen Edu	3	ENGL 250 or Gen Edu	3
ENGL 150	3	Gen Edu	3
Gen Edu	3	Gen Edu	3
Gen Edu	3	LIB 160	1
	16.5		17

Sophomore

Fall	Credits	Spring	Credits
ARTID 250	2	ARTID 263	3
ARTID 251	3	ARTID 259	0
ARTID 261	3	ARTID 267	4
ARTID 265	4	ARTID 351	3
ARTID 350	3	ARTID 355	3
ENGL 250 or Gen Edu	3	ARTID 360	1
		(ART 494I-Rome Preg)	1

	(DSN S 492 Sec1-Rome Prep)	1	
	(DSN S 301-Rome Prep)	1	
	18	17	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
ARTID 353	3	ARTID 352	3	ARTID 460	3
ARTID 356 or Gen Design Edu	3	ARTID 360	0.5		
ARTID 359	0	ARTID 367	4		
ARTID 365	4	Gen Design Edu	3		
Studio/Bus Option	3	Gen Edu	6		
Gen Design Edu or Gen Edu	3				
	16		16.5		3

Senior

Fall	Credits	Spring	Credits
ARTID 356 or Elective	3	ARTID 461	2
ARTID 459	0	ARTID 467 or DSN S 546	4-6
ARTID 465	4	ARTID 469 or Gen Edu	3
ARTID 469 or Gen Edu	3	Gen Edu	3
Studio/Bus Option	3	Elective	3
Gen Edu	3		
	16		15-17

Graduate Study

The department offers the degrees of Master of Fine Arts (M.F.A.) in Interior Design, and Master of Arts (M.A.) in Art and Design, with degree specialization in interior design.

The M.A. in Art and Design with specialization in interior design requires a minimum of 34 credits including a studio concentration and work in research methods and human factors. Candidates focus on research in an area of specialization culminating in a written thesis comprised of original research. Graduates have a broad understanding of current interior design issues and design research, preparing them for special analytical aspects of design practice and further studies leading to the PhD. Applicants without a degree in interior design may be required to complete up to 40 additional credits of course work.

M.F.A. graduates in Interior Design are proficient in visual communication skills, design theory, human factors, and space planning. The M.F.A. degree is considered a terminal degree in the interior design field. The degree requires completion of a written thesis comprised of original research.

Credit earned at Iowa State University or other institution for the Master of Arts degree may be applied toward the Master of Fine Arts degree at the discretion of the program of study committee.

Applicants to the graduate program should have an undergraduate major in an art or design area and demonstrate the ability to do technically competent and original work through the presentation of a slide or digital portfolio for faculty review. Past academic performance and the quality of studio work are critical in the admission process. A minimum 3.0 GPA in the student's undergraduate major is the standard for full admission to the graduate program. Admission is also determined by studio space available within the program area, which changes yearly due to graduate students' progress in their programs of study.

Graduate students who have not completed an undergraduate program of study substantially equivalent to that required of undergraduates in the department can expect that additional supporting coursework, determined by the graduate faculty, will be required.

Prospective students are advised to contact the graduate coordinator with specific questions about admission procedures and portfolio review. Application and additional program information may be obtained from the Department of Interior Design, College of Design, Iowa State University, Ames, Iowa, 50011-3092

Master of Fine Arts (MFA

Studio Courses: 18 cr.

ARTID 668	Advanced Experimental Interior Design	4
Studio Options		10
Field Trip		R

Human Factors: 15 cr.

ARTID 551	Design Humanics	3
Human Factors Options		6

Methods, Theory & Electives: 21 cr.

ARTID 552	Design Methods: Design Methods	2
ARTID Methods Option		2-3

ARTID 660	Research Methods	3
ARTID History Theory Option		3
ARTID 554	Interior Design Teaching Practicum	3
Electives		3-4

Thesis: 6 cr.

6 credits thesis		6
ARTID 699A	Thesis	

Related Courses (outside of IVA program): 3 cr.
Total 60 cr.
Courses primarily for undergraduates:

ARTID 250: Fundamentals of Interior Design
(2-0) Cr. 2. F.
The profession, issues, and the role of interior design.

ARTID 251: Human Factors in Design
(3-0) Cr. 3. F.
Overview of issues related to the human/built environment interface: introduction to health and safety factors, ergonomics, anthropometrics, sensory perception, psycho-behavioral response, physical performance, cultural factors and universal design. Emphasis on application of human factor methods to the analysis, solution, and evaluation of design problems.

ARTID 255: Forces That Shape Interior Space
(3-0) Cr. 3. F.S.
A survey of variables influencing the nature and function of "interior" environments. Review of professional, geo-political, utilitarian, social-cultural, economic, humanistic, historical, technological, and other factors as generators of form and space.

ARTID 259: Sophomore Field Study
Cr. R.
Prereq: Enrollment in interior design studio course
Study and tours of areas of interest within the interior design profession such as manufacturers, design studios, showrooms and museums. Offered on a satisfactory-fail basis only.

ARTID 261: Graphic Communication for Interior Design I
(2-4) Cr. 3. F.
Prereq: Admission to the interior design program through program review and enrollment in ARTID 265
Perspective drawing, design sketching, and presentation drawings. Introduction to technical drawing conventions, and design drawings. Emphasis on drawing layout, line quality, and lettering. Use of various rendering media and techniques on 2D and 3D drawings. Overview of presentation techniques, both visual and verbal.

ARTID 263: Graphic Communication for Interior Design II
(2-4) Cr. 3. S.
Prereq: ARTID 261, enrollment in ARTID 267
Computer visualization techniques and applications; projects employing computer graphic methods.

ARTID 265: Interior Design Studio I
(1-6) Cr. 4. F.
Prereq: Credit or enrollment in ARTID 250 and ARTID 261; admission to the interior design program through program review
Enhanced creative interior design problem solving. Emphasis on research, spatial composition theories and graphic ideation and communication as applied to the interior design of small scale environments. Modeling and manual visualization techniques.

ARTID 267: Interior Design Studio II
(1-6) Cr. 4. S.
Prereq: ARTID 265
Human factors issues including ergonomics, human behavior and the requirements of special groups. Color theories related to interior spaces. Residential interior design and medium scale projects. Detail drawings, and expansion of visualization techniques.

ARTID 350: Interior Finish Materials and Systems
(3-0) Cr. 3. S.
Prereq: Completion of the College of Design Core.
Exploration of concepts, materials, and assemblies associated with development of planar interior elements including floors, walls, ceiling, windows, and finishes. Fiber, plastic, sheet metal, and other surfacing materials. Attention to related human factors, testing, detailing, specifications writing and end-use application.

ARTID 351: Interior Health and Safety Systems
(3-0) Cr. 3. S.
Prereq: Completion of the College of Design Core.
Exploration of interior design concepts, materials, and assemblies as they contribute to the user, health, safety and general well-being. Wood, steel, masonry, and glass assemblies. Attention to related human factors, testing, codes, detailing, specifications writing and end-use application.

ARTID 352: Interior Environmental Control Systems
(3-0) Cr. 3. S.
Prereq: Completion of the College of Design Core.
Exploration of concepts, materials, assemblies associated with building service systems. Overview of electrical, lighting, acoustical, HVAC, plumbing and other non-structural building features. Attention to related human factors, testing, codes, detailing, specifications writing and end-use application.

ARTID 353: Interior Building Systems and Details
(3-0) Cr. 3. F.
Prereq: Completion of the College of Design Core.
Exploration of building construction concepts, materials, and assemblies and their influence on interior design. Attention to human factors, codes, detailing, and other interior design issues related to buildings.

ARTID 355: Interior Design History/Theory/Criticism I
(3-0) Cr. 3. S.
Theoretical approaches to evaluation of interior finishes, furnishings, and decorative arts in relation to parallel developments in art and architecture, from a critical, historical and multicultural perspective. Focus on pre-1850.

ARTID 356: Interior Design History/Theory/Criticism II
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in ARTID 355 or permission of instructor
Advanced theoretical approaches to evaluation of interior finishes, furnishings, and decorative arts in relation to parallel developments in art and architecture from a critical, historical, and multicultural perspective. Focus on mid-nineteenth and twentieth century.

ARTID 357: Made in Italy
(2-0) Cr. 2. F.
Prereq: Participation in Study Abroad Rome program
An investigation of the 20th century roots of modern Italian design and its contemporary form. Lectures and seminar presentations highlight major Italian designers and internationally significant design in the 20th century. Focus is on innovative design that exhibits a synthesis of formal and social functions.
Meets International Perspectives Requirement.

ARTID 359: Junior Field Study
Cr. R. F.
Prereq: Enrollment in third year interior design studio course
Study and tours of areas of interest within the interior design profession such as manufacturers, design studios, showrooms, and museums. Offered on a satisfactory-fail basis only.

ARTID 360: Sophomore Interior Design Internship Seminar
(1-0) Cr. 1. S.
Prereq: Sophomore classification in interior design program.
Procedural and ethical concerns relating to interior design internship. Preparation of documents for internship search. Formulation of personal internship and career goals.

ARTID 361: Junior Interior Design Internship Seminar
(1-0) Cr. 1. S.
Prereq: junior classification in interior design program.
Procedural and ethical concerns relating to interior design internship. Refinement of placement credentials and personal goals. Internship search process and agreements.

ARTID 365: Interior Design Studio III
(1-6) Cr. 4. F.
Prereq: ARTID 263, ARTID 267, and enrollment in ARTID 359
Refined methods of problem identification design programming and problem solving, including theoretically-based concept development and refinement. Emphasis and compliance with codes and standards. Produce small and large scale projects. Alternative manual and computer-based visualization methods. Teamwork. Multi-cultural, study abroad option.

ARTID 367: Interior Design Studio IV
(1-6) Cr. 4-5. S.
Prereq: ARTID 365
Emphasis on three-dimensional spatial development in large scale, multiple scale unit institutional projects. Inclusion of extensive design documentation. Expansion of alternative manual and computer-based visualization methods. Teamwork.

ARTID 367H: Interior Design Studio IV: Honors
(1-6) Cr. 4-5. S.
Prereq: ARTID 365
Emphasis on three-dimensional spatial development in large scale, multiple scale unit institutional projects. Inclusion of extensive design documentation. Expansion of alternative manual and computer-based visualization methods. Teamwork.

ARTID 459: Senior Field Study
Cr. R.
Prereq: Enrollment in fourth year interior design studio course
Study and tours of areas of interest within the interior design profession such as manufacturers, design studios, showrooms and museums. Offered on a satisfactory-fail basis only.

ARTID 460: Interior Design Internship
Cr. 3. SS.
Prereq: ARTID 350, 360, and 365
Professional interior design off-campus experience.

ARTID 461: Interior Design Professional Practices
(2-0) Cr. 2. S.
Prereq: ARTID 460
Organization and general management of the interior design office: agreements, business procedures, and professional ethics. Professional interior design issues and concerns.

ARTID 461H: Interior Design Professional Practices: Honors
(2-0) Cr. 2. S.
Prereq: ARTID 460
Organization and general management of the interior design office: agreements, business procedures, and professional ethics. Professional interior design issues and concerns.

ARTID 463: Environments for the Aging
(Dual-listed with ARTID 563). (Cross-listed with GERON, HD FS). (3-0) Cr. 3. S.
Prereq: HD FS 360 or 3 credits in housing, architecture, interior design, rehabilitation, psychology, or human development and family studies or permission of instructor
Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (on-line course offering via Distance Education).
Meets U.S. Diversity Requirement

ARTID 465: Interior Design Studio V
(Dual-listed with ARTID 565). (1-6) Cr. 4. F.
Prereq: ARTID 460, or permission of instructor, and enrollment in ARTID 459
Design research and refined problem solving methods including functional analysis, programming and detailing.

ARTID 467: Interior Design Studio VI
(Dual-listed with ARTID 567). (1-6) Cr. 4. S.
Prereq: ARTID 465
Refinement of technical, analytical and theoretical problem-solving methods and comprehensive design documentation. In-depth development of interior design projects. Current issues in interior design.

ARTID 468: Interior Design in an Urban Setting
(1-4) Cr. 3. S.
Prereq: Enrollment or credit in third year studio courses
Study of selected interior design projects and designers practicing in an urban setting. Studio project examining issues related to interior design in an urban context.

ARTID 468H: Interior Design in an Urban Setting: Honors
(1-4) Cr. 3-4. S.
Prereq: Enrollment or credit in third year studio courses
Study of selected interior design projects and designers practicing in an urban setting. Studio project examining issues related to interior design in an urban context.

ARTID 490: Independent Study
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related interior design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTID 490H: Independent Study, Honors
Cr. 1-6. Repeatable.
Prereq: Written approval of instructor and department chair on required form in advance of semester of enrollment
Student must have completed related interior design coursework appropriate to planned independent study. Offered on a graded basis or a satisfactory-fail basis.

ARTID 493: Workshop
Cr. 1-3. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: Evidence of satisfactory experience in area of specialization
Intensive 2 to 4 week studio exploration. Topics vary each time offered.

Courses primarily for graduate students, open to qualified undergraduates:

ARTID 551: Design Humanics
(3-0) Cr. 3. Repeatable, maximum of 15 credits. F.S.
Prereq: Instructor permission
An exploration of human nature as broadly defined and as applied to design of the built environment. Consideration of human characteristics, responses and performance, at varying scales, as sources of design insight. Topics vary each time offered.

ARTID 551A: Design Humanics: Sensory Perception & Ergonomic Factors
(3-0) Cr. 3. Repeatable, maximum of 9 credits. F.S.
Prereq: Instructor permission
Human factors related to the nature, performance and accommodation of the individuals and small groups, including sensation and perception, physical requirements, anthropometrics, safety and other issues connecting human needs and built environmental responses. Topics vary each time offered.

ARTID 551B: Design Humanics: Emotional, Behavioral & Contextual Factors
(3-0) Cr. 3. Repeatable, maximum of 9 credits. F.S.
Prereq: Instructor permission
Human factors issues related to the nature, performance and accommodation of medium to large groups and settings. Emphasis on psychological, sociological, cultural, interpersonal safety, and related human needs and built environmental responses. Topics vary each time offered.

ARTID 552: Design Methods: Design Methods
(2-0) Cr. 2. Repeatable, maximum of 10 credits. F.S.
Prereq: Permission of instructor
Survey of methodologies and methodological tools for varied end uses and drawn from wide ranging sources. Emphasis on their organization and application to design of the human environment. Topics vary each time offered.

ARTID 552A: Design Methods: Investigation Analysis
(2-0) Cr. 2. Repeatable, maximum of 10 credits. F.S.
Prereq: Permission of instructor
Methods of design research, analysis, programming and theory formulation.

ARTID 552B: Design Methods: Synthesis
(2-0) Cr. 2. Repeatable, maximum of 10 credits. F.S.
Prereq: Permission of instructor
Methods of synthesizing design concepts and solutions.

ARTID 552C: Design Methods: Communication
(2-0) Cr. 2. Repeatable, maximum of 10 credits. F.S.
Prereq: Permission of instructor
Methods of managing, translating, communicating and otherwise utilizing text, image, abstract and other forms of information.

ARTID 552D: Design Methods: Procedural Alternatives
(2-0) Cr. 2. Repeatable, maximum of 10 credits. F.S.
Prereq: Permission of instructor
New and specialized methodological trends, including subject or setting-specific methods.

ARTID 554: Interior Design Teaching Practicum
Cr. 3. Repeatable. F.S.SS.
Prereq: ARTID 668 and permission of instructor
Supervised practical application of interior design theory, materials, and practice to the educational process.

ARTID 559: Graduate Interior Design Field Study
Cr. 1-3. Repeatable.
Prereq: Graduate enrollment or permission of instructor
Study and tours of places of interior design-related interest such as manufacturers, design studios, related professional offices, showrooms, museums, and historical sites.

ARTID 560: Interior Design Internship
Cr. 3. F.S.SS.
Prereq: Permission of instructor.
Professional interior design off-campus experience.

ARTID 563: Environments for the Aging
(Dual-listed with ARTID 463). (Cross-listed with GERON, HD FS). (3-0) Cr. 3. S.
Prereq: HD FS 360 or 3 credits in housing, architecture, interior design, rehabilitation, psychology, or human development and family studies or permission of instructor
Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (on-line course offering via Distance Education).
Meets U.S. Diversity Requirement

ARTID 565: Interior Design Studio V
(Dual-listed with ARTID 465). (1-6) Cr. 4. F.
Prereq: ARTID 460, or permission of instructor, and enrollment in ARTID 459
Design research and refined problem solving methods including functional analysis, programming and detailing.

ARTID 567: Interior Design Studio VI
(Dual-listed with ARTID 467). (1-6) Cr. 4. S.
Prereq: ARTID 465
Refinement of technical, analytical and theoretical problem-solving methods and comprehensive design documentation. In-depth development of interior design projects. Current issues in interior design.

ARTID 568: Experimental Interior Design
(0-8) Cr. 4. Repeatable, maximum of 16 credits. F.S.
Prereq: Graduate classification and permission of instructor
Application of alternative design methods and sources of insight to the solution of human environmental design problems. Focus on the identification, formulation, refinement and application of theory to the design process. Emphasis on the pursuit of new discovery and innovative problem solving. Approaches, settings and scales vary each time offered.

ARTID 569: Advanced Studies in Interior Design
Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or permission of instructor
Examination of special issues with emphasis on their translation into design application.

ARTID 569A: Advanced Studies in Interior Design: Design Theory
Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or permission of instructor
Examination of special issues with emphasis on their translation into design application.

ARTID 569B: Advanced Studies in Interior Design: Advanced Color
Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or permission of instructor
Examination of special issues with emphasis on their translation into design application.

ARTID 569C: Advanced Studies in Interior Design: Sustainable Design
Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or permission of instructor
Examination of special issues with emphasis on their translation into design application.

ARTID 569D: Advanced Studies in Interior Design: Variable Topics
Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or permission of instructor
Examination of special issues with emphasis on their translation into design application.

ARTID 590: Special Topics
Cr. arr.
Prereq: Bachelor's degree in interior design, or evidence of satisfactory equivalency in specialized area. Written approval of instructor and department chair on required form in advance of semester of enrollment

ARTID 593: Workshop
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification; evidence of satisfactory experience in area of specialization
Intensive 2 to 4 week studio exploration. Topics vary each time offered.

ARTID 598: Research Forum
(1-0) Cr. 1-3. Repeatable, maximum of 9 times. F.S.
Prereq: Concurrent enrollment in ARTID 565, ARTID 567, ARTID 568, ARTID ARTID 665, or ARTID 668, and permission of instructor
Presentation and discussion of cross-disciplinary design research theory, methods, and application. Focus on the investigation, application, and communication of types of design research.

ARTID 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

ARTID 660: Research Methods
(3-0) Cr. 3. S.
Prereq: Permission of instructor
Research strategies related to design. Application of selected methods to specific issues. Open to non-majors.

ARTID 668: Advanced Experimental Interior Design
(0-8) Cr. 4. Repeatable, maximum of 16 credits. F.S.
Prereq: Graduate classification and permission of instructor.
Application of alternative design methods and sources of insight to the solution of human environmental design problems. Focus on the identification, formulation, refinement and application of theory to the design process. Emphasis on the pursuit of new discovery and innovative problem solving. Approaches, settings and scales vary each time offered.

ARTID 690: Advanced Topics
Cr. arr. Repeatable.
Prereq: M.F.A classification, permission of instructor

ARTID 697: Design Practicum
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Approval of POS committee
Applied, off campus, professional interior design-related experience.

ARTID 699: Research
Cr. arr. Repeatable.

ARTID 699A: Thesis
Cr. arr. Repeatable.

ARTID 699B: Thesis-Exhibition
Cr. arr. Repeatable.

ARTID A560: Interior Design Internship
Cr. 3. F.S.SS.
Prereq: Permission of instructor.
Professional interior design off-campus experience.

Landscape Architecture

Landscape Architecture is an environmental design discipline. Landscape architects actively shape the human environment: they map, interpret, imagine, draw, build, conceptualize, synthesize, and project ideas that transform landscapes. The design process involves creative expression that derives from an understanding of the context of site (or landscape) ecosystems, cultural frameworks, functional systems, and social dynamics. Students in our program learn to change the world around them by re-imagining and re-shaping the landscape to enhance its aesthetic and functional dimensions, ecological health, cultural significance, and social relevance. The profession addresses a broad range of landscapes in urban, suburban, rural, and wilderness

settings. The scale of landscape architecture projects varies from broad, regional landscape analysis and planning to detailed, individual site-scale designs. The curriculum at Iowa State prepares students for this challenge as they develop their abilities to design and communicate ideas through a sequence of foundational courses and studios. The program seeks to produce graduates who understand the ethical, social, and environmental/ecological dimensions of issues involving changes in the landscape.

Graduates are active in a broad range of careers, such as sustainable site design, land development, park management, environmental advocacy, community planning, urban design, and others. In their professional lives, graduates apply their creative and technical skills in the planned arrangement of natural and constructed elements on the land with a concern for the stewardship and conservation of natural, constructed, and human resources. The resulting environments serve useful, aesthetic, safe, and enjoyable purposes. Graduates are able to communicate effectively with colleagues in the sciences and humanities as well as in the allied professions, and are prepared to work individually and in multidisciplinary teams to address complex problems dealing with the cultural/ecological environment.

The undergraduate curriculum includes one year of the college's Core Design Program followed by a four-year professional program. Admission to the professional program is subject to the approval of a faculty committee at the completion of the Core Design Program. The department also cooperates in the undergraduate minor in Design Studies, Critical Studies in Design, and Digital Media.

Following admission to the professional program, students embark on the traveling studio during the fall semester of their second year. This studio is a full semester's credit of integrated departmental courses and involves extensive travel within and beyond the great Midwest region of North America, to study regional natural systems and the cultural responses to those systems.

To enhance the study of landscape architecture in off-campus settings, the department requires students to choose from among the following three options during the spring and summer of their fourth year: a professional internship, an independent study abroad experience, or National Student Exchange. The department assists students with placement, and additional information is provided through the department and the College of Design's Career Services Office.

Personal laptop/notebook computers and appropriate software are regularly used in classes starting with the second year.

The undergraduate curriculum is fully accredited by the Landscape Architecture Accreditation Board (LAAB) and provides the education which, combined with experience, is necessary for professional license.

Curriculum in Landscape Architecture

The department offers graduate and undergraduate degree programs.

The undergraduate program consists of a five-year curriculum, requiring 149.5 credits, leading to the degree Bachelor of Landscape Architecture. These credits are distributed between a one-year Core Program of 30 credits and a four-year professional program of 119.5 credits.

Admission into the professional program depends upon available resources and is subject to the approval of a faculty committee at the completion of the Core Design Program. Applicants are reviewed on the basis of academic performance, a portfolio of original work, and a written essay.

The BLA from Iowa State University is an LAAB (Landscape Architectural Accreditation Board)-accredited professional degree program. In the United States, most state registration boards require a degree from an accredited professional degree program as a prerequisite for professional licensure. The LAAB is the sole entity recognized by the Council for Higher Education Accreditation to accredit U.S. first professional degree programs in landscape architecture at the Bachelor's and Master's levels.

The department also offers a graduate program leading to the degrees of Master of Landscape Architecture or Master of Science in Landscape Architecture. For more complete graduate program descriptions, contact the department or go to the Graduate program link on the College of Design web page.

Total Degree Requirement: 149.5 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communications: 10 cr.
(C or better grade)

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
One of the following:		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
Total Credits		10

Humanities: 9 cr.
9 cr. from Phil, Hist, Music or other humanities course offerings.

Social Sciences: 6 cr.
6 cr. from Anthr, Econ, Pol S, Psych, or Soc.

Mathematics and Science: 12 cr.

One of the following:		3-4
MATH 140	College Algebra	
MATH 145	Applied Trigonometry	
MATH 165	Calculus I (4 crs)	
ENV S 120	Introduction to Renewable Resources	3
Science Elective		6

Additional General Education Course 3 cr.

3 cr. from 300-400 Level Courses

Design Core: 11.5 cr.

DSN S 102	Design Studio I	4
DSN S 115	Design Collaborative Seminar	0.5-1
or DSN S 110	Design Exchange Seminar I	
DSN S 131	Design Representation	4
DSN S 183	Design Cultures	3
Total Credits		11.5-12

Landscape Architecture: 89 cr.

L A 201	Studio: Landscape Interpretation and Representation	6
L A 202	Studio: Site Design I	6
L A 221	Native Plants of the Savanna Ecotone	3
L A 222	Introduced Plants of the Midwest	3
L A 241	Developing Identity as a Landscape Architect	1
L A 272	Cultural Landscape Studies	3
L A 274	The Social and Behavioral Landscape	3
L A 281	Investigating Landscape Form, Process, and Detail	3
L A 282	Landscape Dynamics	3
L A 301	Site Design II	6
L A 302	Ecological Design at the Regional Scale	6
L A 341	Contemporary Landscape Architecture	1
L A 371	History of Modern Landscapes, 1750 to Present	3
L A 373	Gardens and Landscapes from Antiquity to 1750	3
L A 381	Shaping the Land	3
L A 401	Community Design	6
L A 402	Urban Design	6
L A 444	Landscape Architecture Independent Educational Enrichment	R
L A 442	Professional Practice	2
L A 481	Landscape Construction	3
L A 482	Advanced Landscape Construction	3
DSN S 546	Interdisciplinary Design Studio	6
Plus ten credits professional electives		10
Total Credits		89

Electives: 13 cr.

Complete electives sufficient to complete graduation requirements.

Landscape Architecture, B.L.A.

First Year

Fall	Credits	Spring	Credits
DSN S 102 or DSN S 131	4		
DSN S 183 (or General Education)	3	DSN S 131 or DSN S 102	4
DSN S 115	0.5	Soc. Sciences/Humanities Elective	3
ENGL 150 or 250	3	Science Elective or MATH 142	3
Soc. Sciences/Humanities Elective	3	LIB 160	1
MATH 145	3	Elective (Optional for pre-professional year; not required for program application. If not taken in first year, add 3 cr. to a subsequent semester to meet the 150.0 credit total)	3
	16.5		14

Second Year

Fall	Credits	Spring	Credits
L A 201	6	L A 202	6
L A 221	3	L A 274	3
L A 241	1	L A 222	3
L A 272	3	L A 282	3
L A 281	3	Elective	3
	16		18

Third Year

Fall	Credits	Spring	Credits
L A 301	6	L A 302	6
L A 381	3	L A 341	1
L A 373	3	L A 371	3
ENV S 120	3	Social Science/Humanities Electives	3
ENGL 250	3	Math/Science Elective	3
	18		16

Fourth Year

Fall	Credits	Spring	Credits
L A 402	6	One of the following:	
L A 481	3	L A 444A	0
Social Science/Humanities Elective	3	L A 444B	0
LA electives	3	L A 444C	0
Communications (300 level English)	3		
DSN S 301 (Rome option only)	1		
	19		0

Fifth Year

Fall	Credits	Spring	Credits
L A 401	6	DSN S 546	6
LA Electives	3	L A 442	2
Social Science/Humanities Elective (300 level)	6	L A 482	3
LA Electives	3	Electives/LA Electives	3
		Professional Elective	1
	18		15

Additionally: Each student needs to take 3 credits of a US Diversity (usually covered by LA 272) and 3 credits of an International Perspectives course (usually covered by LA 373). Students also need to take at least 6 credits of 300 level or above in the combined areas of communication, science, math, humanities, and social science (6 total from all the areas).

Graduate Study

The department offers two primary opportunities for professional and postprofessional study: the M.L.A. degree (Master of Landscape Architecture), which provides the skills and knowledge for the application of research and or/scholarly methods to professional practice and the M.S.L.A. degree (Master of Science in Landscape Architecture), which focuses on research on the built environment. Students are also able to pursue double degrees of M.L.A. with Master of Community and Regional Planning (MLA/MCRP), Master of Urban Design (MLA/MUD), and Master of Design of Sustainable Environment (MLA/Mdes SE). Minor work is offered to students taking major work in other departments.

The M.L.A is an accredited professional degree designed for students with or without an undergraduate degree in landscape architecture. The degree provides skills and knowledge as measured by the licensing exam for students seeking to practice as a licensed professional in the public or the private sectors. The M.L.A degree also offers competency for students interested in post professional study and research. Minor work is offered to students taking major work in other departments.

The program offers three concentration tracks in the following topical area – Theory/Urbanism, Technology/Ecology, Advocacy/Community — through
coursework and/or an optional thesis and creative component. The concentration in one of the three tracks will be determined by the student in consultation with his/her major professor. It will also be designated in the Program of Study (PoS), to be completed by the end of the first year of study. Concentration electives may be selected from within the department and college and from an approved list. In their final year students will be able to take Creative Component or Thesis option with the approval of their major professor and the department Graduate Committee.

The M.S.L.A. is an unaccredited, research degree addressing landscape architecture as a scholarly endeavor. The degree is primarily intended as an advanced professional degree targeted at students already possessing an accredited first professional degree (B.L.A., B.Arch, M.Arch, etc.) and wishing to pursue in-depth, independent research. The M.S.L.A. is granted upon completion of 36 credits (at least 30 of which are completed at the 500-level) and the acceptance of a thesis or creative component. Periodically, students without accredited, first professional design degrees wish to complete an unaccredited master's degree in landscape architecture. Such students may, in special cases, be allowed to pursue an M.S.L.A.,
provided they take an additional 12 credits of coursework, at least 6 of which must be an approved design studio, for a total of 48 hours of coursework.

Students interested in the double degree programs should contact the departments to receive a detailed description of requirements. The department also offers courses in the Graduate Certificate Program in Geographic Information Systems (GIS), administered by the Department of Community and Regional Planning. Students are able to take advantage of increasing offerings of interdisciplinary graduate-level electives in all college departments.

Design and Planning: 33 cr.

L A 601	Design Representation	3
L A 602	Studio I – Land/Form & Plant/Scape	6
L A 603	Studio II – Living Systems	6
L A 604	Studio III - City Matters	6
L A 605	Studio IV - LandWorks/LandDigits	6
DSN S 546	Interdisciplinary Design Studio	6

or 2 cr. L A 580 Thesis, Creative Comp. Tutorial + 4 cr. L A 599 Creative Comp. or L A 699 Thesis

Theory/History/Urbanism: 14 cr.

L A 571	Landscape Architectural Theory	3
L A 590D	Special Topics: History/Theory/Criticism	3
or L A 578D: LA History elective*		
Concentration Theory Elective ***		3
L A 543 Colloquium I		1
L A 545 Colloquium II		1

Technology/Ecology/Materiality: 14 cr.

L A 557 Computer Applications		3
L A 583 Landscape TopoGraphics		3
L A 581 Landscape Structure		3
L A 542 Professional Practice & Enterprise		2
L A 522	Advanced Plant Technology	3

Advocacy/Planning/Policy: 9 cr.

SUS E 531	Human Dimensions of Sustainability	3
L A 593 Environmental Justice in Built Environments		3
Planning Elective**		3

Concentration Electives: 9 cr.
Elective: 3 cr.
Total 82 cr.

Approved Distribution Electives:
LA History elective (3cr.)*
Courses offered on term-by-term basis
L A 590D: Special Topics: History
L A 578D: Landscape Architecture: History

Planning elective (3cr.)**
L A 591: Environmental Law and Planning
C R P 561: Planning Theory for Practice
C R P 592: Land Use and Development Regulation Law
C R P 529: International Planning in Developing Countries

Theory elective (3 cr.)***
Theory course in your concentration area (Theory, Technology or Advocacy) – Select from CRP, ARCH, MUD, SUS E, IND D, or other relevant field in the college or university

Concentration Track Electives
1. Theory/History/Urbanism MLA/MUD
2. Advocacy/Planning/Community MLA/CRP
3. Technology/Ecology/Materiality MLA/MDES SE

Concentration track electives from approved list on separate sheet

Students may also take courses from other departments across college

Elective
3 cr. Non-LA course from college or university courses (incl. LA 509: Field Trip)

Courses primarily for undergraduates:

L A 201: Studio: Landscape Interpretation and Representation
(1-15) Cr. 6. F.
Prereq: Enrollment in the professional program
Reading and representing varied landscapes; development of aesthetic sensitivity to the geomorphology, vegetation, and cultural influences on these landscapes. Small-scale interventions and exploration of landscape phenomena and change. Emphasis on a variety of documentation and drawing techniques.

L A 202: Studio: Site Design I
(1-15) Cr. 6. S.
Prereq: L A 201
Fundamental issues of landscape planning and design at a site scale. Projects introduce a variety of (objective and subjective) site inquiry methods, space and place making, and sensitive integration of architecture and landscape for specific land uses. User needs, precedent study, programming, site engineering, planting design, and outdoor space design expressed through a variety of three-dimensional modeling, graphic, and written media.

L A 211: Digital Design Methods for Landscape Architecture
(3-0) Cr. 3. S.
Introduction of computer applications and standards used by landscape architects and other design professions and their place in a replicable work flow. Foundational knowledge and basic skills in a range of industry-standard 2D, 3D, and 4D computer applications used for design development and communication.

L A 221: Native Plants of the Savanna Ecotone
(2-3) Cr. 3. F.
Prereq: Enrollment in the professional program
Observation and study of the wetland, prairie, and woodland vegetation native to the savanna ecotone. Emphasis on plant communities, their distribution, structure, habitat and aesthetics. Plant identification and use in landscape design. Precedent and case studies of vegetation preservation, restoration and use in built works.

L A 222: Introduced Plants of the Midwest
(2-3) Cr. 3. S.
Prereq: L A 221
Identification, observation, and study of plants introduced to cultivation in the Midwest region. Plant cultural requirements, including adaptations to climate changes, solar exposure, and soil conditions. Investigation of history of plant introduction and use in designed landscape, including consequent impacts of plant introduction such as plant invasion. Introduction to planting design at the site scale, including matching plant cultural requirements to site conditions, functional uses of plants and expressive composition using plant form, texture and color.

L A 241: Developing Identity as a Landscape Architect
(1-0) Cr. 1. F.
Prereq: Enrollment in the professional program
Development of life skills for conflict resolution, effective interpersonal communication, and CPR/First Aid. Examination of personal values as they relate to the backgrounds, abilities, attitudes, and values of others; exploration of how these influence personal decision-making and group interaction. Reading, discussion, class activities, journal-keeping, writing. Offered on a satisfactory-fail basis only.

L A 270: Foundations in Natural Resource Policy and History
(Cross-listed with ENV S, NREM). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
The development of natural resource conservation philosophy and policy from the Colonial Era to the present. North American wildlife, forestry, and environmental policy; national parks and other protected lands; federal and state agencies. Relationship to cultural contexts, including urban reform and American planning movement. Discussion of common pool resources, public and private lands.

L A 272: Cultural Landscape Studies
(3-0) Cr. 3. F.
Prereq: Enrollment in the professional program
Exploration of cultural landscapes, from broad settlement patterns to individual sites, with an emphasis on the origins and evolution of landscapes. Investigation of relationships between vernacular and designed landscapes. Landscapes considered as modes of cultural production that shape and are shaped by social, political, and economic processes. Exploration of landscapes as persistent (yet ephemeral) repositories of culture. Lectures, reading, field studies, and writing.
Meets U.S. Diversity Requirement

L A 274: The Social and Behavioral Landscape
(3-0) Cr. 3. S.
Exploration of social and behavioral factors pertinent to design of the domestic, civic, and commercial landscape. Focus on working familiarity with design principles as they relate to the behavior and activities of people across a broad demographic and cultural spectrum; application of these principles to design of outdoor environments. Lectures and discussions, including group exercises and field trips.
Meets U.S. Diversity Requirement

L A 281: Investigating Landscape Form, Process, and Detail
(1-6) Cr. 3. F.
Prereq: Enrollment in professional program
Exploration of the poetics and principles of landscape construction. Investigation and interpretation of landform and geomorphic processes such as the hydrologic cycle, erosion, and sedimentation. Close observation and representation of detail design, with an emphasis on material types, their connections, and weathering. Readings, field studies, and drawings in analog and digital media.

L A 282: Landscape Dynamics
(2-2) Cr. 3. S.
Prereq: Sophomore standing
Understand design implications presented by geotechnical and ecological processes in the landscape including ecology, vegetation, soils and water. Understand the influence of landforms, geology, plants, soils, and water on the creation of landscape designs. Course relates current issues including water quality impairment, erosion, and invasive species with design strategies such as stormwater management, soil quality management, and plant community restoration. Field trips.

L A 301: Site Design II
(1-15) Cr. 6. F.
Prereq: L A 202
Development of half-acre to hundred-acre landscape design and planning proposals, potentially in collaboration with students in other programs. Apply critical methodological frameworks to shape site systems while providing appropriate support for diverse user groups and creating culturally meaningful places. Assess and interpret a program of use, organize subjective and objective site inventory and analysis, develop functional and poetic design strategies for infrastructure and natural systems, and craft artistic and functionally explicit landscape architectural proposals. Development of appropriate technique and high level of craft in representations to support design thinking process and final scheme presentation.

L A 302: Ecological Design at the Regional Scale
(1-15) Cr. 6. S.
Prereq: L A 282, L A 301, L A 381 and NREM 120
Application of ecological theories and processes in design and planning at the hundred plus-acre scale specifically focusing on urban and urban fringe landscapes. Apply advanced landscape analysis of soil, water, and vegetation utilizing geographic information systems. Particular focus on stream and wetland restoration, mitigation, and regulations and developing design representations for public use.

L A 309: Field Travel

Cr. 1. Repeatable, maximum of 2 times. F.S.SS.

Prereq: Enrollment in the professional program and permission of instructor

Observation of and reflection on professional practice and landscapes in urban, rural, and wilderness areas. Offered on a satisfactory-fail basis only.

L A 322: Fundamentals of Planting Design

(2-3) Cr. 3.

Prereq: L A 221

The art and techniques of creating plant compositions in the landscape that respond to cultural and biophysical contexts. Investigation of soil properties and plant/soil relationships relevant to the built environment. Methods of site inventory and analysis, developing plant palettes and composing plant assemblages that address expressive and functional needs. Introduction to the techniques of preparing planting plans, including standards for plant selection, plant lists and plant specification.

L A 341: Contemporary Landscape Architecture

(1-0) Cr. 1. S.

Prereq: L A 301

Exploration of contemporary landscape architectural practice through individualized research into practicing firms. Preparation of paper and presentation outlining broad framework and specific parameters of a selected area of contemporary practice using specific projects as examples. Work may result in invitation of current practitioner(s) as a lecture series or event. Resume and portfolio preparation in advance of required off-campus semester (L A 444 A, B or C).

L A 371: History of Modern Landscapes, 1750 to Present

(3-0) Cr. 3. S.

Investigation of landscape design concepts and trends as observed over time, from approximately 1750 to the present, with emphasis on the United States and Europe. Examination of significant figures and outstanding works (sites, gardens, landscapes, monuments, subdivisions, city plans, etc.) of varied geographic regions. Analysis of the social, economic, political, and technical forces contributing to the development of landscape design styles, vocabulary, and literature. Lectures, readings, projects, research papers.

L A 373: Gardens and Landscapes from Antiquity to 1750

(3-0) Cr. 3. F.

Investigation of international landscape design concepts and trends as observed over time, from pre-history to the mid 18th century. Examination of significant figures and outstanding works (sites, gardens, landscapes, monuments, subdivisions, city plans, etc.) of varied geographic regions. Analysis of the social, economic, political, and technical forces contributing to the development of landscape design styles, vocabulary, and literature. Lectures, readings, projects, research papers.
Meets International Perspectives Requirement.

L A 381: Shaping the Land

(3-0) Cr. 3. F.

Prereq: L A 282 and MATH 143 or MATH 145

Design of landforms to achieve aesthetic, functional, and safety goals. Landform changes to accommodate human uses and activities. Impacts and implications of landform transformation on the surrounding environment. Surface and subsurface drainage design, storm water runoff best management practices, contour manipulation to incorporate slopes, swales, culverts, pads, retaining walls, walks, steps, terraces, buildings, and other structures in the landscape. Road layout and alignment, parking lot design, and earthwork volume estimates. Design communication using CAD, perspectives, cross-sections, contour maps, landform models, and narratives. Class exercises, case study precedents, and preliminary construction documents.

L A 401: Community Design

(1-15) Cr. 6. F.

Prereq: L A 402

Physical planning and design of places utilizing community-based methods. Projects address social and cultural dimensions of placemaking such as reuse of abandoned sites, in-fill development, and community visioning. Emphasis on development of user-client relationship skills and design research. Integrated seminar component.

L A 401H: Community Design: Honors

(1-15) Cr. 7. F.

Prereq: L A 402

Physical planning and design of places utilizing community-based methods. Projects address social and cultural dimensions of placemaking such as reuse of abandoned sites, in-fill development, and community visioning. Emphasis on development of user-client relationship skills and design research. Integrated seminar component.

L A 402: Urban Design

(1-15) Cr. 6. F.

Prereq: L A 302

Comprehensive planning and design for urban sites or for sites within urban contexts. Projects typically include planning for a variety of integrated land uses, and cover the full range of design scales from master planning to proposals for site details. Emphasis on written and verbal as well as graphic communications. Integrated seminar component.

L A 402H: Urban Design: Honors
(1-15) Cr. 7. F.
Prereq: L A 302
Comprehensive planning and design for urban sites or for sites within urban contexts. Projects typically include planning for a variety of integrated land uses, and cover the full range of design scales from master planning to proposals for site details. Emphasis on written and verbal as well as graphic communications. Integrated seminar component.

L A 403H: Senior Thesis Preparation Tutorial
Cr. 2. F.
Prereq: L A 402, permission of thesis advisor, enrollment in Honors program
Preparation for senior thesis.

L A 404: Advanced Landscape Architectural Design
(1-15) Cr. 6. Repeatable, maximum of 2 times. S.
Prereq: L A 401
Advanced forum for the demonstration of sophistication in landscape architectural design. Experimentation and innovation are encouraged.

L A 404H: Advanced Landscape Architectural Design: Honors
(1-15) Cr. 6-7. Repeatable, maximum of 2 times. S.
Prereq: L A 401
Advanced forum for the demonstration of sophistication in landscape architectural design. Experimentation and innovation are encouraged.

L A 405H: Senior Thesis
(0-15) Cr. 6. S.
Prereq: L A 401, L A 402, L A 403, enrollment in Honors program and permission of adviser, chair and thesis adviser
Individual advanced forum for the demonstration of sophistication in landscape architectural design. Experimentation and innovation are expected.

L A 417: Urban and Peri-urban Watershed Assessment
(Dual-listed with L A 517). (Cross-listed with ENV S). (2-3) Cr. 3. F.
Prereq: Junior classification and 6 credits of natural science
Assessment and reduction of impacts in urban and peri-urban watershed areas. Course prepares students to work with various analysis methods for vegetation, topography, stormwater and stream condition as well as work with data from other disciplines. Emphasis on communicating with the public. Introductory GIS and GPS technologies are utilized. Learning is largely field-based.

L A 442: Professional Practice
(Dual-listed with L A 542). (2-0) Cr. 2. S.
Prereq: L A 481
Studies of conventional and developing forms of public and private practice. Explore relationships between professional life and the culture of the professional design firm; investigate firm identities and structures; understand design projects, their delivery process, and contractual agreements. Lecture and class discussion.

L A 444: Landscape Architecture Independent Educational Enrichment
Cr. R. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 341 or permission of adviser and chair
Independent educational enrichment through exploration of landscape architectural practice in a professional internship, international studies, or out-of-region national study experience.

L A 444A: Landscape Architecture Independent Educational Enrichment: Professional Internship
Cr. R. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 341 or permission of adviser and chair
Independent educational enrichment through exploration of landscape architectural practice in a professional internship, international studies, or out-of-region national study experience.

L A 444B: Landscape Architecture Independent Educational Enrichment: Study Abroad
Cr. R. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 341 or permission of adviser and chair
Independent educational enrichment through exploration of landscape architectural practice in a professional internship, international studies, or out-of-region national study experience.

L A 444C: Landscape Architecture Independent Educational Enrichment: National Student Exchange
Cr. R. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 341 or permission of adviser and chair
Independent educational enrichment through exploration of landscape architectural practice in a professional internship, international studies, or out-of-region national study experience.

L A 454: Fundamentals of Remote Sensing
(Dual-listed with L A 554). (Cross-listed with C R P). (3-0) Cr. 3. F.
Introduction to remote sensing techniques needed for basic analysis of satellite images, including: filtering and conflation techniques, stacking, pan sharpening, image rectification, image enhancement, unsupervised and supervised classification. Practical applications in a variety of topics to understand how to interpret images.

L A 457: Landscape Parametrics & Design Computing
(Dual-listed with L A 557). (3-0) Cr. 3. F.
Prereq: Junior classification
Exploration of computational representation of the landscape palette. Geometric parameters for terrain, vegetation, water, weather and lighting effects are modeled and developed algorithmically. Basic computer programming logic and computer graphics interactivity are combined to produce stand-alone software application prototypes that address core landscape design principles.

L A 458: Web Mapping/GIS
(Dual-listed with L A 558). (Cross-listed with C R P). (2-2) Cr. 3.
Prereq: CRP 451/551, LA 302. GEOL 452/552 or instructor permission.
Use and development of online mapping tools to support participatory GIS, Volunteered Geographic Information, information sharing, geodesign and decision making actions. Geoprocessing and Web Scripting/coding and user interface design. Laboratory emphasis practical applications and uses of Web GIS.

L A 459: Digital Design Methods for Landscape Architecture
(Dual-listed with L A 559). (Cross-listed with C R P). (3-0) Cr. 3. S.
Introduction to digital tools used by landscape architects for design communication, visualization, and design development. Include 2D drafting, 3D modeling, image CAD, geospatial data handling (GIS), and animation. Emphasis on concepts and workflow interoperability.

L A 461I: Introduction to GIS
(Cross-listed with ENSCI, ENV S, IA LL). Cr. 4. SS.
Descriptive and predictive GIS modeling techniques, spatial statistics, and map algebra. Application of GIS modeling techniques to environmental planning and resource management.

L A 478: Topical Studies in Landscape Architecture
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections. Course contact hours can range from (2-0) to (3-0) depending on number of credits.

L A 478A: Topical Studies in Landscape Architecture: Landscape Design
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478B: Topical Studies in Landscape Architecture: Planting Design
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478C: Topical Studies in Landscape Architecture: Construction
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478D: Topical Studies in Landscape Architecture: History/Theory/ Criticism
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478E: Topical Studies in Landscape Architecture: Landscape Planning
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478F: Topical Studies in Landscape Architecture: Urban Design
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478G: Topical Studies in Landscape Architecture: Graphics
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478H: Topical Studies in Landscape Architecture: Honors
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478I: Topical Studies in Landscape Architecture: Interdisciplinary Studies
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478J: Topical Studies in Landscape Architecture: International Studies
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior or graduate classification
Offerings vary with each term; check with department for available sections.

L A 478K: Landscape Architecture: Computer Applications
(Dual-listed with L A 578K). Cr. 2-3. Repeatable. F.S.SS.
Prereq: Senior classification or graduate standing
Offerings vary with each term; check with department for available sections. Course contact hours can range from (2-0) to (3-0) depending on number of credits.

L A 478L: Topical Studies in Landscape Architecture: Ecological Design
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior classification or graduate standing
Offerings vary with each term; check with department for available sections.

L A 478M: Topical Studies in Landscape Architecture: Landscape Architecture: Social/Behavioral
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior classification or graduate standing
Offerings vary with each term; check with department for available sections.

L A 478N: Topical Studies in Landscape Architecture: Natural Resources
Cr. 2-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: L A 202 or senior classification or graduate standing
Offerings vary with each term; check with department for available sections.

L A 481: Landscape Construction
(Dual-listed with L A 581). (3-0) Cr. 3. F.
Prereq: L A 381
Development of construction details with emphasis on materials and their aesthetic and functional uses as building materials. Explore characteristics and uses of construction materials and application of wood systems, paving systems, retaining walls, masonry and concrete systems, and metals; investigate structural theory of wood systems. Preliminary preparation of construction documents.

L A 482: Advanced Landscape Construction
(Dual-listed with L A 582). (3-0) Cr. 3. S.
Prereq: L A 481
Advanced site construction issues, including proposal preparation, construction documentation, project scheduling, estimating, and specification writing.

L A 490: Independent Study
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490A: Independent Study: Landscape Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490B: Independent Study: Planting Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490C: Independent Study: Construction
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490D: Independent Study: History/Theory/Criticism
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490E: Independent Study: Landscape Planning
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490F: Independent Study: Urban Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490G: Independent Study: Graphics
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490H: Independent Study: Honors
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490I: Independent Study: Interdisciplinary Studies
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490J: Independent Study: International Studies
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490K: Independent Study: Computer Applications
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490L: Independent Study: Ecological Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490M: Independent Study: Social/Behavioral
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 490N: Independent Study: Natural Resources
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Written approval of instructor and department chair on required form
Investigation of a topic of special interest to the student.

L A 491: Environmental Law and Planning
(Dual-listed with L A 591). (Cross-listed with C R P, ENV S). (3-0) Cr. 3. S.
Prereq: 6 credits in natural sciences
Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs.

Courses primarily for graduate students, open to qualified undergraduates:

L A 509: Field Travel
Cr. 1. Repeatable, maximum of 2 times.
Prereq: Enrollment in the professional program and permission of instructor
Observation of and reflection on professional and academic practice and landscapes. Field study and travel to conferences and educational events. Reading and final report. Offered on a satisfactory-fail basis only.

L A 517: Urban and Peri-urban Watershed Assessment
(Dual-listed with L A 417). (2-3) Cr. 3. F.
Prereq: Junior classification and 6 credits of natural science
Assessment and reduction of impacts in urban and peri-urban watershed areas. Course prepares students to work with various analysis methods for vegetation, topography, stormwater and stream condition as well as work with data from other disciplines. Emphasis on communicating with the public. Introductory GIS and GPS technologies are utilized. Learning is largely field-based.

L A 522: Advanced Plant Technology
(1-4) Cr. 3. F.
Prereq: Junior or graduate standing
Planting design and emergent technologies for design performance in the urban built environment. Emphasis on innovative strategies for planting design and plant technology in building design, sustainable streetscapes, and urban systems integrating storm water and urban "hardscape" design. Interviews with practitioners, technical experts and agency program leaders will complement readings, lecture and site visits to exemplary project sites.

L A 541: Design Inquiry
(3-0) Cr. 3. S.
Prereq: Graduate standing
Examination of design inquiry and research methods relevant to landscape architectural projects, including bibliographical, historical, numerical, statistical, survey, and geographical methods. Readings, discussions, and application problems. Preparation of a written research proposal.

L A 542: Professional Practice
(Dual-listed with L A 442). (2-0) Cr. 2. S.
Prereq: L A 481
Studies of conventional and developing forms of public and private practice. Explore relationships between professional life and the culture of the professional design firm; investigate firm identities and structures; understand design projects, their delivery process, and contractual agreements. Lecture and class discussion.

L A 543: Colloquium I: Landscape Architecture Research
(0-1) Cr. 1. S.
Prereq: Graduate standing.
Graduate forum on current research in landscape architecture. Weekly presentations of scholarly and professional work by department faculty. Readings, discussions, and development of student research focus. Offered on a satisfactory-fail basis only.

L A 545: Colloquium II: Interdisciplinary Research
Cr. 1. Repeatable. F.
Prereq: LA 543 or graduate standing.
Student-run graduate forum on current research in landscape architecture and related disciplines. Weekly presentations by invited faculty from the departments across the College of Design, University, and professional guests. Readings, discussions, and writing. Offered on a satisfactory-fail basis only.

L A 554: Fundamentals of Remote Sensing
(Dual-listed with L A 454). (Cross-listed with CRP). (3-0) Cr. 3. F.
Introduction to remote sensing techniques needed for basic analysis of satellite images, including: filtering and conflation techniques, stacking, pan sharpening, image rectification, image enhancement, unsupervised and supervised classification. Practical applications in a variety of topics to understand how to interpret images.

L A 557: Landscape Parametrics & Design Computing
(Dual-listed with L A 457). (3-0) Cr. 3. F.
Prereq: Junior classification
Exploration of computational representation of the landscape palette. Geometric parameters for terrain, vegetation, water, weather and lighting effects are modeled and developed algorithmically. Basic computer programming logic and computer graphics interactivity are combined to produce stand-alone software application prototypes that address core landscape design principles.

L A 558: Web Mapping/GIS
(Dual-listed with L A 458). (Cross-listed with C R P). (2-2) Cr. 3.
Prereq: CRP 451/551, LA 302. GEOL 452/552 or instructor permission.
Use and development of online mapping tools to support participatory GIS, Volunteered Geographic Information, information sharing, geodesign and decision making actions. Geoprocessing and Web Scripting/coding and user interface design. Laboratory emphasis practical applications and uses of Web GIS.

L A 559: Digital Design Methods for Landscape Architecture
(Dual-listed with L A 459). (Cross-listed with C R P). (3-0) Cr. 3. S.
Introduction to digital tools used by landscape architects for design communication, visualization, and design development. Include 2D drafting, 3D modeling, image CAD, geospatial data handling (GIS), and animation. Emphasis on concepts and workflow interoperability.

L A 567: Advanced GIS Landscape Modeling
(0-6) Cr. 3.
Prereq: L A 302 or C R P 451/C R P 551
Application of Geographic Information Systems (GIS) modeling techniques to landscape planning and management issues. Selection, acquisition, and conversion of digital landscape data. Modeling applications for studio projects, outreach projects, and research projects.

L A 571: Landscape Architectural Theory
(3-0) Cr. 3. F.
Prereq: graduate classification or permission of instructor
Examination of the development of ideas in landscape architecture in their historical context of social practices and knowledge systems. Emphasis on exposure to key modern and contemporary texts and projects in landscape architecture, architecture, art, and related fields. Readings, discussions, and writings.

L A 580: Thesis, Creative Component Tutorial
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Permission of major professor
Hands-on participation in a creative or research activity in the student's area of specialization. Development of a detailed prospectus that defines the thesis or creative component.

L A 581: Landscape Construction
(Dual-listed with L A 481). (3-0) Cr. 3. F.
Prereq: L A 381
Development of construction details with emphasis on materials and their aesthetic and functional uses as building materials. Explore characteristics and uses of construction materials and application of wood systems, paving systems, retaining walls, masonry and concrete systems, and metals; investigate structural theory of wood systems. Preliminary preparation of construction documents.

L A 582: Advanced Landscape Construction
(Dual-listed with L A 482). (3-0) Cr. 3. S.
Prereq: L A 481
Advanced site construction issues, including proposal preparation, construction documentation, project scheduling, estimating, and specification writing.

L A 583: Landscape TopoGraphics
(3-0) Cr. 3. F.
Prereq: LA 602
Design of landforms to achieve aesthetic, functional, and safety goals. Impacts and implications of landform transformation on the surrounding environment. Design communication using CAD, perspectives, cross-sections, contour maps, landform models, and narratives. Class exercises, case study precedents, and preliminary construction documents.

L A 590: Special Topics
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590A: Special Topics: Landscape Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590B: Special Topics: Planting Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590C: Special Topics: Construction
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590D: Special Topics: History/Theory/Criticism
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590E: Special Topics: Landscape Planning
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590F: Special Topics: Urban Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590G: Special Topics: Graphics
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590I: Special Topics: Interdisciplinary Studies
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590J: Special Topics: International Studies
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590K: Special Topics: Computer Applications
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590L: Special Topics: Ecological Design
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590M: Special Topics: Social/Behavioral
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 590N: Special Topics: Natural Resources
Cr. 1-6. Repeatable, maximum of 3 times. F.S.SS.
Prereq: graduate standing.

L A 591: Environmental Law and Planning
(Dual-listed with L A 491). (Cross-listed with C R P). (3-0) Cr. 3. S.
Prereq: 6 credits in natural sciences
Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs.

L A 594: Environmental Justice in Built Environments
(3-0) Cr. 3. S.
Prereq: Graduate standing or senior classification.
Examination of the equitable distribution of environmental burdens and benefits for sustainable and resilient cities. Focus on impact of climate change, social exclusion, and physical isolation on cumulative risk amongst vulnerable populations. Synthesis of recent social and environmental research to develop innovative physical planning and urban design strategies that support healthy behaviors.

L A 599: Creative Component
Cr. 1-8. Repeatable, maximum of 8 credits. F.S.SS.
Prereq: Permission of major professor
Comprehensive study and original development of a project selected by the student and approved by the major professor. Completed project must be submitted to and approved by a graduate faculty committee as evidence of mastery of the principles of landscape architecture.

Courses for graduate students:

L A 601: Studio I: Design Representation
(3-0) Cr. 3. F.
Prereq: Graduate standing
Introduction to history, techniques, and conventions of landscape architecture representation. Production of design drawings that facilitate critical thinking, the testing of design ideas, and effective communication. Use of two- and three-dimensional media, both analog and digital.

L A 602: Studio II: Land Form and Plant Scape
(1-15) Cr. 6. S.
Prereq: LA 601
Landscape design integrating knowledge of land patterns, plant ecosystems, and human processes. Project involve landform and plants at varied scale of design. Emphasis on competencies in design based in natural process, human behavior, and representation.

L A 603: Studio III: Performance Landscapes
(1-15) Cr. 6. S.
Prereq: LA 602
Theory and methods of landscape design at a variety of scales to achieve desired cultural and biophysical impacts. Development and use of performance metrics drawn from design, humanities, and science. Construction of integrated rhetorical structures of representation and analysis and critical viewpoints to create rigorous design "arguments" and meaningful, just and vibrant environments.

L A 604: Studio IV: City Matters

(1-15) Cr. 6. S.

Prereq: LA 603

Exploration of sociopolitical, ecological, and visual-spatial conditions of the urban environment through design at multiple scales. Focus on urban projects that highlight the complexity of human, ecological, and infrastructural systems. Development of innovative strategies for sustainable, healthy, and just cities. Special attention us paid to building material and construction of physical elements in cities.

L A 605: Studio V: Land Works/Land Digits

(1-15) Cr. 6.

Prereq: LA 604

Landscape design focusing on broadening the representational palette for landscape architectural concepts to complex sites at multiple scales. Emphasis on technical competency through advanced skills in design research, digital representation and teamwork.

L A 699: Thesis Research

Cr. 1-8. Repeatable, maximum of 8 credits. F.S.SS.

Prereq: Permission of major professor

Design Studies

Interdepartmental Undergraduate Program

http://www.design.iastate.edu

The Design Studies programs bring together courses that deal with the integrated study of the conceptualization, production, visible form, uses, and history of artifacts, buildings, and environments as well as the common qualities and connections among the design, art and planning fields.

Core Design Program

Four Design Studies courses constitute the Core Design Program: Design Studio 1 (DsnS 102), Design Representation (DsnS 131), Design Cultures (DsnS 183) and Design Collaborative (Dsn S 115). Full or partial credit of the Core Design program is required for all undergraduate students in the College of Design.

Minor—Critical Studies in Design

The undergraduate minor in Critical Studies in Design offers students opportunities to engage the history, theory and criticism of visual and material culture. In lectures and focused seminars, students explore historical and contemporary issues, including cultural production, the built environment, media and technology, design in everyday life, and models of professional practice. The minor is open to all undergraduates at Iowa State University.

Minor—Design Studies

The undergraduate minor in Design Studies is constructed to facilitate design awareness among interested students and to provide a vehicle for multi-disciplinary study within the College of Design. This minor is open to all undergraduate students at Iowa State University.

Minor—Digital Media

The undergraduate minor in Digital Media covers the knowledge and techniques for applying digital representations to generate designs and art. The body of knowledge specializes in the fields of design, art and planning. This minor is open to all undergraduate students at Iowa State University.

Additional information about minors is available in the Student Programs and Services Office, 297 College of Design.

Design Core Program

Design Core Program: 11.5 cr.

DSN S 102	Design Studio I	4
DSN S 115	Design Collaborative Seminar	0.5
or DSN S 110	Design Exchange Seminar I	
DSN S 131	Design Representation	4
DSN S 183	Design Cultures	3
Total Credits		11.5

Courses primarily for undergraduates:

DSN S 102: Design Studio I

(1-6) Cr. 4.

A core design studio course exploring the interaction of two-and three-dimensional design. Emphasis on fundamental skills and ideas shared across design disciplines. Investigation of creative process, visual order and materials, and development of critical thinking through studio projects and lectures. Includes study of precedents, contemporary design practices and disciplines in their cultural contexts.

DSN S 110: Design Exchange Seminar I

(0-2) Cr. 1. F.

Prereq: Member of Design Exchange Learning Community

Orientation to the College of Design. Introduction to the design disciplines and studio pedagogy. Offered on a satisfactory-fail basis only.

DSN S 111: Design Exchange Seminar II

(0-2) Cr. 1. S.

Prereq: Member of the Design Exchange Learning Community

Development and clarification of career and academic plans. Offered on a satisfactory-fail basis only.

DSN S 115: Design Collaborative Seminar
(1-0) Cr. 0.5.
Prereq: Member of Design Collaborative Learning Community
Orientation to the College of Design. Introduction to the design disciplines and studio pedagogy. Offered on a satisfactory-fail basis only.

DSN S 131: Design Representation
(1-6) Cr. 4.
An introduction to methods of visual thinking and drawing through studio experiences and lectures. All design fields utilize visual communication and drawing. Focus on the use of drawing as a method for creative problem solving, design development and visual communication. Explore, from observation and imagination, the use of fast sketching and in-depth drawing, using various scales, mediums and processes.

DSN S 183: Design Cultures
(3-0) Cr. 3.
A broad-based exploration of the dynamic relationship between design and culture, employing case study method to investigate particular examples of cultural production in contemporary society. Design processes and design works are presented as culturally, economically, environmentally, historically, ideologically, politically, and socially grounded events and artifacts.

DSN S 232: Digital Design Communications
(3-0) Cr. 3.
Introductory investigations of various digital design media to develop multi-dimensional problem solving, digital communication skills and perceptual sensitivity. Open to all university majors.

DSN S 301: Study Abroad Preparation Seminar
(1-0) Cr. 1. Repeatable.
Cultural introduction to host country, introduction to faculty sponsor and program of study, the particulars of traveling and living abroad, and financial and logistical preparations. Guest lectures. Required of all students planning to participate in a College of Design study abroad program for 9 or more credits. Offered on a satisfactory-fail basis only.

DSN S 302: Design Leadership Seminar
(1-2) Cr. 2. Repeatable, maximum of 4 credits.
Prereq: Selection as a peer mentor for the Core Design program.
For students serving as peer mentors for the Core Design Program, under faculty supervision. Development of teaching and leadership skills within the context of design education experiences. Offered on a satisfactory-fail basis only.

DSN S 303: Design Ambassadors
(1-2) Cr. 1-2. Repeatable, maximum of 4 credits.
Prereq: Admittance into one of the professional programs in the College of Design
Opportunity to strengthen leadership, communication and presentation skills. Introduction to student development theory. Students participate in collaborative projects focused on prospective design students. Offered on a satisfactory-fail basis only.

DSN S 310: Practical Experience
Cr. R.
Prereq: Permission of adviser or Coordinator of Design Studies
Independent educational enrichment through practical experience. Students must register for this course prior to commencing each term. Available only to students taking course loads of eleven credits or less. Offered on a satisfactory-fail basis only.

DSN S 332: Multi-Dimensional Digital Design Communication
Cr. 3.
Prereq: Arch 230, ARTGR 275, DSN S 232, or permission of the instructor
Investigations if interoperable digital-design tools, techniques and methods directed at human scale interactive hybrid design from ideation to visualization, synthesis to analysis, and realization to fabrication.

DSN S 445: Public Art/Public Space
(3-0) Cr. 3.
Prereq: Junior Standing, DSN S 102, DSN S 131, DSN S 183
Exploration of the history, precedents, and practice of public art and public space with a focus on developments since 1970 in the United States and abroad. Course includes development of a proposal for a site specific work of art.
Meets U.S. Diversity Requirement

DSN S 446: Interdisciplinary Design Studio
(0-12) Cr. 4-6. Repeatable, maximum of 18 credits.
Prereq: Junior classification in a curriculum in the College of Design and permission of instructor
Advanced interdisciplinary design projects.

DSN S 446H: Interdisciplinary Design Studio: Honors
(0-12) Cr. 5-7. Repeatable, maximum of 18 credits.
Prereq: Junior classification in a curriculum in the College of Design and permission of instructor
Advanced interdisciplinary design projects.

DSN S 490: Independent Study
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490A: Independent Study: History
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490B: Independent Study: Technology
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490C: Independent Study: Communications
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490D: Independent Study: Design
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490E: Independent Study: Entrepreneurship
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490F: Independent Study: Social/Behavioral
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490G: Independent Study: Outreach
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment.
Independent investigation of a topic of special interest to the student.

DSN S 490H: Independent Study: Honors
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

DSN S 490I: Independent Study: Sustainability
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment.
Independent investigation of a topic of special interest to the student. Offered on a satisfactory-fail basis only.

DSN S 492: Introduction to Italian Culture
(1-0) Cr. 1. Repeatable, maximum of 3 credits.
Prereq: Enrollment in the College of Design Rome Study Abroad Program
Introduction to Italian contemporary culture for design students, including food, religion, fashion, politics, media, and social mores.

Courses primarily for graduate students, open to qualified undergraduates:

DSN S 546: Interdisciplinary Design Studio
(0-12) Cr. 4-6. Repeatable, maximum of 18 credits.
Prereq: Graduate or senior standing in the College of Design and permission of instructor
Advanced interdisciplinary design projects.

DSN S 578: Topical Studies in Landscape Architecture
(Dual-listed with DSN S 478). (3-0) Cr. 2-3. Repeatable. F.S.SS.
Prereq: Senior Classification or graduate standing
Offerings vary with each term; check with department for available sections. Course contact hours can range from (2-0) to (3-0) depending on number of credits.

DSN S 585: Renaissance Art
(Cross-listed with ART H). (3-0) Cr. 3.
Prereq: Graduate classification and permission of instructor
European art including painting, sculpture, architecture, and crafts; thirteenth through sixteenth centuries.

DSN S 590: Special Topics
Cr. 1-4. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Written approval of instructor and department chair on required form prior to semester of enrollment
Independent investigation of a topic of special interest to the student.

Sustainable Environments

Master of Design in Sustainable Environments

The Master of Design in Sustainable Environments (M.Des.S.E.) is a advanced interdisciplinary degree that focuses on holistic design strategies for the production of sustainable, resilient environments and artifacts. MDesSE Students and faculty constitute a highly interactive multi-disciplinary community that is deeply engaged in understanding, promoting and conceiving sustainable practices in design, planning and

artistic production. Students engage in faculty-led research projects and are challenged to develop individual sustainable design strategies for issues of current relevance that conserve resources, ameliorate ecological problems and promote social, political and economic justice.

Coursework focuses on developing skills in modes of representation and information dissemination, foundational and emerging theoretical discourse, research methods and design interventions. The degree concludes with an integrated capstone experience through a student-defined thematic project. Capstone projects are situated in different parts of the world and include themes such as:

- addressing the impact of climate change on communities and the built environment;
- integrating informal economies within contemporary modes of urbanization;
- developing strategies to reinvigorate waterways and enhance water quality;
- integrating waste as a resource in contemporary infrastructures; and
- rethinking disaster mitigation processes that promote resilience, social equity and expedited relief.

The Master of Design in Sustainable Environments degree consists of 35 credits, typically distributed over three semesters (fall, spring and summer); however students may choose to distribute these credits over four or five semesters. The degree is geared toward students with professional degrees in art (BFA, MFA), architecture (BArch, MArch), Graphic Design (BFA, MFA), Interior Design (BFA, MFA), Industrial Design (BID, MID), landscape architecture (BLA, MLA), planning (BSCRP, MCRP, MUP) or Engineering. Graduate students can also pursue the following double degrees in the College of Design: M Arch/MDesSE, MCRP/MDesSE, MFA in IVA/MDesSE and MLA/MDesSE.

Courses primarily for graduate students, open to qualified undergraduates:

SUS E 501: Sustainable Design Studio I
(0-10) Cr. 5.
Prereq: SUS E 521
Addressing sustainable design at multiple scales of constructed and natural systems and artifacts, this studio engages multidisciplinary graduate students in a team-oriented, project-based learning environment. Faculty-directed projects will include theoretical investigations and applications of an interdisciplinary design process through brief readings and discussions.

SUS E 502: Sustainable Design Studio II
(0-10) Cr. 5.
Prereq: SUS E 501, SUS E 512, SUS E 531
This advanced studio provides a community-based context for an interdisciplinary design team to work on a variety of faculty-directed projects including funded, basic, and applied research. Coursework addresses sustainable design at multiple scales, engaging both systems and artifacts. Field trips.

SUS E 511: Sustainable Design Colloquium I
(3-0) Cr. 3.
Prereq: Admission to MDSE program
Study and discuss practices of sustainable design and design research. Investigate responsibilities, roles, technologies and methods for studying and advancing the art and science of designing sustainable environments.

SUS E 512: Sustainable Design Colloquium II
(1-0) Cr. 1.
Prereq: SUS E 511
A graduate student-led seminar designed to foster the knowledge and skills to support innovation, entrepreneurship, and leadership in the field of sustainable design. Invitation of outside speakers.

SUS E 521: Foundation of Sustainable Design
(3-0) Cr. 3.
Prereq: Graduate standing or senior classification with instructor permission.
Introduction to the broad frameworks and tools for implementing sustainability among a variety of environments, industries, and enterprises. Investigates the role and opportunity for sustainable design strategies.

SUS E 531: Human Dimensions of Sustainability
(3-0) Cr. 3.
Prereq: Graduate standing or senior classification with instructor permission.
This seminar provides students from multiple disciplines with a grounding in designers' interactions with clients, consumers, communities, cultures, and biospheres. Through a review of literature and the production of new case studies in sustainable design, students discover and represent conditions in which products of design operate across scales, markets, social conditions, geographic domains, academic disciplines, and zones of professional responsibility.

SUS E 540: Methods for Sustainable Design
(3-0) Cr. 3. S.
Prereq: senior or graduate standing.
Overview of qualitative, quantitative and design research methods. In-depth application of methods relevant to capstone project proposal development (SUS E 502). Proposal must address research questions, articulation of research methods and preliminary findings grounded within contemporary theoretical discourse on Sustainable Environments.

SUS E 550: Making Resilient Environments
(3-0) Cr. 3. S.
Prereq: senior or graduate standing.
Major theories and ideas revolving around the concept of resilience. Assessing the social and political processes associated with policy making for resilience. Application of the concept of resilience in order to understand and evaluate environments. Evaluate the different approaches toward resilience and develop an understanding of the relationship between sustainability and resilience. Case studies of communities that proactively prepare for, absorb, recorver from, and adapt to actual or potential future adverse events.

Urban Design

The Master of Urban Design (M.U.D.) is an advanced, interdisciplinary program of study that focuses on contemporary challenges of urbanism at local, regional and global scales. Courses are taught by faculty from Architecture, Community and Regional Planning, and Landscape Architecture; with an understanding that urban environments should be engaged through an integrated design process that includes ecological, social, material, economic, and urban policy factors.

The urban design degree reflects a deep commitment to resilient urban environments within the context of an increasingly concentrated, connected and, diverse urban world. Accordingly, the coursework engages emerging urbanization topics including:

- The formation of more adaptable, flexible and resilient cities;
- the exponential growth of megacities and steady decline of investments in traditional urban economies in the twenty-first century;
- The transformation of Industrial landscapes, particularly within the Midwestern context, and the global impact of transnational economic operations.
- the spatialization of informal economies, practices, and services across the south-north global divide;
- and, a reexamination of the potentials of hard and soft infrastructures, principles of the circular economy and a reframing of the urban-rural divide.

The program consists of 36 credits, typically distributed over three semesters (fall, spring and summer), however, students may choose to distribute these credits over four or five semesters. The degree is geared toward students with professional degrees in architecture (BArch, MArch), landscape architecture (BLA, MLA) or planning (BSCRP, MCRP, MUP). Graduate students can also pursue the following double degrees in the College of Design: M Arch/MUD, MCRP/MUD and MLA/MUD.

Courses primarily for graduate students, open to qualified undergraduates:

URB D 501: Urban Design Local Studio
(3-6) Cr. 6.
Prereq: Graduate standing or senior classification with instructor permission
Analysis and observation of urban morphology and culture with urban design projects set in local cities of the United States. Students with learn skills to observe and interpret urbanism as they develop processes for designing cities concerned for both physical form, ecological principles and human activity.

URB D 502: Urban Design Global Studio
(1-10) Cr. 6.
Prereq: Graduate standing or senior classification with instructor permission.
Students develop proposals for urban design interventions in an international context at multiple scales using investigation, analysis, observation, and interaction. Field trips.

URB D 511: North American Urbanization
(3-0) Cr. 3.
Prereq: Graduate standing or senior classification with instructor permission
Focus on the historical role of planning and urban design in the shaping of North American cities and regions, from the colonial period to the late twentieth century. Examine the legacy of planning and design by exploring the intersection of geographic space, politics, and policy. Investigate the factors and the processes that produce the built environment.

URB D 521: Foundations of Urban Design
(3-0) Cr. 3.
Prereq: Graduate standing, senior classification with instructor permission.
Introduction to the ways that urban designers think about the city with a focus on how history, theory, and a wide range of contextual factors inform urban design practice. Field trip.

URB D 522: Contemporary Urban Design Practices
(3-0) Cr. 3.
Prereq: Graduate standing or senior classification with instructor permission.
Study of emerging trends and practices in urban design using a range of current media communication platforms. Course will be conducted in a combination of lecture, seminar formats. Graduate level readings, discussions, research, and development of projective scenarios.

URB D 531: Methods of Urban Design Workshop
(3-0) Cr. 3.
Prereq: Graduate standing or senior classification with instructor permission.
An exploration of contemporary urban design methods derived from significant urban projects and (re)development initiatives. Selected case studies to articulate and evaluate methods for implementing urban design goals and objectives in a variety of urbanized contexts. Case studies will build on a combination of analytical research, lectures, student presentations, and field trips.

URB D 532: Urban Design Media Workshop
(3-0) Cr. 3.
Prereq: Graduate standing or senior classification with instructor permission.
An introduction to visual representation tools and techniques for generating and communicating urban design concepts and analytical research. Projects and exercises will utilize traditional and contemporary approaches to drawing, modeling, and mapping, as well as desktop publishing tools for print, web, and presentation graphics. Field trip.

URB D 533: Urbanism Theory and Methods
(3-0) Cr. 3.
Prereq: Graduate standing or senior classification with instructor permission.
This course examines how political-economic forces shape the contemporary built and social environments and the way urban designers respond to these forces. The course highlights various methods urban designers use to create change and, in turn, how these affect stakeholders and communities. Students develop critical awareness of existing social, political and economic systems; understand the impact of the decision they make, and the methods they use, on the city and these systems.

College of Engineering

Sarah Rajala, Dean for College of Engineering
Arun Somani, Associate Dean for Research
Ron Cox, Associate Dean for Extension and Outreach
Sriram Sundararajan, Associate Dean for Academic Affairs

www.engineering.iastate.edu (http://www.engineering.iastate.edu)

Aligning Education in Engineering with the University Mission

The mission of Iowa State University is to create, share, and apply knowledge to make Iowa and the world a better place. Students will become broadly educated, global citizens who are culturally informed, technologically adept, and ready to lead. The College of Engineering echoes this philosophy and emphasizes preparing its graduates to meet the challenges of the 21st century.

Engineering education seeks to develop a capacity for objective analysis, synthesis, and design to obtain a practical solution. The engineering programs at Iowa State University are designed to develop the professional competence of a diverse student body and, by breadth of study, to prepare students to solve the technical problems of society while considering the ethical, social, and economic implications of their work at state, national and global levels.

The focus of each curriculum is to strengthen students' critical thinking, creative abilities, and communication skills. Students in engineering will have the opportunity for interdisciplinary and experiential learning through learning communities, service learning, internships and cooperative education, as well as research, capstone, and study abroad experiences.

The problem-solving skills learned from an engineering education at Iowa State University also provide an excellent launching pad for careers not only in engineering, but also medicine, law, business, and many other fields.

Registration as a professional engineer, which is granted by each individual state, is required for many types of positions. The professional curricula in engineering at Iowa State University are designed to prepare a graduate for subsequent registration in all states.

Seniors in accredited curricula of the College of Engineering are encouraged to take the Fundamentals of Engineering Examination toward professional registration during their final academic year. Seniors in engineering curricula who have obtained at least 6 semester credits in surveying may take the Fundamentals Examination for professional registration as land surveyors.

Concurrent Graduate/ Undergraduate Programs

Several engineering programs offer the opportunity for well-qualified undergraduate juniors and seniors to pursue a graduate degree in their program while finishing the undergraduate requirements. The programs offering concurrent undergraduate/graduate degrees are: aerospace engineering, agricultural engineering, biological systems engineering, chemical engineering, civil engineering, computer engineering,

electrical engineering, industrial engineering, materials engineering, and mechanical engineering.

Programs offering concurrent bachelor of science/master of business administration degrees are: aerospace engineering, agricultural engineering, biological systems engineering, civil engineering, computer engineering, electrical engineering, industrial engineering and mechanical engineering. For more information, refer to the graduate study sections for each engineering program. Advanced work in engineering is offered in the post-graduate programs. See the Graduate College section of this catalog.

Joint Undergraduate Programs

A bachelor of science degree in software engineering is offered in the College of Engineering and the College of Liberal Arts and Sciences. This program is jointly administered by the Department of Electrical and Computer Engineering and the Department of Computer Science.

Accreditation

Twelve undergraduate engineering programs are accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org. These twelve programs are: aerospace, agricultural, biological systems, chemical, civil, computer, construction, electrical, industrial, materials, mechanical and software engineering. Accreditation status is indicated in the Courses and Programs section for each engineering program.

Organization of Curricula

All curricula in engineering are designed as four-year programs. They are structured in two phases: a basic program and a professional program. The basic program consists primarily of subjects fundamental and common to all branches of engineering and includes chemistry, physics, mathematics, engineering computations, and English. The professional phase of a curriculum includes intensive study in a particular branch of engineering, as well as a continuation of supporting work in mathematics, basic sciences, humanities, and social sciences.

Students should complete the requirements of the basic program before proceeding to a professional program.

Preparation for the Engineering Curricula

In addition to the standard university admission requirements, the college also requires 2 years of a foreign language. Other high school credits particularly important to students wishing to study engineering include:

- 2 years of algebra,
- 1 year of geometry
- 1/2 year of trigonometry
- 1/2 year of pre-calculus
- 1 year each of chemistry, biology, and physics
- 3 years of social science
- 4 years of English

See Index for specific admission requirements.

Placement in mathematics, English, and chemistry will generally be based on high school preparation and test scores. Advanced placement is possible for exceptionally well-prepared students. Students who are not adequately prepared may be encouraged or required to take additional preparatory coursework and should expect to spend more than the customary time to complete the engineering program. Any coursework which is preparatory or remedial in nature cannot be used to satisfy credit requirements for graduation in any of the engineering curricula.

Engineering Basic Program

Please see "Basic Program for Engineering Curricula" section.

Requirement for Graduation

In order to graduate in a professional engineering curriculum, students must have a minimum GPA of 2.00 in a department-designated group of 200-level and above courses known as the Core. These courses will total no fewer than 24 semester credits.

Engineering Minors

The College of Engineering offers four undergraduate minors which are open only to students in the College of Engineering. These are minors in biomedical engineering, energy systems, engineering sales and nondestructive evaluation. These minors must include at least nine credits which are beyond the total used to meet curriculum requirements.

The biomedical engineering minor is a 16 credit interdisciplinary program that complements a student's major discipline by providing additional insight into the interactions between various engineering disciplines and Biological systems. The minor is administered by a supervisory faculty committee. For minor course requirements, refer to Biomedical Engineering in Courses and Programs.

The energy systems minor is a 15 credit program that provides engineering students with focused educational opportunities in the broad area of energy systems. Students will understand broad energy perspectives, the language of energy systems and the economic, environmental, and policy issues related to energy. The minor is administered by a supervisory faculty committee. For minor course requirements, refer to Energy Systems in Courses and Programs or see http://www.me.iastate.edu/energy-systems-minor/ .

The engineering sales minor is a 15 credit minor that complements the technical training in the student's major discipline by providing the tools

and knowledge required for technical (i.e. business-to-business) sales careers. The minor is administered by a supervisory faculty committee. For minor course requirements, refer to Engineering Sales in Courses and Programs.

The nondestructive evaluation minor (16 credit minimum) open to engineering students who have met the basic program requirements and are not on academic warning or probation. The minor is supervised by an inter-disciplinary Engineering faculty committee. For minor course requirements, refer to Nondestructive Evaluation Engineering in Courses and Programs.

Engineering Minor (Interdisciplinary)

The College of Engineering offers undergraduate minors in wind energy and nuclear engineering which are open to all students at ISU who meet the prerequisites. The wind energy minor is a 15 credit minor which enables students to acquire an interdisciplinary knowledge of the wind energy industry. There are two required courses; the remaining credits are chosen from a list of elective courses that are related to wind energy. The minor is administered by a supervisory faculty committee from several departments. For minor course requirements, refer to Wind Energy Minor in Courses and Programs. The nuclear engineering minor is a 15 credit minor which enables engineering students to acquire a basic and fundamental knowledge of nuclear sciences and engineering. Courses are provided at Iowa State University and also transfer courses that have been evaluated as substitutes for ISU courses may be used toward the minor. For minor course requirements, refer to Nuclear Engineering in Courses and Programs.

Undergraduate Majors and Minors Outside the College of Engineering

In addition to the engineering degree program, students may earn majors or minors in other colleges of the university. A major or minor program must meet all requirements of the offering department or program and its college and contain credits beyond the requirements for a B.S. degree in engineering. A minimum of 15 additional credits is required for each major area of study and an additional 9 credits for each minor.

Advising System

The purpose of the advising system in the College of Engineering is to work constructively with students in developing their individual academic programs and to provide a resource contact person for students during their college careers.

The college offers an orientation program during the spring and summer for students planning to enter in the fall, and during the fall for students planning to enter in the spring. Transfer students may also complete orientation online. All entering students are encouraged to attend orientation which includes meeting with an academic adviser to register for classes. Placement assessments given during the orientation program help determine the student's current level of proficiency which enables the academic adviser to prepare an appropriate course schedule for the student.

Special Programs

All engineering students are strongly encouraged to participate in either the cooperative education or internship programs. Students who are qualified to participate in the engineering honors program are also urged to do so. These programs are integrated into the professional engineering curricula and may require additional work. However, both these professional and academic programs offer opportunities that will enrich the standard academic experience. Engineering students are also encouraged to take advantage of study abroad opportunities available through the College of Engineering's International Programs Office.

a. Cooperative Education Program. The College of Engineering offers, through its curricula, an experiential education program. Enrollment in the program allows students to gain practical work experience in their career field while attending college. In general, students enrolled in the co-op program will require an additional semester to complete curriculum requirements.
Cooperative programs are a mechanism by which a student may work full-time for one semester per academic or calendar year. The student has the opportunity to assess career paths within her/his chosen curriculum and the employer evaluates the student's potential as a future full-time employee. Both domestic and international co-op programs are allowed. Cooperative education students pay no tuition to the university during their work periods and do not receive credit hours for their work experience. Students register for a non-credit cooperative education course (398) for fall or spring and are considered full-time students while enrolled in these courses. For additional information contact your academic adviser and the Office of Engineering Career Services.

b. Internship Program. The College of Engineering offers, through its curricula, an experiential education program. Internships are a mechanism by which a student may work full-time for the summer. Enrollment in the program allows students to gain practical work experience in their career field while attending college.
Internship students pay no tuition to the university during their work periods and do not receive credit hours for their work experience. Students who register for the internship course (396) for the summer are considered to be full-time students. For additional information contact your academic adviser and the Office of Engineering Career Services.

c. Honors Program. The College of Engineering participates in the University Honors Program (see Index). The honors program is designed for students with above average ability who wish to individualize their programs of study. For further details consult the chair of the Engineering

College Honors Program Committee or your departmental honors program adviser.

d. Engineering International Engagement. In a world where the sun never sets, engineers must be prepared to understand other cultures and other ways of doing business. Engineers must expand their exportable skills, language and cross-cultural skills.

The College of Engineering has formed worldwide partnerships to create opportunities for students to work and study with leading universities in other countries and multinational corporations. With careful planning, students may earn credit in courses that fulfill their degree requirements. To learn more about work and study abroad, visit the Engineering International Engagement website: http://www.engineering.iastate.edu/studyabroad/

Departments of the College

For information on undergraduate options refer to the following curriculum sections, and for graduate specializations or certificate programs, refer to the Courses and Programs section of the catalog.

- Aerospace Engineering
- Agricultural and Biosystems Engineering
- Chemical and Biological Engineering
- Civil, Construction and Environmental Engineering
- Electrical and Computer Engineering
- Industrial and Manufacturing Systems Engineering
- Materials Science and Engineering
- Mechanical Engineering

Degree Programs

Aerospace Engineering
Agricultural Engineering
Biological Systems Engineering
Chemical Engineering
Civil Engineering
Computer Engineering
Construction Engineering
Electrical Engineering
Engineering Mechanics
Industrial Engineering
Information Assurance
Materials Engineering
Materials Science and Engineering
Mechanical Engineering
Software Engineering
Systems Engineering

Minors

Biomedical Engineering
Cyber Security

Energy Systems
Engineering Sales
Non-Destructive Evaluation Engineering
Nuclear Engineering
Wind Energy

Engineering

Engineering

Basic Program for Engineering Curricula

The Basic Program is a set of courses that provides a foundation common to all engineering curricula. Students normally enroll in most of the Basic Program courses during their first year. Before enrolling in engineering courses at the 200-level and above, students enrolled in the College of Engineering must do the following:

1. Complete the Basic Program with a Basic Program grade point average (GPA) of at least 2.00.
2. Earn an ISU cumulative GPA of at least 2.00.

A grade of C or better is required for any transfer credit course applied to the Basic Program. Grades from transfer courses will not be used in computing the Basic Program GPA.

Students enrolled in the College of Engineering who have not met the above requirements may enroll for no more than two semesters in 200-level engineering courses. Students not enrolled in the College of Engineering may take engineering courses as long as they meet the prerequisites and space is available; only the first two semesters of engineering courses at the 200-level and above taken at ISU while a student is not enrolled in the College of Engineering can be applied toward an engineering degree.

Entering undergraduates must demonstrate proficiency in trigonometry based on test scores, or by having transfer credits from a college trigonometry course, or by passing MATH 143 Preparation for Calculus before enrolling in MATH 165 Calculus I.

The Department of English may recommend placement in one or more sections of ENGL 099 or ENGL 101 English for Native Speakers of Other Languages if the placement test administered to students whose first language is not English indicates deficiencies. Satisfactory completion of the recommended English course(s) will be required of students to complete their Basic Program.

Basic Program
(A minimum GPA of 2.00 required for this set of courses. Transfer courses are not used in the Basic Program GPA computation).

MATH 165	Calculus I	4
MATH 166	Calculus II	4
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
CHEM 167	General Chemistry for Engineering Students *	4
or CHEM 177	General Chemistry I	
PHYS 221	Introduction to Classical Physics I	5
ENGR 101	Engineering Orientation ***	R
LIB 160	Information Literacy	1
ENGR 160	Engineering Problems with Computer Applications Laboratory	3
Or one of the following in place of ENGR 160**		
AER E 160	Aerospace Engineering Problems With Computer Applications Laboratory	
A B E 160	Systematic Problem Solving and Computer Programming	
C E 160	Engineering Problems with Computational Laboratory	
CH E 160	Chemical Engineering Problems with Computer Applications Laboratory	
CPR E 185	Introduction to Computer Engineering and Problem Solving I	
E E 185	Introduction to Electrical Engineering and Problem-Solving I	
I E 148	Information Engineering	
M E 160	Mechanical Engineering Problem Solving with Computer Applications	
S E 185	Problem Solving in Software Engineering	
Total Credits		27

ENGL 250 Written, Oral, Visual, and Electronic Composition is normally taken in the second year. However, students who advance place into this course may be able to enroll during their first year. Credit for ENGL 150 Critical Thinking and Communication is earned upon successful completion of ENGL 250 Written, Oral, Visual, and Electronic Composition, but only when ENGL 250 Written, Oral, Visual, and Electronic Composition is completed at Iowa State.

In addition to the basic program courses listed above, curriculum designated courses normally taken the first year of each engineering curricula are listed below.

Curriculum Designated Requirements
Aerospace Engineering

AER E 161	Numerical, Graphical and Laboratory Techniques for Aerospace Engineering	3
AER E 192	Aerospace Seminar	R
GenEd Electives		3

Agricultural Engineering

CHEM 167L	Laboratory in General Chemistry for Engineering	1
or CHEM 177L	Laboratory in General Chemistry I	
A B E 110	Experiencing Agricultural and Biosystems Engineering	1
A B E 170	Engineering Graphics and Introductory Design	3

Biological Systems Engineering

CHEM 167L	Laboratory in General Chemistry for Engineering	1
or CHEM 177L	Laboratory in General Chemistry I	
A B E 110	Experiencing Agricultural and Biosystems Engineering	1
A B E 170	Engineering Graphics and Introductory Design	3

Chemical Engineering

CHEM 177	General Chemistry I *	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 178L	Laboratory in College Chemistry II	1
SSH Elective		3

Civil Engineering

CHEM 177	General Chemistry I *	4
CHEM 177L	Laboratory in General Chemistry I	1
C E 105	Introduction to the Civil Engineering Profession	1
C E 170	Graphics for Civil Engineering	2
C E 111	Fundamentals of Surveying I	3
SSH Elective		3

CIVIL ENGINEERING: STUDENTS IN THE GENERAL EMPHASIS IN C E HAVE TWO CHEMISTRY/PHYSICS SEQUENCE OPTIONS. THE ENVIRONMENTAL EMPHASIS REQUIRES OPTION 1.
OPTION 1

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 178L	Laboratory in College Chemistry II	1
PHYS 221	Introduction to Classical Physics I	5

OPTION 2

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1

PHYS 221 & PHYS 222	Introduction to Classical Physics I and Introduction to Classical Physics II	10

Computer Engineering

COM S 227	Introduction to Object-oriented Programming	4
CPR E 166	Professional Programs Orientation	R
Gen Ed Elective		3

Construction Engineering

CON E 121	Cornerstone Learning Community: Orientation to Academic Life	1
CON E 122	Cornerstone Learning Community: Orientation to Professional Life	1
C E 170	Graphics for Civil Engineering	2

Electrical Engineering

E E 285	Problem Solving Methods and Tools for Electrical Engineering	4
E E 166	Professional Programs Orientation	R
Gen Ed Elective		3

Industrial Engineering

I E 101	Industrial Engineering Profession	R
SSH Elective		6

Materials Engineering

CHEM 177	General Chemistry I *	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 178L	Laboratory in College Chemistry II	1
ENGR 160	Engineering Problems with Computer Applications Laboratory	3
Gen Ed Elective		3
PHYS 221	Introduction to Classical Physics I (scheduled in sophomore year)	5

Mechanical Engineering

M E 170	Engineering Graphics and Introductory Design	3
Gen Ed Elective		3

Software Engineering

S E 166	Careers in Software Engineering	R
COM S 227	Introduction to Object-oriented Programming	4
ECON Elective		3

The student's adviser may require or recommend courses in addition to those specified above if the preparation and progress of the student are such that additional courses are necessary or desirable.

*Students planning to enroll in C E[1], Ch E, or Mat E will find CHEM 177 General Chemistry I to be a better preparation for CHEM 178 General Chemistry II. However CHEM 167 General Chemistry for Engineering Students, is accepted as a substitute for CHEM 177 General Chemistry I for those students declaring one of these curricula after having completed CHEM 167 General Chemistry for Engineering Students.

**Recommended choices by program:

Credit hours for graduation will be given for any one of the following without increasing a curriculum's minimum number of credits required for graduation. It is recommended that students choose the class associated with their chosen major:

AER E 160	Aerospace Engineering Problems With Computer Applications Laboratory	3
A B E 160	Systematic Problem Solving and Computer Programming	3
C E 160	Engineering Problems with Computational Laboratory	3
CH E 160	Chemical Engineering Problems with Computer Applications Laboratory	3
ENGR 160	Engineering Problems with Computer Applications Laboratory	3
I E 148	Information Engineering	3
CPR E 185	Introduction to Computer Engineering and Problem Solving I	3
E E 185	Introduction to Electrical Engineering and Problem-Solving I	3
M E 160	Mechanical Engineering Problem Solving with Computer Applications	3
S E 185	Problem Solving in Software Engineering	3

***Students enrolled in the joint software engineering degree program should take S E 101 Software Engineering Orientation, note that ENGR 101 can be substituted for SE 101.

Engineering Courses (ENGR)

Most of the courses with the designator of Engr are broad-based engineering courses applicable to all engineering disciplines. Several of these courses are part of the basic program which is required for engineering students. All courses are administered by the college and with the exception of ENGR 160 Engineering Problems with Computer Applications Laboratory, ENGR 340 Introduction to Wind Energy: System Design & Delivery, ENGR 466 Multidisciplinary Engineering Design and ENGR 467 Multidisciplinary Engineering Design II Multidisciplinary Engineering Design II are coordinated through Engineering Student Services in Engineering Academic and Student Affairs.

ENGR 160	Engineering Problems with Computer Applications Laboratory	3
ENGR 340	Introduction to Wind Energy: System Design & Delivery	3
ENGR 466	Multidisciplinary Engineering Design	3
ENGR 467	Multidisciplinary Engineering Design II	3

Courses primarily for undergraduates:

ENGR 101: Engineering Orientation
Cr. R. F.S.
Introduction to the College of Engineering and the engineering profession. Information concerning university and college policies, procedures, and resources. Undeclared sections: Considerations in choosing an engineering curriculum. Opportunities to interact with departments. Declared sections: Introduction to major-specific topics. Offered on a satisfactory-fail basis only.

ENGR 104: LEAD Program Orientation
(1-0) Cr. 1. F.
Orientation for LEAD Learning/Living Community participants. Introduction to college and university resources, tools and techniques to promote academic, professional and social/cultural development and success. Focus on building support networks with peers, faculty, and staff. Introduction to core engineering competencies including but not limited to initiative, communication, teamwork, and cultural adaptability. Offered on a satisfactory-fail basis only.

ENGR 105: LEAD Program Seminar
(1-0) Cr. 1. S.
Seminar for LEAD Learning/Living Community participants. Focus on professional development and exposure to various engineering disciplines through hands-on lab experiences, industry visits and networking opportunities with alumni, faculty, and staff. Development of core competencies: engineering/technical knowledge, communication and teamwork. Offered on a satisfactory-fail basis only.

ENGR 121: Learning Skills for Engineering
Cr. R. F.S.
Exploration of personal and academic strategies that promote academic and career success. Offered on a satisfactory-fail basis only.

ENGR 131: Learning Community Seminar
Cr. R. F.S.
Peer-mentored review of course topics in engineering undeclared learning communities. Offered on a satisfactory-fail basis only.

ENGR 150: Foundations of Leadership Development and Learning
(1-0) Cr. 1. F.S.
Leadership development with focus on global context and awareness of events shaping the context. Exposure to theory of leadership with examples. Necessary characteristics of a leader, and strategies for leadership skills development. Exposure to non-traditional career paths for engineers. Outline of personalized leadership development. Offered on a satisfactory-fail basis only.

ENGR 155: Leadership in Engineering Student Organizations
(1-0) Cr. 1. F.S.
Development of leadership skills of student organization leaders in the College of Engineering. Introduction to organizational leadership concepts and analyze organization purpose and function. Students practice mentoring and learn how their campus leadership experiences transfer to the field of engineering.

ENGR 160: Engineering Problems with Computer Applications Laboratory
(2-2) Cr. 3. F.S.SS.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Solving engineering problems and presenting solutions through technical reports. Significant figures. Use of SI units. Graphing and curve-fitting. Flowcharting. Introduction to mechanics, statistics and engineering economics. Use of spreadsheet programs to solve and present engineering problems. Solution of engineering problems using computer programming languages. (The honors section includes application of programming to mobile robotics).

ENGR 160H: Engineering Problems with Computer Applications Laboratory
(2-2) Cr. 3. F.S.SS.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Solving engineering problems and presenting solutions through technical reports. Significant figures. Use of SI units. Graphing and curve-fitting. Flowcharting. Introduction to mechanics, statistics and engineering economics. Use of spreadsheet programs to solve and present engineering problems. Solution of engineering problems using computer programming languages. (The honors section includes application of programming to mobile robotics).

ENGR 250: Leadership in Engineering Teams
(1-0) Cr. 1. F.S.
Building and sustaining decision-making engineering teams. Students will explore the interrelated processes of discerning purpose, thinking systemically, developing reflective judgment, and exercising leadership by mobilizing and setting the direction for adaptive change within a team. Industry based examples and information from engineering and natural resource sciences will be infused into the course.

ENGR 260: Engineering: Getting from Thought to Thing
(Cross-listed with IND D). (3-0) Cr. 3. F.S.
What is engineering, technology and their roles in society? Investigation of engineering methods through case studies of everyday objects. Explore questions about the impact of technology in society. Apply engineering methods to design and failure analysis.

ENGR 265: Survey of the Impacts of Engineering Activity
(3-0) Cr. 3. F.S.
Survey of the economic, environmental, societal, and political benefits and problems resulting from engineering activity. Effects of engineering projects on human health, social structures, and the environment. Examination of improvements in economic opportunities and quality of life resulting from engineering activity. Case studies of the effects of engineering activity.

ENGR 270: Survey of How Things Work
(Cross-listed with IND D). (3-0) Cr. 3. F.S.
Removing mysteries surrounding science and technology. Identify key concepts from applied science and technology to obtain better understanding on how things work. Review and explain the principles behind the technologies which define our modern way of life. A survey of broad range of technology could include: cell phones, GPS, radio, television, computers, ultrasound, microwave ovens, automobile, bioengineering and other industrial and consumer technologies. Common day technology examples illustrating scientific knowledge and applications.

ENGR 320: International Experience Report
Cr. 3. F.S.
Prereq: Satisfactory completion of international work experience of at least ten weeks or nine credits of approved course work taken abroad. Permission of student's department prior to departure
Critique of work/study abroad experience as it relates to professional development. Taken the semester after completion of work abroad or study abroad. Written report and presentation. Offered on a satisfactory-fail basis only.
Meets International Perspectives Requirement.

ENGR 327: Voices of Public Policy
(3-0) Cr. 3. F.
Prereq: Sophomore classification in engineering
Role and impact of legislative process, partisan politics, government, lobbyists, the media, expert testimony and grassroots activism on public policy. Critical analysis of context; of claims, assumptions, premises, and evidence of both sides; represented and disenfranchised populations; the ethical issues to develop personal position and courses of action to impact public policy process.

ENGR 340: Introduction to Wind Energy: System Design & Delivery
(3-0) Cr. 3. F.
Prereq: MATH 166, PHYS 222
Introduction to wind energy. Economic analysis related to wind energy. Electrical power generation, transmission, and grid operations. Tower, blade and nacelle materials and manufacturing. Tower design. Construction, transportation, supply chain and life cycle analysis for wind turbine components.

ENGR 350: Dean's Leadership Seminar
(1-0) Cr. 1. F.S.
Prereq: Selection based on demonstrated commitment to leadership development; for junior status or above.
Understanding the complexities of leadership in building an organization, decision-making styles, communication, managing change, building trust, shared responsibility leadership, creating legacy, prioritizing, effective use of authority, conflict, ethics, integrity, transparency, accountability. Offered on a satisfactory-fail basis only. May not apply toward a degree in Engineering

ENGR 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

ENGR 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

ENGR 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, AER E, B M E, CPR E, E E, I E, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

ENGR 467: Multidisciplinary Engineering Design II
(Cross-listed with AER E, CPR E, E E, I E, M E, MAT E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: Student must be within two semesters of graduation or receive permission of instructor.
Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

ENGR 490E: Entrepreneurship
Cr. 1-3. Repeatable, maximum of 3 credits.
Prereq: Junior or senior classification in engineering, college approval

ENGR 490L: Independent Study
Cr. 1-3. Repeatable, maximum of 3 credits. F.S.SS.
Leadership.

Aerospace Engineering

Undergraduate Study

For undergraduate curriculum in aerospace engineering leading to the degree bachelor of science. This curriculum is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org/.

The aerospace engineer is primarily concerned with the design, analysis, testing, and overall operation of vehicles which operate in air and space. The curriculum is designed to provide the student with an education in the fundamental principles of aerodynamics, flight dynamics, propulsion, structural mechanics, flight controls, design, testing, and space technologies. A wide variety of opportunities awaits the aerospace engineering graduate in research, development, design, production, sales, and management in the aerospace industry, and in many related industries in which fluid flow, control, structural, and transportation challenges play major roles.

Make To Innovate (M:2:I) is an exciting new program in the Aerospace Engineering Department that engages students in hands-on projects to augment their understanding of engineering fundamentals.

A cooperative education program in aerospace engineering is available in cooperation with government agencies and industry. The usual four-year curriculum is extended for students who participate in alternating industrial experience periods and academic periods. This arrangement offers valuable practical experience and financial assistance during the college years.

Undergraduate Mission and Educational Objectives

The Department of Aerospace Engineering maintains an internationally recognized academic program in aerospace engineering via ongoing consultation with students, faculty, industry, and aerospace professionals. Results of these consultations are used in a process of continuous academic improvement to provide the best possible education for our students.

Mission statement:

The mission of the aerospace engineering program is to prepare the aerospace engineering student for a career with wide-ranging opportunities in research, development, design, production, sales, and management in the aerospace industry and in the many related industries which are involved with the solution of multi-disciplinary, advanced technology problems.

Program Educational Objectives:

Within three to five years after graduation, Aerospace Engineering alumni will have become actively contributing, valued engineers showing professional growth or be actively pursuing an advanced degree in graduate school. They will have achieved this by:

- Utilizing their strong foundation in science, mathematics and engineering.
- Demonstrating teamwork, leadership, and integrity.
- Being aware of the societal, economic and environmental impact of their work.
- Demonstrating critical thinking and effective communication skills.
- Ensuring superior quality, customer satisfaction, and safety outcomes in their work.

Curriculum in Aerospace Engineering

Leading to the degree bachelor of science.

Total credits required: 129.0.
Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs. Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements for either required or elective courses.

International Perspectives [1]: 3 cr.
U.S. Diversity [1]: 3 cr.
Communication Proficiency/Library requirement:

ENGL 150	Critical Thinking and Communication (C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
LIB 160	Information Literacy	1

One of the following:		3
ENGL 314	Technical Communication (C or better in this course)	
ENGL 309	Proposal and Report Writing (C or better in this course)	

General Education Electives: 12.0 cr. [2]

Complete 12 cr. General Education Electives are requirements for graduation so may not be taken on a P-NP basis.

Basic Program: 27 cr.

A minimum GPA of 2.00 required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 167	General Chemistry for Engineering Students	4
or CHEM 177	General Chemistry I	
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGR 101	Engineering Orientation	R
AER E 160	Aerospace Engineering Problems With Computer Applications Laboratory [3]	3
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Math and Physical Science: 13 cr.

MATH 265	Calculus III	4
MATH 267	Elementary Differential Equations and Laplace Transforms	4
PHYS 222	Introduction to Classical Physics II	5
Total Credits		13

Aerospace Engineering Core: 44 cr.

A minimum GPA of 2.00 required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Core GPA):

AER E 261	Introduction to Performance and Design	3
AER E 310	Aerodynamics I: Incompressible Flow	3
AER E 311	Aerodynamics II: Compressible Flow	3
AER E 321	Flight Structures Analysis	3
AER E 331	Flight Control Systems I	3
AER E 322	Aerospace Structures Laboratory	2
AER E 344	Aerodynamics and Propulsion Laboratory	3
AER E 351	Astrodynamics I	3
AER E 355	Aircraft Flight Dynamics and Control	3
AER E 411	Aerospace Vehicle Propulsion I	3
AER E 421	Advanced Flight Structures	3
AER E 461	Modern Design Methodology with Aerospace Applications	3
AER E 462	Design of Aerospace Systems	3
E M 324	Mechanics of Materials	3
M E 231	Engineering Thermodynamics I	3
Total Credits		44

Other Remaining Courses: 33 cr.

E M 274	Engineering Statics	3
E M 345	Engineering Dynamics	3
MAT E 273	Principles of Materials Science and Engineering	3
AER E 161	Numerical, Graphical and Laboratory Techniques for Aerospace Engineering	3
AER E 361	Computational Techniques for Aerospace Design	3
AER E 362	Aerospace Systems Integration	3
3 credits from the following		3
AER E 412	Aerospace Vehicle Propulsion II	
AER E 417	Experimental Mechanics	
AER E 422	Vibrations and Aeroelasticity	
AER E 423	Composite Flight Structures	
AER E 426	Design of Aerospace Structures	
AER E 432	Flight Control Systems II	
AER E 433	Spacecraft Dynamics and Control	
AER E 442	V/STOL Aerodynamics and Performance	
AER E 446	Computational Fluid Dynamics	
AER E 448	Fluid Dynamics of Turbomachinery	
AER E 451	Astrodynamics II	
AER E 463	Introduction to Multidisciplinary Design Optimization	
AER E 464	Spacecraft Systems	
AER E 468	Large-Scale Complex Engineered Systems (LSCES)	
AER E 481	Advanced Wind Energy: Technology and Design	
One of the following:		3
ENGL 314	Technical Communication (C or better in this course)	
ENGL 309	Proposal and Report Writing (C or better in this course)	
Technical Electives (see below) [2]		3

Career Electives (see below) [2]	6
Total Credits	33

Technical Electives, 3 cr. and Career Electives, 6 cr. selected from preceding Aer E list or departmental-approved 300-level or above courses relevant to technical and career areas.

Seminar/Co-op/Internships/Flight Experience:

AER E 192	Aerospace Seminar	R
AER E 301	Flight Experience	R

Co-op and internships are optional

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also allowed by the department to meet other course requirements within the degree program. U.S. diversity and international perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list. (http://www.aere.iastate.edu/students/undergraduate_program)
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

See also: A 4-year plan of study grid showing course template by semester.

Aerospace Engineering, B.S.

Freshman

Fall	Credits	Spring	Credits
AER E 160	3	AER E 161	3
CHEM 167	4	AER E 192	0
ENGL 150	3	General Education Elective	3
ENGR 101	0	MATH 166	4
LIB 160	1	PHYS 221	5
MATH 165	4		
	15		15

Sophomore

Fall	Credits	Spring	Credits
AER E 261	3	E M 324	3
E M 274	3	E M 345	3
ENGL 250	3	MAT E 273	3
MATH 265	4	MATH 267	4
PHYS 222	5	M E 231	3
	18		16

Junior

Fall	Credits	Spring	Credits
AER E 301	0	AER E 311	3
AER E 310	3	AER E 331	3
AER E 321	3	AER E 344	3
AER E 322	2	AER E 361	3
AER E 351	3	AER E 362	3
AER E 355	3	AER E 421	3
ENGL 314	3		
	17		18

Senior

Fall	Credits	Spring	Credits
AER E 411	3	AER E 462	3
AER E 461	3	General Education Elective	3
General Education Elective	3	General Education Elective	3
Technical Elective	3	Technical Elective	3
Technical Elective	3	Technical Elective	3
	15		15

Nondestructive Evaluation (NDE)

The NDE Minor (http://catalog.iastate.edu/collegeofengineering/non_destructiveevaluationengineering) is multidisciplinary and open to undergraduates in the College of Engineering.

Graduate Study

The department offers graduate programs that lead to the degrees master of engineering, master of science, and doctor of philosophy with major in aerospace engineering and minor work to students taking major work in other departments. For all graduate degrees, it is possible to establish a co-major program with another graduate degree-granting department. Within the aerospace program, students can specialize in one or more of the following areas: aerospace systems design, atmospheric and space flight dynamics, computational fluid dynamics, control systems, wind engineering, fluid mechanics, optimization, structural analysis, and non-destructive evaluation.

Master of Science and Master of Engineering

The Master of Science degree requires a thesis and has strong research emphasis. The Master of Science degree is recommended for students who anticipate entering a doctoral program later. The Master of Engineering degree does not require either research credits or a thesis and is intended for students who do not anticipate pursuing a doctoral degree. The Master of Engineering degree can be completed with coursework only or with a combination of coursework and creative component. Credits for creative component will be obtained by

registering for **AerE 599 Creative Component.** A written report and an oral presentation will be given to the student's graduate committee.

At least 30 credits of acceptable graduate work are required for both the Master of Science and the Master of Engineering degrees. For specific course, research, and creative component requirements, see the departmental Graduate Student Handbook (http://www.aere.iastate.edu/files/2015/04/AerE-Graduate-Handbook-Revised-S15.pdf).

Bachelor of Science/Master of Science Concurrent Degree Program

The department offers concurrent BS/MS and BS/ME degree programs (http://www.aere.iastate.edu/students/concurrent-degrees) and a concurrent BS/MBA degree program which offer an opportunity for well-qualified Iowa State juniors and seniors to begin working on a master's degree before completing a bachelor's degree. The concurrent degree programs reduce by one year the normal time period for completing both degrees separately.

Preparation for Graduate Work

The normal prerequisite for major graduate work in aerospace engineering is the completion of an undergraduate curriculum substantially equivalent to that required of aerospace engineering students at this university. Due to the diversity of interests of aerospace faculty, students whose prior undergraduate or graduate education has been in allied engineering and/or scientific fields may also qualify. In such cases, it may be necessary for the student to take additional work to provide the requisite aerospace background. A prospective graduate student is urged to specify the degree program and the specific field(s) of interest on the application for admission.

Courses are offered at the times stated in the course description. Where no specific time of offering is stated, the course may be offered during any semester provided there is sufficient demand.

Graduate Minor Work

Minor work for aerospace engineering majors is usually selected from mathematics, physics, electrical engineering, engineering mechanics, mechanical engineering, materials science, meteorology, computer science, and computer engineering.

Courses primarily for undergraduates:

AER E 160: Aerospace Engineering Problems With Computer Applications Laboratory
(2-2) Cr. 3. F.S.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Solving aerospace engineering problems and presenting solutions through technical reports. Significant figures and estimation. SI units. Graphing and curve fitting. Introduction to aerospace engineering and engineering design. Spreadsheet programs. History of aerospace. Systems thinking. Team projects.

AER E 160H: Aerospace Engineering Problems With Computer Applications Laboratory: Honors
(2-2) Cr. 3. F.S.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Solving aerospace engineering problems and presenting solutions through technical reports. Significant figures. SI units and estimation. Graphing and curve fitting. Introduction to aerospace engineering and engineering design. Spreadsheet programs. History of aerospace. Systems thinking. Team projects.

AER E 161: Numerical, Graphical and Laboratory Techniques for Aerospace Engineering
(2-2) Cr. 3. F.S.
Prereq: AER E 160 or equivalent course
Computer-based problem solving using Matlab(R), with emphasis on numerical methods. Introduction to solid modeling and aerospace design using SolidWorks.

AER E 161H: Numerical, Graphical and Laboratory Techniques for Aerospace Engineering: Honors
(2-2) Cr. 3. F.S.
Prereq: AER E 160 or equivalent course
Computer-based problem solving using Matlab(R), with emphasis on numerical methods. Introduction to solid modeling and aerospace design using SolidWorks.

AER E 192: Aerospace Seminar
Cr. R. S.
Vectors, differentiation, integration, matrices, and systems of linear equations.

AER E 192H: Aerospace Seminar: Honors.
Cr. R. S.
Vectors, differentiation, integration, matrices, and systems of linear equations.

AER E 261: Introduction to Performance and Design
(3-0) Cr. 3. F.S.
Prereq: AER E 161, MATH 166, PHYS 221
Aerodynamics of the airplane, lift and drag, drag polar, propulsion characteristics of turbojets and piston props, level flight, range, endurance, climbing flight, turning flight, take-off and landing, design examples.

AER E 265: Scientific Balloon Engineering and Operations
(Cross-listed with MTEOR). (0-2) Cr. 1. Repeatable. F.
Engineering aspects of scientific balloon flights. Integration of science mission objectives with engineering requirements. Operations team certification. FAA and FCC regulations, communications, and command systems. Flight path prediction and control.

AER E 290: Aerospace Engineering Independent Study: Independent Study
Cr. 1-2. Repeatable.
Prereq: Sophomore classification, approval of the department

AER E 290A: Aerospace Engineering Independent Study: Flight ground instruction
Cr. 1-2. Repeatable.
Prereq: Sophomore classification, approval of the department

AER E 290B: Aerospace Engineering Independent Study: In-flight training
Cr. 1-2. Repeatable.
Prereq: AER E 301

AER E 290C: Aerospace Engineering Independent Study: Other
Cr. 1-2. Repeatable.
Prereq: AER E 301

AER E 301: Flight Experience
Cr. R. F.S.
Prereq: Credit or enrollment in AER E 355
Two hours of in-flight training and necessary ground instruction. Course content prescribed by the Aerospace Engineering Department. Ten hours of flight training certified in a pilot log book can be considered by the course instructor as evidence of satisfactory performance in the course. Offered on a satisfactory-fail basis only.

AER E 310: Aerodynamics I: Incompressible Flow
(3-0) Cr. 3. F.S.
Prereq: Grade of C- or better in AER E 261 and MATH 265
Introduction to fluid mechanics and aerodynamics. Fluid properties and kinematics. Conservation equations in differential and integral form. Bernoulli's equation. Basic potential flow concepts and solutions. Boundary layer concept. Incompressible flow over airfoils and wings. Examples of numerical methods. Applications of multi-variable calculus to fluid mechanics and aerodynamics.

AER E 311: Aerodynamics II: Compressible Flow
(3-0) Cr. 3. F.S.
Prereq: AER E 310, M E 231
Review of thermodynamics, energy equation, compressible flow, and isentropic flow. Normal and oblique shocks. Mach waves and expansion fans. Applications to ducts and nozzles. Compressible airfoil and wing theory. Introduction to advanced compressible flow topics.

AER E 321: Flight Structures Analysis
(3-0) Cr. 3. F.S.
Prereq: E M 324, Credit or enrollment in MATH 266 or 267
Introduction to elasticity, airworthiness, and flight loads. Introduction to fatigue. Materials selection for flight applications. Thin walled cross-sections under bending, torsion, and shear loads using classical methods. Shear center. Column buckling. Matrix methods of structural analysis.

AER E 322: Aerospace Structures Laboratory
(1-2) Cr. 2. F.S.
Prereq: Credit or enrollment in AER E 321
Design of experiments. Data analysis. Strain gage installation. Measurement of stiffness/strength of aluminum. Analysis/fabrication/testing of riveted joints. Shear/bending measurements inbeam sections. Analysis/measurement of strains in frames. Buckling of columns. Stress concentration. Vibration testing of beams and plates. Fabrication/testing of composites.

AER E 331: Flight Control Systems I
(3-0) Cr. 3. F.S.
Prereq: AER E 355
Linear system analysis. Control system designs using root-locus and frequency response methods. Applications in flight control systems.

AER E 344: Aerodynamics and Propulsion Laboratory
(2-2) Cr. 3. F.S.
Prereq: AER E 310; Coreq: AER E 311
Similitude and dimensional analysis. Measurement uncertainty analysis. Pressure and velocity measurement methods and instruments. Pressure distribution around a circular cylinder. Aerodynamic performance of low-speed airfoils. Airfoil wake flow; Boundary layer flow. Flow visualization techniques for supersonic flows and de Laval nozzles.

AER E 351: Astrodynamics I
(3-0) Cr. 3. F.S.
Prereq: E M 345, AER E 261, Credit or enrollment in AER E 310
Introduction to astrodynamics. Two-body motion. Geocentric, lunar and interplanetary trajectories and applications. Launch and atmospheric re-entry trajectories.

AER E 355: Aircraft Flight Dynamics and Control
(3-0) Cr. 3. F.S.
Prereq: AER E 261, MATH 267, E M 345
Aircraft rigid body equations of motion, linearization, and modal analysis. Longitudinal and lateral-directional static and dynamic stability analysis. Flight handling characteristics analysis. Longitudinal and lateral-directional open loop response to aircraft control inputs. Aircraft flight handling qualities.

AER E 361: Computational Techniques for Aerospace Design
(2-2) Cr. 3. F.S.
Prereq: AER E 310, MATH 267, E M 324, E M 345
Advanced programming, workstation environment, and development of computational tools for aerospace analysis and design. Technical report writing.

AER E 362: Aerospace Systems Integration
(3-0) Cr. 3. F.S.
Prereq: Junior standing in Aerospace Engineering or permission of instructor
Emphasis on impact of component interfaces in aerospace systems. Understand how changes in variables associated with individual components impact the performance of the aerospace system. Specific integration challenges include: capturing implicit disciplinary interactions (e.g. structures/aerodynamics, propulsion/aerodynamics, etc.), propagating tolerances through the system (i.e. uncertainty modeling), balancing component attributes in the system objective.

AER E 381: Introduction to Wind Energy
(3-0) Cr. 3. S.
Prereq: MATH 166, PHYS 221
Basic introduction to the fundamentals of Wind Energy and Wind Energy conversion systems. Topics include but not limited to various types of wind energy conversion systems and the aerodynamics, blade and tower structural loads, kinematics of the blades and meteorology.

AER E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

AER E 398: Cooperative Education
Cr. R. Repeatable. F.S.
Prereq: AER E 298, permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

AER E 411: Aerospace Vehicle Propulsion I
(3-0) Cr. 3. F.S.
Prereq: AER E 311, Aer E 344
Atmospheric propulsion system performance and cycle analysis. Momentum theorem, thrust and propulsive efficiency. Thermodynamics of compressible flow with heat and work addition. Components and principles of turbojets and turbofans. Rocket engines and ramjet principles.

AER E 412: Aerospace Vehicle Propulsion II
(3-0) Cr. 3. S.
Prereq: AER E 311
Electricity and magnetism. Plasma physics. Ion engine performance. Introduction to advanced electromagnetic propulsion systems. Energy sources and nuclear propulsion. Space mission requirements.

AER E 417: Experimental Mechanics
(Dual-listed with AER E 517). (Cross-listed with E M). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324; MAT E 273
Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments.

AER E 421: Advanced Flight Structures
(2-2) Cr. 3. F.S.
Prereq: AER E 321, MATH 266 or MATH 267
Analysis of indeterminate flight structures including finite element laboratory. Static analysis of complex structural components subject to thermal and aerodynamic loads. Analytical and finite element solutions for stresses and displacements of membrane, plane stress, plate structures. Buckling of beams, frames, and plate structures. Introduction to vibration of flight structures. Steady state and transient structural response using normal modal analysis.

AER E 422: Vibrations and Aeroelasticity
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E M 324 or AER E 321
Vibration theory. Steady and unsteady flows. Mathematical foundations of aeroelasticity, static and dynamic aeroelasticity. Linear unsteady aerodynamics, non-steady aerodynamics of lifting surfaces. Stall flutter. Aeroelastic problems in civil engineering structures. Aeroelastic problems of rotorcraft. Experimental aeroelasticity. Selected wind tunnel laboratory experiments.

AER E 423: Composite Flight Structures
(2-2) Cr. 3. S.
Prereq: E M 324; MAT E 273
Fabrication, testing and analysis of composite materials used in flight structures. Basic laminate theory of beams, plates and shells. Manufacturing and machining considerations of various types of composites. Testing of composites for material properties, strength and defects. Student projects required.

AER E 426: Design of Aerospace Structures
(2-2) Cr. 3. F.
Prereq: E M 324
Detailed design and analysis of aerospace vehicle structures. Material selection, strength, durability and damage tolerance, and validation analysis. Design for manufacturability.

AER E 432: Flight Control Systems II
(3-0) Cr. 3. F.
Prereq: AER E 331
Aircraft lateral directional stability augmentation. Launch vehicle pitch control system design. Control of flexible vehicles. Satellite attitude control. Flight control designs based on state-space methods. Introduction to sample-data systems.

AER E 433: Spacecraft Dynamics and Control
(3-0) Cr. 3. F.
Prereq: EM 345
Three-dimensional rotational kinematics and attitude dynamics of a rigid body in space. Stability analysis of a spinning spacecraft with or without energy dissipation. Attitude dynamics and stability of a satellite in circular orbit. Introduction to spacecraft attitude determination and control systems (ADCS). Simulation of spacecraft attitude-dynamics and control problems of practical interest using MATLAB.

AER E 442: V/STOL Aerodynamics and Performance
(3-0) Cr. 3. F.
Prereq: AER E 261
Introduction to the aerodynamics, performance, stability, control and critical maneuvering characteristics of V/STOL vehicles. Topics include hovercrafts, jet flaps, ducted fans and thrust vectored engines.

AER E 446: Computational Fluid Dynamics
(3-0) Cr. 3. F.
Prereq: AER E 311, AER E 361
Introduction to computational fluid dynamics. Discretization, consistency, and stability. Explicit and implicit methods for ordinary and partial differential equations. Linearization techniques. Iterative and direct solution algorithms. Numerical methods for parabolic, elliptic and hyperbolic equations. Curvilinear coordinates and numerical grid generation. Applications to Euler, boundary-layer and Navier-Stokes equations.

AER E 448: Fluid Dynamics of Turbomachinery
(Cross-listed with M E). (3-0) Cr. 3. S.
Prereq: AER E 311 or M E 335
Applications of principles of fluid mechanics and thermodynamics in performance analysis and design of turbomachines. Conceptual and preliminary design of axial and radial flow compressors and turbines using velocity triangles and through-flow approaches.

AER E 451: Astrodynamics II
(3-0) Cr. 3. F.S.
Prereq: AER E 351
Orbit determination and prediction using Gibb's and Gauss' methods. Advanced orbit maneuvers, triple-, and fixed-impulse; universal variables; Kepler's problem. Earth gravity field models and gravity harmonics, orbit perturbations, advanced dynamics, variational methods, relative orbital mechanics, and Clohessy-Wiltshire equations.

AER E 461: Modern Design Methodology with Aerospace Applications
(2-2) Cr. 3. F.S.
Prereq: AER E 361, AER E 311, AER E 321, AER E 351, AER E 355
Introduction to modern engineering design methodology. Computational constrained optimal design approach including selection of objective function, characterization of constraint system, materials and strength considerations, and sensitivity analyses.

AER E 462: Design of Aerospace Systems
(1-4) Cr. 3. F.S.
Prereq: AER E 461
Fundamental principles used in engineering design of aircraft, missile, and space systems. Preliminary design of aerospace vehicles. Engineering Ethics.

AER E 463: Introduction to Multidisciplinary Design Optimization
(Dual-listed with AER E 563). (3-0) Cr. 3. F.
Prereq: senior standing in College of Engineering or permission of instructor
Introduction to the theory and methods of Multidisciplinary Design Optimization (MDO), including system coupling, system sensitivity methods, decomposition methods, MDO formulations (such as multi-discipline feasible (MDF), individual discipline feasible (IDF) and all-at-once (AAO) approaches, and MDO search methods.

AER E 464: Spacecraft Systems
(3-0) Cr. 3. S.
Prereq: AER E 351
An examination of spacecraft systems including attitude determination and control, power, thermal control, communications, propulsion, guidance, navigation, command and data handling, and mechanisms. Explanation of space and operational environments as they impact spacecraft design. Includes discussion of safety, reliability, quality, maintainability, testing, cost, legal, and logistics issues.

AER E 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, B M E, CPR E, E E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

AER E 467: Multidisciplinary Engineering Design II
(Cross-listed with CPR E, E E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: Student must be within two semesters of graduation or receive permission of instructor.
Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

AER E 468: Large-Scale Complex Engineered Systems (LSCES)
(Dual-listed with AER E 568). (Cross-listed with I E). (3-0) Cr. 3. S.
Prereq: senior standing in College of Engineering or permission of AerE 468 instructor
Introduction to the theoretical foundation and methods associated with the design for large-scale complex engineered systems, including objective function formation, design reliability, value-driven design, product robustness, utility theory, economic factors for the formation of a value function and complexity science as a means of detecting unintended consequences in the product behavior.

AER E 480: Ultrasonic Nondestructive Evaluation
(Cross-listed with E M). (3-0) Cr. 3. S.
Prereq: E M 324, MATH 266 or MATH 267, PHYS 222
Introduction to stress/strain, Hooke's law, and elastic wave propagation in two dimensions in isotropic media. Ultrasonic plane-wave reflection and transmission; and simple straight-crested guided waves. Transducer construction, behavior, and performance. Simple signal analysis and discrete signal processing. The last few weeks of the course are devoted to case studies.

AER E 481: Advanced Wind Energy: Technology and Design
(3-0) Cr. 3. S.
Prereq: AER E 381 or senior classification in engineering or junior in engineering with a course in fluid mechanics
Advanced topics in wind energy, emphasis on current practices. Theoretical foundations for horizontal and vertical axis wind turbine. Design codes for energy conversion systems design, aerodynamic and structural load estimation, wind resource characterization wind farm design, optimization.

AER E 490: Aerospace Engineering Independent Study
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490A: Aerospace Engineering Independent Study: Aero and/or Gas Dynamics
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490B: Aerospace Engineering Independent Study: Propulsion
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490C: Aerospace Engineering Independent Study: Aerospace Structures
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490D: Aerospace Engineering Independent Study: Flight Dynamics
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490E: Aerospace Engineering Independent Study: Spacecraft Systems
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490F: Aerospace Engineering Independent Study: Flight Control Systems
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490G: Aerospace Engineering Independent Study: Aeroelasticity
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490H: Aerospace Engineering Independent Study: Independent Study, Honors
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490I: Aerospace Engineering Independent Study: Design
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490J: Aerospace Engineering Independent Study: Non-destructive Evaluation
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490K: Aerospace Engineering Independent Study: Wind Engineering
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490L: Aerospace Engineering Independent Study: Multi-functional Ultra-light Structures
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 490O: Aerospace Engineering Independent Study: Other
Cr. 1-6. Repeatable.
Prereq: Junior or senior classification, approval of the department

AER E 499: Senior Project
Cr. 1-2. Repeatable. F.S.
Prereq: Senior classification, credit or enrollment in AER E 491
Development of aerospace principles and concepts through individual research and projects. Written report.

Courses primarily for graduate students, open to qualified undergraduates:

AER E 514: Advanced Mechanics of Materials
(Cross-listed with E M). (3-0) Cr. 3. F.
Prereq: E M 324
Theory of stress and strain, stress-strain relationships. Unsymmetrical bending, curved beams, shear center. Torsion of thin-walled noncircular sections. Equilibrium, compatibility equations. Airy stress functions. Membrane stresses in shells, thick-walled cylinders.

AER E 517: Experimental Mechanics
(Dual-listed with AER E 417). (Cross-listed with E M). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324; MAT E 273
Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments.

AER E 521: Airframe Analysis
(3-0) Cr. 3. F.
Prereq: AER E 421 or E M 424
Analysis of static stresses and deformation in continuous aircraft structures. Various analytical and approximate methods of analysis of isotropic and anisotropic plates and shells.

AER E 522: Design and Analysis of Composite Materials
(3-0) Cr. 3. F.
Prereq: E M 324
Composite constituent materials, micro-mechanics, laminate analysis, hygro-thermal analysis, composite failure, joining of composites, design of composite beams and plates, honeycomb core, manufacturing of composites, short fiber composites, and demonstration laboratory.

AER E 524: Numerical Mesh Generation
(3-0) Cr. 3. F.
Prereq: MATH 385, proficiency in programming
Introduction to modern mesh generation techniques. Structured and unstructured mesh methods, algebraic and PDE methods, elliptic and hyperbolic methods, variational methods, error analysis, Delaunay triangulation, data structures, geometric modeling with B-spline and NURBS surfaces, surface meshing.

AER E 525: Finite Element Analysis
(Cross-listed with E M). (3-0) Cr. 3. S.
Prereq: E M 425, MATH 385
Variational and weighted residual approach to finite element equations. Emphasis on two- and three-dimensional problems in solid mechanics. Isoparametric element formulation, higher order elements, numerical integration, imposition of constraints and penalty, convergence, and other more advanced topics. Use of two- and three-dimensional computer programs. Dynamic and vibrational problems, eigenvalues, and time integration. Introduction to geometric and material nonlinearities.

AER E 531: Automatic Control of Flight Vehicles
(3-0) Cr. 3. S.
Prereq: AER E 331
Applications of classical and modern linear control theory to automatic control of flight vehicles. Spacecraft attitude control. Control of flexible vehicles. Linear-quadratic regulator design applications.

AER E 532: Compressible Fluid Flow
(Cross-listed with M E). (3-0) Cr. 3. S.
Prereq: AER E 310, 311 or equivalent
Thermodynamics of compressible flow. Viscous and inviscid compressible flow equations. One dimensional steady flow; isentropic flow, shocks, expansions. Multidimensional compressible flow aspects. Linear and nonlinear wave analysis and method of characteristics. Subsonic, transonic, supersonic and hypersonic flows.

AER E 541: Incompressible Flow Aerodynamics
(3-0) Cr. 3. F.
Prereq: AER E 310 or M E 335 or equivalent
Kinematics and dynamics of fluid flow. Derivation of the Navier-Stokes, Euler and potential flow equations. Introduction to generalized curvilinear coordinates. Ideal fluids. Two-dimensional and three-dimensional potential flow. Complex variable methods.

AER E 545: Experimental Flow Mechanics and Heat Transfer
(3-0) Cr. 3. F.
Prereq: AER E 310 or M E 335 or E M 378
Similitude and dimensional analysis. Measurement uncertainty analysis; Fluid mechanical apparatus: wind tunnel and water tunnels. Various experimental techniques widely used for fluid mechanics, aerodynamics, heat transfer, and combustion studies: Pressure gauge and transducers; Pitot tube; hot wire anemometry; Shadowgraph and Schlieren Photography; laser Doppler velocimetry; particle image velocimetry (PIV); advanced PIV techniques (stereo PIV, 3-D PIV, Tomographic PIV, Holograph PIV and microscopic PIV); laser induced fluorescence; pressure sensitive painting, temperature sensitive painting; molecular tagging velocimetry; molecular tagging thermometry. Extensive applications and laboratory experiments will be included.

AER E 546: Computational Fluid Mechanics and Heat Transfer I
(Cross-listed with M E). (3-0) Cr. 3. F.
Prereq: AER E 310 or M E 335, and programming experience
Basic concepts of discretization, consistency, and stability. Explicit and implicit methods for ordinary differential equations. Methods for each type of partial differential equation. Iterative solution methods; curvilinear grids. Students will program basic algorithms.

AER E 547: Computational Fluid Mechanics and Heat Transfer II
(Cross-listed with M E). (3-0) Cr. 3. S.
Prereq: AER E 546 or equivalent
Application of computational methods to current problems in fluid mechanics and heat transfer. Methods for solving the Navier-Stokes and reduced equation sets such as the Euler, boundary layer, and parabolized forms of the conservation equations. Introduction to relevant aspects of grid generation and turbulence modeling.

AER E 551: Orbital Mechanics
(3-0) Cr. 3. F.
Prereq: AER E 351
Review of 2-body problem. Orbital maneuvers. Relative motion in orbit. Orbit perturbation analysis. Gravity field expansions and effects on orbiters. 3-body problem with applications.

AER E 556: Guidance and Navigation of Aerospace Vehicles
(3-0) Cr. 3. F.
Prereq: AER E 331
Principles of guidance systems for spacecraft, launch vehicles, homing and ballistic missiles. Optimal guidance. Interplanetary transfer guidance with low thrust. Principles of inertial navigation. Theory and applications of the Global Positioning System. Celestial navigation procedures. Application of Kalman filtering to recursive navigation theory.

AER E 563: Introduction to Multidisciplinary Design Optimization
(Dual-listed with AER E 463). (3-0) Cr. 3. F.
Prereq: senior standing in College of Engineering or permission of instructor
Introduction to the theory and methods of Multidisciplinary Design Optimization (MDO), including system coupling, system sensitivity methods, decomposition methods, MDO formulations (such as multi-discipline feasible (MDF), individual discipline feasible (IDF) and all-at-once (AAO) approaches, and MDO search methods.

AER E 564: Fracture and Fatigue
(Cross-listed with E M, M E, M S E). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324 and either MAT E 216 or MAT E 273 or MAT E 392. Undergraduates: Permission of instructor
Materials and mechanics approach to fracture and fatigue.
Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue.

AER E 565: Systems Engineering and Analysis
(Cross-listed with E E, I E). (3-0) Cr. 3.
Prereq: Coursework in basic statistics
Introduction to organized multidisciplinary approach to designing and developing systems. Concepts, principles, and practice of systems engineering as applied to large integrated systems. Life-cycle costing, scheduling, risk management, functional analysis, conceptual and detail design, test evaluation, and systems engineering planning and organization. Not available for degrees in industrial engineering

AER E 566: Avionics Systems Engineering
(Cross-listed with E E). (3-0) Cr. 3. S.
Prereq: E E 565
Avionics functions. Applications of systems engineering principles to avionics. Top-down design of avionics systems. Automated design tools.

AER E 568: Large-Scale Complex Engineered Systems (LSCES)
(Dual-listed with AER E 468). (Cross-listed with I E). (3-0) Cr. 3. S.
Prereq: senior standing in College of Engineering or permission of AerE 468 instructor
Introduction to the theoretical foundation and methods associated with the design for large-scale complex engineered systems, including objective function formation, design reliability, value-driven design, product robustness, utility theory, economic factors for the formation of a value function and complexity science as a means of detecting unintended consequences in the product behavior.

AER E 569: Mechanics of Composite and Combined Materials
(Cross-listed with E M, M S E). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E M 324
Mechanics of fiber-reinforced materials. Micromechanics of lamina. Macromechanical behavior of lamina and laminates. Strength and interlaminar stresses of laminates. Failure criteria. Stress analysis of laminates. Thermal moisture and residual stresses. Joints in composites.

AER E 570: Wind Engineering
(Cross-listed with E M). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: E M 378, E M 345
Atmospheric circulations, atmospheric boundary layer wind, bluff-body aerodynamics, aeroelastic phenomena, wind-tunnel and full-scale testing, wind-load code and standards, effect of tornado and thunderstorm winds, design applications.

AER E 572: Turbulence
(Cross-listed with CH E). (3-0) Cr. 3.
Prereq: AER E 541 or M E 538
Qualitative features of turbulence. Statistical representation of turbulent velocity fields: averages, moments, correlations, length and time scales and the energy cascade. Averaged equations of motion, closure requirements, Reynolds averaged models. Homogeneous shear flows, free shear flows, boundary layers. Numerical simulation of turbulence: DNS, LES, DES.

AER E 573: Random Signal Analysis and Kalman Filtering
(Cross-listed with E E, M E). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or M E 370 or M E 411 or MATH 341
Elementary notions of probability. Random processes. Autocorrelation and spectral functions. Estimation of spectrum from finite data. Response of linear systems to random inputs. Discrete and continuous Kalman filter theory and applications. Smoothing and prediction. Linearization of nonlinear dynamics.

AER E 574: Optimal Control
(Cross-listed with E E, M E). (3-0) Cr. 3. S.
Prereq: E E 577
The optimal control problem. Variational approach. Pontryagin's principle, Hamilton-Jacobi equation. Dynamic programming. Time-optimal, minimum fuel, minimum energy control systems. The regulator problem. Structures and properties of optimal controls.

AER E 575: Introduction to Robust Control
(Cross-listed with E E, M E). (3-0) Cr. 3.
Prereq: E E 577
Introduction to modern robust control. Model and signal uncertainty in control systems. Uncertainty description. Stability and performance robustness to uncertainty. Solutions to the H2, Hoo, and l1 control problems. Tools for robustness analysis and synthesis.

AER E 576: Digital Feedback Control Systems
(Cross-listed with E E, M E). (3-0) Cr. 3. F.
Prereq: E E 475 or AER E 432 or M E 411 or MATH 415; and MATH 267
Sampled data, discrete data, and the z-transform. Design of digital control systems using transform methods: root locus, frequency response and direct design methods. Design using state-space methods. Controllability, observability, pole placement, state estimators. Digital filters in control systems. Microcomputer implementation of digital filters. Finite wordlength effects. Linear quadratic optimal control in digital control systems. Simulation of digital control systems.

AER E 577: Linear Systems
(Cross-listed with E E, M E, MATH). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or MATH 415; and MATH 207
Linear algebra review. Least square method and singular value decomposition. State space modeling of linear continuous-time systems. Solution of linear systems. Controllability and observability. Canonical description of linear equations. Stability of linear systems. State feedback and pole placements. Observer design for linear systems.

AER E 578: Nonlinear Systems
(Cross-listed with E E, M E, MATH). (3-0) Cr. 3. S.
Prereq: E E 577
Linear vs nonlinear systems. Phase plane analysis. Bifurcation and center manifold theory. Lyapunov stability. Absolute stability of feedback systems. Input-output stability. Passivity theory and feedback linearization. Nonlinear control design techniques.

AER E 581: Perturbation Methods
(3-0) Cr. 3. F.
Prereq: MATH 267
Mathematical perturbation methods with applications to ordinary and partial differential equations. Perturbation expansions. Order of magnitude and gauge functions. Matched asymptotic expansions. Boundary layer problems. Multiple scales. Resonance and mode coupling. Solvability conditions for differential equations. Physical and engineering applications.

AER E 590: Aerospace Engineering Independent Study: Special Topics
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590A: Aerospace Engineering Independent Study: Aero and/or Gas Dynamics
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590B: Aerospace Engineering Independent Study: Propulsion
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590C: Aerospace Engineering Independent Study: Aerospace Structures
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590D: Aerospace Engineering Independent Study: Flight Dynamics
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590E: Aerospace Engineering Independent Study: Spacecraft Systems
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590F: Aerospace Engineering Independent Study: Flight Control Systems
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590G: Aerospace Engineering Independent Study: Aeroelasticity
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590H: Aerospace Engineering Independent Study: Viscous Aerodynamics
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590I: Aerospace Engineering Independent Study: Design
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590J: Aerospace Engineering Independent Study: Hypersonics
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590K: Aerospace Engineering Independent Study: Computational Aerodynamics
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590L: Aerospace Engineering Independent Study: Optimization
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590M: Aerospace Engineering Independent Study: Non Destructive Evaluation
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 590N: Aerospace Engineering Independent Study: Wind Engineering
Cr. 1-5. Repeatable, maximum of 3 times.

AER E 591: Graduate Student Seminar Series
Cr. R. Repeatable.
Presentation of professional topics by department graduate students. Development of presentation skills used in a professional conference setting involving question and answer format.

AER E 599: Creative Component
Cr. 1-5. Repeatable.

Courses for graduate students:

AER E 640: Stability of Fluid Flow
(3-0) Cr. 3.
Prereq: AerE 541
Theoretical methods of stability analysis; linear analysis of exchange of stability and over stability; bifurcation of equilibria; most dangerous modes and pattern formation; shear flow stability theorems. Physical mechanisms. Tollmein-Schlichting waves, disintegration of capillary jets, Benard convection, Taylor-Couette flow, centrifugal instability, double diffusion.

AER E 647: Advanced Computational Fluid Dynamics
(Cross-listed with M E). (3-0) Cr. 3. S.
Prereq: AER E 547
An examination of current methods in computational fluid dynamics. Differencing strategies. Advanced solution algorithms for unstructured meshes. Grid generation. Construction of higher-order CFD algorithms. Parallel computing. Current applications. Use of state of the art CFD codes.

AER E 690: Aerospace Engineering Independent Study: Advanced Topics
Cr. 1-5. Repeatable.

AER E 690A: Aerospace Engineering Independent Study: Aero and/or Gas Dynamics
Cr. 1-5. Repeatable.

AER E 690B: Aerospace Engineering Independent Study: Propulsion
Cr. 1-5. Repeatable.

AER E 690C: Aerospace Engineering Independent Study: Aerospace Structures
Cr. 1-5. Repeatable.

AER E 690D: Aerospace Engineering Independent Study: Flight Dynamics
Cr. 1-5. Repeatable.

AER E 690E: Aerospace Engineering Independent Study: Spacecraft Systems
Cr. 1-5. Repeatable.

AER E 690F: Aerospace Engineering Independent Study: Flight Control Systems
Cr. 1-5. Repeatable.

AER E 690G: Aerospace Engineering Independent Study: Aeroelasticity
Cr. 1-5. Repeatable.

AER E 690H: Aerospace Engineering Independent Study: Viscous Aerodynamics
Cr. 1-5. Repeatable.

AER E 690I: Aerospace Engineering Independent Study: Design
Cr. 1-5. Repeatable.

AER E 690J: Aerospace Engineering Independent Study: Hypersonics
Cr. 1-5. Repeatable.

AER E 690K: Aerospace Engineering Independent Study: Computational Aerodynamics
Cr. 1-5. Repeatable.

AER E 690L: Aerospace Engineering Independent Study: Non Destructive Evaluation
Cr. 1-5. Repeatable.

AER E 690M: Aerospace Engineering Independent Study: Wind Engineering
Cr. 1-5. Repeatable.

AER E 697: Engineering Internship
Cr. R. Repeatable.
Prereq: Permission of DOGE (Director of Graduate Education), graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

AER E 699: Research
Cr. arr. Repeatable.

Agricultural Engineering

For the undergraduate curriculum in agricultural engineering leading to the degree bachelor of science. This curriculum is accredited under the General Criteria and Program Criteria for Agricultural Engineering Programs by the Engineering Accreditation Commission of ABET, http://www.abet.org/.

Curriculum Educational Goal, Objectives, and Learning Outcomes:

Goal: To educate students in the analysis and design of machinery, animal housing, and environmental systems for the production, processing, storage, handling, distribution, and use of food, feed, fiber and other biomaterials, and the management of related natural resources, by integrating basic physical and biological sciences with engineering design principles.

Program Educational Objectives: Three to five years after graduation, our graduates will be using the knowledge, skills, and abilities from their agricultural engineering degree to improve the human condition through successful careers in a wide variety of fields. They will be effective leaders, collaborators, and innovators who address environmental, social, technical, and business challenges. They will be engaged in life-long learning and professional development through self-study, continuing education, or graduate/professional school.

Student Outcomes: At graduation, students will have developed and demonstrated these outcomes:

(a) an ability to apply knowledge of mathematics, science, and engineering;

(b) an ability to design and conduct experiments, as well as to analyze and interpret data;

(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;

(d) an ability to function on multidisciplinary teams;

(e) an ability to identify, formulate, and solve engineering problems;

(f) an understanding of professional and ethical responsibility;

(g) an ability to communicate effectively;

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;

(i) a recognition of the need for, and an ability to engage in life-long learning;

(j) a knowledge of contemporary issues;

(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Graduates find employment in diverse ag- and bio-related industries and government agencies dealing with agricultural machines and buildings, animal and environmental control, grain processing and handling, soil and water resources, food, biorenewables, and biotechnology. Their work involves engineering design, development, testing, research, manufacturing, consulting, sales, and service. Students are highly encouraged to participate in either cooperative education or internship programs.

The department also offers a bachelor of science curriculum in biological systems engineering. Additionally, the department offers bachelor of science curricula in agricultural systems technology and in industrial technology.

Well-qualified juniors and seniors in agricultural engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue a bachelor of science degree in agricultural engineering and a master of science degree in agricultural engineering. A concurrent bachelor of science and master of business administration program is also offered by the department. Refer to Graduate Study for more information.

Curriculum in Agricultural Engineering

Administered by the Department of Agricultural and Biosystems Engineering.

Leading to the degree bachelor of science.

Total credits required: 126.0cr Land and Water Resources Engineering Option, 128.0cr Power and Machinery Engineering Option, 128.0cr Animal Production Systems Engineering Option.

Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.

International Perspectives: 3 cr. [1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirement :
(Minimum GPA of 2.00 in this set of courses.)

ENGL 150	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 160	Information Literacy	1
Communication Elective: One of the following (Must have a C or better in this course)		3
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
SP CM 212	Fundamentals of Public Speaking	
MKT 343	Personal Sales	

Social Sciences and Humanities: 12 cr. [1,2]

3 credits from international perspectives-university approved list	3
3 credits from U.S. diversity-university approved list	3
6 credits from Social Sciences and Humanities courses-department approved list	6
Total Credits	12

Basic Program: 27 cr.
A minimum GPA of 2.00 required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

A B E 160	Systematic Problem Solving and Computer Programming [3]	3
CHEM 167	General Chemistry for Engineering Students	4
or CHEM 177		
and		
CHEM 178	General Chemistry II	
ENGL 150	Critical Thinking and Communication	3

ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGR 101	Engineering Orientation	R
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Math and Physical Science: 7 cr.

CHEM 167L	Laboratory in General Chemistry for Engineering	1
or CHEM 177L	Laboratory in General Chemistry I	
MATH 266	Elementary Differential Equations	3
STAT 305	Engineering Statistics	3
Total Credits		7

Ag Engineering Core: 35 cr.

(A minimum GPA of 2.00 required for this set of courses, including any transfer courses please note that transfer course grades will not be calculated into the Core GPA).

A B E 216	Fundamentals of Agricultural and Biosystems Engineering	3
A B E 218	Project Management & Design in Agricultural and Biosystems Engineering	2
A B E 316	Applied Numerical Methods for Agricultural and Biosystems Engineering	3
A B E 363	Agri-Industrial Applications of Electric Power and Electronics	4
A B E 404	Instrumentation for Agricultural and Biosystems Engineering	3
A B E 415	Agricultural & Biosystems Engineering Design I	2
A B E 416	Agricultural & Biosystems Engineering Design II	2
E M 274	Engineering Statics	3
E M 324	Mechanics of Materials	3
E M 327	Mechanics of Materials Laboratory	1
E M 378	Mechanics of Fluids	3
I E 305	Engineering Economic Analysis	3
M E 231	Engineering Thermodynamics I	3
Total Credits		35

Other Remaining Courses: 8 cr.

A B E 110	Experiencing Agricultural and Biosystems Engineering	1
A B E 170	Engineering Graphics and Introductory Design	3
A B E 201	Preparing for Workplace Seminar	1
Communication Elective: One of the following (Must have a C or better in this course)		3
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
MKT 343	Personal Sales	
SP CM 212	Fundamentals of Public Speaking	
Total Credits		8

Complete remaining courses from one of the following options:

Land and Water Resources Engineering Option: 37 cr.

A B E 431	Design and Evaluation of Soil and Water Conservation Systems	3
AGRON 181	Introduction to Crop Science	3
AGRON 182	Introduction to Soil Science	3
BIOL 251	Biological Processes in the Environment	3
or BIOL 211		
C E 326	Principles of Environmental Engineering	3
C E 372	Engineering Hydrology and Hydraulics	3
GEOL 201	Geology for Engineers and Environmental Scientists	3
MICRO 201	Introduction to Microbiology	2
MICRO 201L	Introductory Microbiology Laboratory	1
Computer Graphics (One of the following):		1
A B E 271	Engineering Applications of Parametric Solid Modeling	
A B E 272	Parametric Solid Models, Drawings, and Assemblies Using Pro/ENGINEER	
A B E 273	CAD for Process Facilities and Land Use Planning (Preferred)	
GIS Elective (One of the following):		3
C R P 251X Fundamentals of Geographic Information Systems		
C R P 451	Introduction to Geographic Information Systems	
ENSCI 370X Natural Resources Photogrammetry and Geographic Information Systems		
ENSCI 461I	Introduction to GIS	
GEOL 452	GIS for Geoscientists	
NREM 345	Natural Resource Photogrammetry and Geographic Information Systems	
NREM 446	Integrating GPS and GIS for Natural Resource Management	
Subsurface Systems Elective (One of the following):		3
C E 360	Geotechnical Engineering	

C E 473	Groundwater Hydrology	
Water Quality Elective (One of the following):		3
A B E 432	Nonpoint Source Pollution and Control	
A B E 436	Design and Evaluation of Soil and Water Monitoring Systems (offered Spring even years)	
A B E 537	Watershed Modeling and Policy	
A B E Breadth (One of the following):		3
A B E 340	Functional Analysis and Design of Agricultural Field Machinery	
A B E 380	Principles of Biological Systems Engineering	
A B E 424 (3 different 1cr modules)		
A B E 424A	Air Polution: Air quality and effects of pollutants	
A B E 424B	Air Pollution: Climate change and causes	
A B E 424C	Air Pollution: Transportation Air Quality	
A B E 424D	Air Pollution: Off-gas treatment technology	
A B E 424E	Air Pollution: Agricultural sources of pollution	
A B E 469	Grain Processing and Handling	
A B E 472	Design of Environmental Modification Systems for Animal Housing (offered Spring even years)	
A B E 478	Wood Frame Structural Design (offered Spring odd years)	
A B E 480	Engineering Analysis of Biological Systems	
Total Credits		37

Power and Machinery Engineering Option: 39 cr.

A B E 340	Functional Analysis and Design of Agricultural Field Machinery	3
A B E 342	Agricultural Tractor Power	3
A B E 413	Fluid Power Engineering	3
AGRON 182	Introduction to Soil Science	3
BIOL 251	Biological Processes in the Environment	3
or BIOL 211		
E M 345	Engineering Dynamics	3
MAT E 273	Principles of Materials Science and Engineering	3
M E 324	Manufacturing Engineering	3
M E 324L	Manufacturing Engineering Laboratory	1
M E 325	Mechanical Component Design	3
Computer Graphics (Two of the following):		2
A B E 271	Engineering Applications of Parametric Solid Modeling	
A B E 272	Parametric Solid Models, Drawings, and Assemblies Using Pro/ENGINEER	
A B E 273	CAD for Process Facilities and Land Use Planning	
A B E Elective (One of the following):		3
A B E 431	Design and Evaluation of Soil and Water Conservation Systems	
A B E 469	Grain Processing and Handling	
A B E 472	Design of Environmental Modification Systems for Animal Housing (offered Spring even years)	
A B E 478	Wood Frame Structural Design (offered Spring odd years)	
A B E 480	Engineering Analysis of Biological Systems	
Math/Science Elective		3
AGRON 181	Introduction to Crop Science	
CHEM 178	General Chemistry II (In combination with CHEM 177)	
MATH 207	Matrices and Linear Algebra	
MATH 265	Calculus III	
Technical Electives [2]		3
Total Credits		39

Animal Production Systems Engineering Option: 39 cr.

A B E 469	Grain Processing and Handling	3
A B E 472	Design of Environmental Modification Systems for Animal Housing (offered Spring even years)	3
A B E 475	Design in Animal Production Systems Engineering	2
A B E 478	Wood Frame Structural Design (offered Spring odd years)	3
AN S 114	Survey of the Animal Industry	2
BIOL 251	Biological Processes in the Environment	3
or BIOL 211		
C E 332	Structural Analysis I	3
C E 333	Structural Steel Design I	3
C E 334	Reinforced Concrete Design I	3
M E 436	Heat Transfer	4
Animal Science/Agronomy Elective (One of the following):		3
AGRON 206	Introduction to Weather and Climate	
AN S 223	Poultry Science	
AN S 225	Swine Science	
AN S 226	Beef Cattle Science	
AN S 229	Sheep Science	
AN S 235	Dairy Cattle Science	
Computer Graphics (One of the following):		1
A B E 271	Engineering Applications of Parametric Solid Modeling	
A B E 272	Parametric Solid Models, Drawings, and Assemblies Using Pro/ENGINEER	

A B E 273	CAD for Process Facilities and Land Use Planning (Preferred)	
A B E elective (One of the following): [2]		3
A B E 431	Design and Evaluation of Soil and Water Conservation Systems	
A B E 340	Functional Analysis and Design of Agricultural Field Machinery	
A B E 408	GIS and Natural Resources Management	
A B E 480	Engineering Analysis of Biological Systems	
Math/Science Elective		3
AGRON 181	Introduction to Crop Science	
AGRON 182	Introduction to Soil Science	
CHEM 178	General Chemistry II (In combination with CHEM 177)	
MATH 265	Calculus III	
MATH 207	Matrices and Linear Algebra	
Total Credits		39

Co-op/Internships (Optional)

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program.
   U.S. Diversity, International Perspectives and Social Science/ Humanities courses may not be taken Pass/Not Pass.
2. Choose from department approved list. (http://www.abe.iastate.edu/undergraduate-students/agricultural-engineering/ae-curricula)
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

See also: A 4-year plan of study grid showing course template by semester.

Agricultural Engineering, B.S. - power & machinery option

First Year

Fall	Credits	Spring	Credits
ENGR 101	0	A B E 110	1
A B E 170	3	A B E 160	3
CHEM 167	4	MATH 166	4
CHEM 167L	1	PHYS 221	5
MATH 165	4	ENGL 250	3
ENGL 150	3		
LIB 160	1		
	16		16

Second Year

Fall	Credits	Spring	Credits
A B E 216	3	A B E 218	2
E M 274	3	A B E 201	1
MAT E 273	3	E M 324	3
AGRON 182	3	MATH 266	3
Math/Science Elective	3	STAT 305	3
		US Diversity Elective	3
	15		15

Third Year

Fall	Credits	Spring	Credits
A B E 340	3	A B E 316	3
A B E 363	4	A B E 342	3
E M 327	1	E M 378	3
E M 345	3	M E 324L	1
M E 231	3	BIOL 251 (OR BIOL 211)	3
International Perspectives Elective	3	Computer Graphics Elective	2
	17		15

Fourth Year

Fall	Credits	Spring	Credits
A B E 415	2	A B E 416	2
A B E 404	3	A B E Elective	3
A B E 413	3	I E 305	3
M E 324	3	Technical Elective	3
M E 325	3	Social Science or Humanities Elective	3
Communication Elective	3	Social Science or Humanities Elective	3
	17		17

Agricultural Engineering, B.S. - animal production systems engineering option

First Year

Fall	Credits	Spring	Credits
ENGR 101	0	A B E 110	1
A B E 170	3	A B E 160	3
CHEM 167	4	MATH 166	4
CHEM 167L	1	PHYS 221	5
MATH 165	4	ENGL 250	3
ENGL 150	3		
LIB 160	1		
	16		16

Second Year

Fall	Credits	Spring	Credits
A B E 216	3	A B E 218	2
E M 274	3	A B E 201	1
MATH 266	3	E M 324	3
Math/Science Elective	3	M E 231	3
US Diversity Elective	3	STAT 305	3
		BIOL 211 (OR BIOL 251)	3
	15		15

Third Year

Fall	Credits	Spring	Credits
A B E 316	3	A B E 478	3
A B E 363	4	C E 333	3
C E 332	3	I E 305	3
E M 327	1	Computer Graphics Elective	1
E M 378	3	Communications Elective	3
AN S 114	2	International Perspective Elective	3
	16		16

Fourth Year

Fall	Credits	Spring	Credits
A B E 415	2	A B E 416	2
A B E 404	3	A B E 469	3
M E 436	4	A B E 472	3
A B E Elective	3	A B E 475	2
An Sci/Agron Elective	3	C E 334	3
Social Science or Humanities Elective	3	SS&H Elective	3
	18		16

Agricultural Engineering, B.S. - land and water resources engineering option

First Year

Fall	Credits	Spring	Credits
ENGR 101	0	A B E 110	1
A B E 170	3	A B E 160	3
CHEM 167	4	MATH 166	4
CHEM 167L	1	PHYS 221	5
MATH 165	4	ENGL 250	3
ENGL 150	3		
LIB 160	1		
	16		16

Second Year

Fall	Credits	Spring	Credits
A B E 216	3	A B E 218	2
E M 274	3	A B E 201	1
MATH 266	3	E M 324	3
AGRON 181	3	M E 231	3
AGRON 182	3	STAT 305	3
		BIOL 251 (OR BIOL 211)	3
	15		15

Third Year

Fall	Credits	Spring	Credits
A B E 316	3	C E 326	3
A B E 363	4	C E 372	3
E M 327	1	MICRO 201	2
E M 378	3	MICRO 201L	1
GIS Elective	3	ABE Breadth Elective	3
International Perspective	3	Computer Graphics Elective	1
		US Diversity Elective	3
	17		16

Fourth Year

Fall	Credits	Spring	Credits
A B E 415	2	A B E 416	2
A B E 404	3	I E 305	3
A B E 431	3	Subsurface Systems Elective	3
GEOL 201	3	Water Quality Elective	3
Communication Elective	3	Social Science or Humanities Elective	3
Social Science or Humanities Elective	3		
	17		14

Graduate Study

The department offers master of science, master of engineering, and doctor of philosophy degrees with a major in agricultural and biosystems engineering. Within the agricultural and biosystems engineering major the student may specialize in advanced machinery engineering, animal production systems engineering, biological and process engineering, occupational safety engineering, or water and environmental stewardship engineering. Details on current research programs available at http://www.abe.iastate.edu/.

For the master of science program, at least 30 credits of acceptable graduate work must be completed with a minimum of 22 credits of course work; corresponding numbers for the master of engineering

program are 32 and 27. For the doctor of philosophy degree, at least 72 credits of acceptable graduate work must be completed with a minimum of 42 credits of course work. All Ph.D. students must complete a teaching/extension experience prior to graduation.

The department also offers both master of science and doctor of philosophy degrees in industrial and agricultural technology.

The department also participates in interdepartmental majors in environmental science, sustainable agriculture, biorenewable resources and technology, human computer interaction, and toxicology (see Index).

Courses primarily for undergraduates:

A B E 110: Experiencing Agricultural and Biosystems Engineering
(0-2) Cr. 1. S.
Laboratory-based, team-oriented experiences in a spectrum of topics common to the practice of agricultural and biosystems engineering. Report writing, co-ops, internships, careers, registration planning.

A B E 160: Systematic Problem Solving and Computer Programming
(2-2) Cr. 3. S.
Prereq: Credit or enrollment in MATH 143 or MATH 165
Engineering approach to problem solution and presentation in the context of real world problems. Introduction to basic principles from statics, projectile motion, conservation of mass and energy and electricity and magnetism. Use of spreadsheet programs and computer programming language(s) to solve and present engineering problems. Introduction to interfacing computers to sensor systems for data collection.

A B E 170: Engineering Graphics and Introductory Design
(2-2) Cr. 3.
Prereq: Satisfactory scores in math placement assessments; credit or enrollment in MATH 142.
Applications of multi-view drawings and dimensioning. Techniques for visualizing, analyzing, and communicating 3-D geometries. Application of the design process including written and oral reports.

A B E 201: Preparing for Workplace Seminar
(Cross-listed with TSM). (1-0) Cr. 1. F.S.
Prereq: Prereq: Sophomore classification in AE, AST, BSE, or I TEC
8 week course. Professionalism in the context of the engineering/technical workplace. Development and demonstration of key workplace competencies: teamwork, initiative, communication, and engineering/technical knowledge. Resumes; Cover Letters; Behavioral Based Interviewing; Industry Speakers; Preparation for internships experiences.

A B E 216: Fundamentals of Agricultural and Biosystems Engineering
(2-2) Cr. 3. F.
Prereq: A B E 160 or permission of the instructor
Application of mathematics and engineering sciences to mass and energy balances in agricultural and biological systems. Emphasis is on solving engineering problems in the areas of heat and mass transfer, air and water vapor systems; animal production systems, grain systems; food systems, hydrologic systems, and bioprocessing.

A B E 218: Project Management & Design in Agricultural and Biosystems Engineering
(1-2) Cr. 2. S.
Prereq: A B E 216
Project management - critical path, Gantt charts, resource allocations, basic project budgeting, and project management software. Engineering design approaches. Open-ended design projects to demonstrate the preceding principles through application of technical concepts taught in prerequisite coursework.

A B E 271: Engineering Applications of Parametric Solid Modeling
(1-2) Cr. 1. F.S.
Prereq: A B E 170 or TSM 116 or equivalent
8 week-course. Creating, editing, and documenting part and assembly models using Solidworks.

A B E 272: Parametric Solid Models, Drawings, and Assemblies Using Pro/ENGINEER
(1-2) Cr. 1. F.S.
Prereq: A B E 170 or TSM 116 or equivalent
8 week-course. Applications of Creo Parametric software. Create solid models of parts and assemblies. Utilize the solid models to create design documentation (standard drawing views, dimensions, and notes) and for the geometric analysis of parts and assemblies.

A B E 273: CAD for Process Facilities and Land Use Planning
(1-2) Cr. 1. F.S.
Prereq: ENGR 170 or TSM 116 or equivalent. 8-week course.
8-week course. Application of 2-D AutoCAD software to create and interpret 2-D drawings and 3-D models of facilities. Topics include geometric construction, design documentation: (using views, dimension, notes), and AutoCAD specific features (i.e. Layers, Blocks, Standards, Styles).

A B E 316: Applied Numerical Methods for Agricultural and Biosystems Engineering
(2-2) Cr. 3. F.S.
Prereq: A B E 160, A B E 218; MATH 266 or MATH 267
Computer aided solution of agricultural engineering problems by use of numerical techniques and mathematical models. Systems analysis and optimization applicable to agricultural and biological systems.

A B E 325: Biorenewable Systems
(Cross-listed with TSM). (3-0) Cr. 3. F.
Prereq: ECON 101; CHEM 163 or higher; and MATH 140 or higher
Converting biorenewable resources into bioenergy and biobased products. Biorenewable concepts as they relate to drivers of change, feedstock production, processes, products, co-products, economics, and transportation/logistics.

A B E 340: Functional Analysis and Design of Agricultural Field Machinery
(2-2) Cr. 3. F.
Prereq: A B E 110, A B E 216
Principles of operation, design, selection, testing and evaluation of agricultural field machinery and systems. Functional and mechanical performances. Crop and soil interaction with machines. Machine systems, including land preparation, crop establishment, crop protection, harvesting and post-harvest, materials handling systems.

A B E 342: Agricultural Tractor Power
(2-3) Cr. 3. S.
Prereq: Ch E 381 or M E 231
Thermodynamic principles and construction of tractor engines. Fuels, combustion, and lubrication. Kinematics and dynamics of tractor power applications; drawbar, power take-off and traction mechanisms.

A B E 363: Agri-Industrial Applications of Electric Power and Electronics
(3-2) Cr. 4. F.S.
Prereq: A B E 218
Single phase and three phase circuit design. Electrical safety. Electric motors and controls. Programmable logic controllers. Digital logic, instrumentation and sensors.

A B E 380: Principles of Biological Systems Engineering
(2-2) Cr. 3. S.
Prereq: A B E 316
Unit-operation analysis of biological systems, through the study of mass, energy, and information transport in bioresource production and conversion systems. Quantification and modeling of biomass production, ecological interactions, and bioreactor operations.

A B E 388: Sustainable Engineering and International Development
(Cross-listed with C E, E E). (2-2) Cr. 3. F.
Prereq: Junior classification in engineering
Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report.
Meets International Perspectives Requirement.

A B E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

A B E 398: Cooperative Education
Cr. R. Repeatable. F.S.
Prereq: A B E 218 and permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

A B E 403: Modeling, Simulation, and Controls for Agricultural and Biological Systems
(Dual-listed with A B E 503). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 316, and A B E 363, and MATH 266 or MATH 267
Modeling dynamic systems with ordinary differential equations. Introduction to state variable methods of system analysis. Analysis of mechanical, electrical, and fluid power systems. Analytical and numerical solutions of differential equations. Introduction to classical control theory. Feedback and stability examined in the s domain. Frequency response as an analytical and experimental tool. MATLAB will be used throughout the course for modeling. Individual and/or group projects required for graduate credit.

A B E 404: Instrumentation for Agricultural and Biosystems Engineering
(Dual-listed with A B E 504). (2-2) Cr. 3. F.
Prereq: A B E 316 and A B E 363 or CPR E 281
Interfacing techniques for computer-based data acquisition and control systems. Basic interfacing components including A/D and D/A conversion, signal filtering, multiplexing, and process control. Sensors and theory of operation applied to practical monitoring and control problems. Individual and group projects required for graduate credit.

A B E 408: GIS and Natural Resources Management
(Dual-listed with A B E 508). (Cross-listed with ENSCI). (2-2) Cr. 3. F.
Prereq: Working knowledge of computers and Windows environment
Introduction to fundamental concepts and applications of GIS in natural resources management with specific focus on watersheds. Topics include: basic GIS technology, data structures, database management, spatial analysis, and modeling; visualization and display of natural resource data. Case studies in watershed and natural resource management using ArcView GIS.

A B E 410: Electronic Systems Integration for Agricultural Machinery & Production Systems
(Dual-listed with A B E 510). Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 363
System architecture and design of electronics used in agricultural machinery and production systems. Emphasis on information technology and systems integration for automated agriculture processes. Design of Controller Area Network (CAN BUS) communication systems and discussion of relevant standards (ISO 11783 and SAE J1939). Application of technologies for sensing, distribution control, and automation of agricultural machinery will be emphasized.

A B E 413: Fluid Power Engineering
(Cross-listed with M E). (2-2) Cr. 3. F.
Prereq: Credit or enrollment in E M 378 or M E 335, A B E 216 or M E 270
Properties of hydraulic fluids. Performance parameters of fixed and variable displacement pumps and motors. Hydraulic circuits and systems. Hydrostatic transmissions. Characteristics of control valves. Analysis and design of hydraulic systems for power and control functions.

A B E 415: Agricultural & Biosystems Engineering Design I
(1-2) Cr. 2. F.S.
Prereq: A B E 316 (majors only)
Identification of current design problems in ag & biosystems engineering. Development of alternate solutions using creativity and engineering analysis and synthesis techniques.

A B E 416: Agricultural & Biosystems Engineering Design II
(1-2) Cr. 2. F.S.
Prereq: A B E 415 (majors only)
Selection of promising solutions to design problems identified in 415 for development by design teams. Presentation of designs through oral and written reports and prototypes.

A B E 418: Fundamentals of Engineering Review
(1-0) Cr. 1.
Prereq: senior classification.
8 week course. Review of core concepts covered in the Fundamentals of Engineering examination with emphasis on statics, dynamics, fluid mechanics, heat transfer, electric circuits, and engineering economics. Open to all College of Engineering seniors, however focus is on the general exam, not discipline specific exams.

A B E 424: Air Pollution
(Dual-listed with A B E 524). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 424A: Air Polution: Air quality and effects of pollutants
(Dual-listed with A B E 524A). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 424B: Air Pollution: Climate change and causes
(Dual-listed with A B E 524B). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 424C: Air Pollution: Transportation Air Quality
(Dual-listed with A B E 524C). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

A B E 424D: Air Pollution: Off-gas treatment technology
(Dual-listed with A B E 524D). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

A B E 424E: Air Pollution: Agricultural sources of pollution
(Dual-listed with A B E 524E). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 431: Design and Evaluation of Soil and Water Conservation Systems
(Dual-listed with A B E 531). (2-3) Cr. 3. F.
Prereq: E M 378 or CH E 356
Hydrology and hydraulics in agricultural and urbanizing watersheds. Design and evaluation of systems for the conservation and quality preservation of soil and water resources. Use and analysis of hydrologic data in engineering design; relationship of topography, soils, crops, climate, and cultural practices in conservation and quality preservation of soil and water for agriculture. Small watershed hydrology, water movement and utilization in the soil-plant-atmosphere system, agricultural water management, best management practices, and agricultural water quality. Graduate students will prepare several research literature reviews on topics covered in the class in addition to the other assignments.

A B E 432: Nonpoint Source Pollution and Control
(Dual-listed with A B E 532). (3-0) Cr. 3.
Prereq: A B E 431 or C E 372 or instructor permission
Characteristics and courses of non-point source (NPS) pollution in agricultural and urban watersheds, computer modeling and NPS pollution for terrestrial and aquatic systems, strategies to control and manage NPS pollution of water bodies, total maximum daily loads (TMDLs) and integrated watershed management. Graduate students are required to review research papers and develop/deliver lecture models on assigned topics.

A B E 436: Design and Evaluation of Soil and Water Monitoring Systems
(Dual-listed with A B E 536). (2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 431/A B E 531
Development of monitoring systems that support effective planning, performance evaluation, modeling, or environmental impact assessment of soil-, water-, and waste-management systems. Typical soil and water pollutants and physical, chemical, and biological characteristics that affect sample location and timing. Sample collection, documentation, chain-of-custody, and quality assurance procedures. In addition to other assignments, graduate students will prepare several research literature reviews on topics covered in the class and develop monitoring plans.

A B E 437: Watershed Modeling and Policy
(Dual-listed with A B E 537). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CE 372 or equivalent
A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools.

A B E 451: Food and Bioprocess Engineering
(Dual-listed with A B E 551). (3-0) Cr. 3. S.
Prereq: A B E 216 and credit or enrollment in M E 436 or CH E 357; or FS HN 351 and MATH 266 or MATH 267
Application of engineering principles and mathematical modeling to the quantitative analysis of food and bioprocessing systems. Physical/chemical characteristics of foods and biological systems, flow processes, thermal processes and separation processes. Term paper required for graduate credit.

A B E 466: Multidisciplinary Engineering Design
(Cross-listed with AER E, B M E, CPR E, E E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

A B E 469: Grain Processing and Handling
(Dual-listed with A B E 569). (Cross-listed with BSE). (2-3) Cr. 3. S.
Prereq: A B E 216
Cereal grain and oilseed properties, quality measurement, processing, and end-use value. Design of drying systems using computer simulation. Corn wet and dry milling. Soybean oil extraction. Grain handling systems.

A B E 472: Design of Environmental Modification Systems for Animal Housing
(Dual-listed with A B E 572). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 216, M E 231
Principles and design of animal environmental control systems. Insulation, heat and mass transfer, fans, ventilation, air distribution, heating and cooling equipment, and controls. Individual and group projects required for graduate credit.

A B E 475: Design in Animal Production Systems Engineering
(2-0) Cr. 2. F.S.
Prereq: A B E 271 or A B E 272, E M 324 and enrollment in APSE option of AE program.
Application of engineering fundamentals to the independent solution of an animal production systems engineering problem with well defined criteria and constraints in either environmental control, structural design, manure management, or air quality/mitigation.

A B E 478: Wood Frame Structural Design
(Dual-listed with A B E 578). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 216, E M 324
Design of light-framed wood structures using LRFD and ASD design procedures. Includes analysis of wind, snow, dead, and live loads. Applications include animal housing and machine storage. Fasteners, laminated posts, truss design and use of National Design Specifications.

A B E 480: Engineering Analysis of Biological Systems
(Cross-listed with ENSCI). (2-2) Cr. 3. F.
Prereq: A B E 380 or permission of the instructor
Systems-level quantitative analysis of biological systems, including applications in foods, feeds, biofuels, bioenergy, and other biological systems. Introduction to economic analysis and life-cycle assessment of these systems at multiple production scales. Applying these tools to evaluate and improve cost and sustainability performance of these biological systems.

A B E 490: A B E Independent Study
Cr. 1-5. Repeatable.
Independent Study.

A B E 490A: A B E Independent Study: Animal Production Systems Engineering
Cr. 1-5. Repeatable.
Independent Study.

A B E 490B: A B E Independent Study: Biorenewable Resources
Cr. 1-5. Repeatable. F.S.SS.
Independent study.

A B E 490E: A B E Independent Study: Environmental Bioprocessing Engineering
Cr. 1-5. Repeatable. F.S.SS.
Independent study in environmental bioprocessing engineering.

A B E 490F: A B E Independent Study: Food Engineering
Cr. 1-5. Repeatable. F.S.SS.
Independent study in food engineering.

A B E 490G: A B E Independent Study: General Topics in A B E
Cr. 1-5. Repeatable. F.S.SS.
Independent study in general A B E topics.

A B E 490H: A B E Independent Study: Honors
Cr. 1-5. Repeatable.
Guided instructing in agricultural and biosystems engineering for honors students.

A B E 490L: A B E Independent Study: Land & Water Resources Engineering
Cr. 1-5. Repeatable.
Guided instruction in land and water resources engineering.

A B E 490M: A B E Independent Study: Advanced Machinery Systems Engineering
Cr. 1-5. Repeatable.
Guided instruction in advance machinery systems engineering.

A B E 495: Agricultural and Biosystems Engineering Department Study Abroad Preparation or Follow-up
(Cross-listed with TSM). Cr. 1-2. Repeatable. F.S.SS.
Prereq: Permission of instructor
Preparation for, or follow-up of, study abroad experience (496). For preparation, course focuses on understanding the tour destination through readings, discussions, and research on topics such as the regional industries, climate, crops, culture, economics, food, geography, government, history, natural resources, and public policies. For follow-up, course focuses on presentations by students, report writing, and reflection. Students enrolled in this course intend to register for 496 the following term or have had taken 496 the previous term.
Meets International Perspectives Requirement.

A B E 496: Agricultural and Biosystems Engineering Department Study Abroad
(Cross-listed with TSM). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
Tour and study at international sites relevant to disciplines of industrial technology, biological systems engineering, agricultural systems technology, and agricultural engineering. Location and duration of tours will vary. Trip expenses paid by students. Pre-trip preparation and/or post-trip reflection and reports arranged through 495.
Meets International Perspectives Requirement.

Courses primarily for graduate students, open to qualified undergraduates:

A B E 503: Modeling, Simulation, and Controls for Agricultural and Biological Systems
(Dual-listed with A B E 403). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 316, and A B E 363, and MATH 266 or MATH 267
Modeling dynamic systems with ordinary differential equations. Introduction to state variable methods of system analysis. Analysis of mechanical, electrical, and fluid power systems. Analytical and numerical solutions of differential equations. Introduction to classical control theory. Feedback and stability examined in the s domain. Frequency response as an analytical and experimental tool. MATLAB will be used throughout the course for modeling. Individual and/or group projects required for graduate credit.

A B E 504: Instrumentation for Agricultural and Biosystems Engineering
(Dual-listed with A B E 404). (2-2) Cr. 3. F.
Prereq: A B E 316 and A B E 363 or CPR E 281
Interfacing techniques for computer-based data acquisition and control systems. Basic interfacing components including A/D and D/A conversion, signal filtering, multiplexing, and process control. Sensors and theory of operation applied to practical monitoring and control problems. Individual and group projects required for graduate credit.

A B E 506: Applied Computational Intelligence
(2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A B E 316 or equivalent, MATH 166, STAT 305
Applications of biologically inspired computational intelligence tools for data mining, system modeling, and optimization for agricultural, biological and other engineered systems. Introduction to Artificial Neural Networks, Support Vector Machines, Fuzzy Logic, Genetic Algorithms, Bayesian and Decision Tree learning. Fundamental Machine Vision techniques will be introduced in the first part of course and be integrated into the lab exercises for learning different computational intelligence techniques. MATLAB will be used throughout the course for algorithm implementation.

A B E 508: GIS and Natural Resources Management
(Dual-listed with A B E 408). (Cross-listed with ENSCI). (2-2) Cr. 3. F.
Prereq: Working knowledge of computers and Windows environment
Introduction to fundamental concepts and applications of GIS in natural resources management with specific focus on watersheds. Topics include: basic GIS technology, data structures, database management, spatial analysis, and modeling; visualization and display of natural resource data. Case studies in watershed and natural resource management using ArcView GIS.

A B E 510: Electronic Systems Integration for Agricultural Machinery & Production Systems
(Dual-listed with A B E 410). Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 363
System architecture and design of electronics used in agricultural machinery and production systems. Emphasis on information technology and systems integration for automated agriculture processes. Design of Controller Area Network (CAN BUS) communication systems and discussion of relevant standards (ISO 11783 and SAE J1939). Application of technologies for sensing, distribution control, and automation of agricultural machinery will be emphasized.

A B E 515: Integrated Crop and Livestock Production Systems
(Cross-listed with AGRON, AN S, SUSAG). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: SUSAG 509
Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms.

A B E 524: Air Pollution
(Dual-listed with A B E 424). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 524A: Air Polution: Air quality and effects of pollutants
(Dual-listed with A B E 424A). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 524B: Air Pollution: Climate change and causes
(Dual-listed with A B E 424B). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 524C: Air Pollution: Transportation Air Quality
(Dual-listed with A B E 424C). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

A B E 524D: Air Pollution: Off-gas treatment technology
(Dual-listed with A B E 424D). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

A B E 524E: Air Pollution: Agricultural sources of pollution
(Dual-listed with A B E 424E). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 531: Design and Evaluation of Soil and Water Conservation Systems
(Dual-listed with A B E 431). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: E M 378 or CH E 356
Hydrology and hydraulics in agricultural and urbanizing watersheds. Design and evaluation of systems for the conservation and quality preservation of soil and water resources. Use and analysis of hydrologic data in engineering design; relationship of topography, soils, crops, climate, and cultural practices in conservation and quality preservation of soil and water for agriculture. Small watershed hydrology, water movement and utilization in the soil-plant-atmosphere system, agricultural water management, best management practices, and agricultural water quality. Graduate students will prepare several research literature reviews on topics covered in the class in addition to the other assignments.

A B E 532: Nonpoint Source Pollution and Control
(Dual-listed with A B E 432). (Cross-listed with ENSCI). (3-0) Cr. 3.
Prereq: A B E 431 or C E 372 or instructor permission
Characteristics and courses of non-point source (NPS) pollution in agricultural and urban watersheds, computer modeling and NPS pollution for terrestrial and aquatic systems, strategies to control and manage NPS pollution of water bodies, total maximum daily loads (TMDLs) and integrated watershed management. Graduate students are required to review research papers and develop/deliver lecture models on assigned topics.

A B E 533: Erosion and Sediment Transport
(Cross-listed with ENSCI, NREM). (2-3) Cr. 3. F.
Prereq: C E 372 or GEOL/ENSCI/MTEOR 402, MATH 166 or equivalent
Soil erosion processes, soil loss equations and their application to conservation planning, sediment properties, initiation of sediment motion and over land flow, flow in alluvial channels and theory of sediment transport, channel stability, reservoir sedimentation, wind erosion, BMPs for controlling erosion.

A B E 536: Design and Evaluation of Soil and Water Monitoring Systems
(Dual-listed with A B E 436). (Cross-listed with ENSCI). (2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 431/A B E 531
Development of monitoring systems that support effective planning, performance evaluation, modeling, or environmental impact assessment of soil-, water-, and waste-management systems. Typical soil and water pollutants and physical, chemical, and biological characteristics that affect sample location and timing. Sample collection, documentation, chain-of-custody, and quality assurance procedures. In addition to other assignments, graduate students will prepare several research literature reviews on topics covered in the class and develop monitoring plans.

A B E 537: Watershed Modeling and Policy
(Dual-listed with A B E 437). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CE 372 or equivalent
A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools.

A B E 551: Food and Bioprocess Engineering
(Dual-listed with A B E 451). (3-0) Cr. 3. S.
Prereq: A B E 216 and credit or enrollment in M E 436 or CH E 357; or FS HN 351 and MATH 266 or MATH 267
Application of engineering principles and mathematical modeling to the quantitative analysis of food and bioprocessing systems. Physical/chemical characteristics of foods and biological systems, flow processes, thermal processes and separation processes. Term paper required for graduate credit.

A B E 569: Grain Processing and Handling
(Dual-listed with A B E 469). (2-3) Cr. 3. S.
Prereq: A B E 216
Cereal grain and oilseed preservation, quality measurement, and end-use value. Design of drying systems using computer simulation. Corn wet and dry milling. Soybean oil extraction. Grain handling systems. Individual and group projects required for graduate credit.

A B E 572: Design of Environmental Modification Systems for Animal Housing
(Dual-listed with A B E 472). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 216, M E 231
Principles and design of animal environmental control systems. Insulation, heat and mass transfer, fans, ventilation, air distribution, heating and cooling equipment, and controls. Individual and group projects required for graduate credit.

A B E 578: Wood Frame Structural Design
(Dual-listed with A B E 478). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 216, E M 324
Design of light-framed wood structures using LRFD and ASD design procedures. Includes analysis of wind, snow, dead, and live loads. Applications include animal housing and machine storage. Fasteners, laminated posts, truss design and use of National Design Specifications.

A B E 580: Engineering Analysis of Biological Systems
(2-2) Cr. 3. F.
Prereq: A B E 216; MATH 266; BIOL 211 or BIOL 212; M E 231
Systems-level engineering analysis of biological systems. Economic and life-cycle analysis of bioresource production and conversion systems. Global energy and resource issues and the role of biologically derived materials in addressing these issues. Students enrolled in ABE 580 will be required to answer additional exam questions and report on two journal articles.

A B E 590: Special Topics in Agricultural & Biosystems Engineering
Cr. 1-3. Repeatable.
Guided instruction and self-study on special topics relevant to agricultural and biosystems engineering.

A B E 598: Technical Communications for a Master's Degree
(Cross-listed with TSM). Cr. 1. F.S.SS.
A technical paper draft based on the M.S. thesis or creative component is required of all master's students. This paper must be in a form that satisfies the requirements of some specific journal and be ready for submission. A technical presentation based on M.S. thesis or creative component is required of all master's students. This presentation must be in a form that satisfies the normal presentation requirements of a professional society. The presentation itself (oral or poster) may be made at a professional society meeting or at any international, regional, state, or university conference/event as long as the presentation content and form conforms to normal expectations. Offered on a satisfactory-fail basis only.

A B E 599: Creative Component
Cr. arr. Repeatable.
Creative Component.

Courses for graduate students:

A B E 601: Graduate Seminar
(Cross-listed with TSM). (1-0) Cr. 1. F.
Keys to starting a good MS thesis or PhD dissertation project. Learning how to begin formulating research questions. Review of literature, research hypotheses, objectives, methods, making figures and tables, and discussing results. Discussion of appropriate outlets including peer-reviewed journals, patents and intellectual property rights, responsible conduct, plagiarism, authorship, and reproducible research. Using peer review, conducting a peer review, and responding to feedback. Other topics may include on-campus library resources, data management, and time management.

A B E 610: Foundations of Sustainable Agriculture
(Cross-listed with AGRON, ANTHR, SOC, SUSAG). (3-0) Cr. 3. F.
Prereq: Graduate classification, permission of instructor
Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts.

A B E 690: Advanced Topics
Cr. arr. Repeatable.
Advanced topics.

A B E 694: Teaching Practicum
(Cross-listed with TSM). Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and permission of instructor
Graduate student experience in the agricultural and biosystems engineering departmental teaching program.

A B E 697: Engineering Internship
Cr. R. Repeatable.
Prereq: Permission of department chair, graduate classification
One semester and one summer maximum per academic year professional work period.

A B E 698: Technical Communications for a Doctoral Degree
(Cross-listed with TSM). Cr. 1. F.S.SS.
A technical paper draft based on the dissertation is required of all Ph.D. students. This paper must be in a form that satisfies the requirements of some specific journal and be ready for submission. A technical presentation based on the dissertation is required of all Ph.D. students. This presentation must be in a form that satisfies the normal presentation requirements of a professional society. The presentation itself (oral or poster) may be made at a professional society meeting or at any international, regional, state, or university conference/event as long as the presentation content and form conforms to normal expectations. Offered on a satisfactory-fail basis only.

A B E 699: Research
Cr. arr. Repeatable.
Research.

A B E 699B: Research: Biosystems Engineering
Cr. arr. Repeatable.
Guided graduate research in biosystems engineering.

A B E 699C: Research: Computer Aided Design
Cr. arr. Repeatable.
Guided graduate research in computer-aided design.

A B E 699E: Research: Environmental Systems
Cr. arr. Repeatable.
Guided graduate research in environmental systems.

A B E 699F: Research: Food Engineering
Cr. arr. Repeatable.
Guided graduate research in food engineering.

A B E 699O: Research: Occupational Safety
Cr. arr. Repeatable.
Guided graduate research in occupational safety.

A B E 699P: Research: Power and Machinery Engineering
Cr. arr. Repeatable.
Guided graduate research in power and machinery engineering.

A B E 699Q: Research: Structures
Cr. arr. Repeatable.
Guided graduate research in structures.

A B E 699R: Research: Process Engineering
Cr. arr. Repeatable.
Guided graduate research in process engineering.

A B E 699S: Research: Environment and Natural Resources
Cr. arr. Repeatable.
Guided graduate research in environment and natural resources.

A B E 699U: Research: Waste Management
Cr. arr. Repeatable.
Guided graduate research in waste management.

Biological Systems Engineering

For the undergraduate curriculum in biological systems engineering leading to the degree bachelor of science. This curriculum is accredited under the General Criteria and Program Criteria for Biological Systems Engineering Programs by the Engineering Accreditation Commission of ABET, http://www.abet.org/.

Curriculum Educational Goal, Objectives, and Learning Outcomes

Biological Systems Engineering integrates life sciences with engineering to solve problems related to, or using, biological systems. These biological systems may include microbes, plants, animals, humans and/or ecosystems. Biological systems engineers have a worldview shaped by an understanding of fundamental principles of engineering and life-sciences. They use their understanding of engineering to analyze organisms or ecosystems, and their knowledge of biological systems to inspire and inform their designs. They approach engineering design from a biological systems perspective, appreciating the complexity of biological systems and developing solutions that accommodate and anticipate the adaptability of biological systems.

Goal: To educate students to solve problems related to biorenewables production and processing, water quality, environmental impacts of the bioeconomy, food processing, and biosensors, and in so doing to prepare students for professional practice and post-graduate educational opportunities.

Program Educational Objectives: Three to five years after graduation, our graduates will be using the knowledge, skills, and abilities from their biological systems engineering degree to improve the human condition through successful careers in a wide variety of fields. They will be effective leaders, collaborators, and innovators who address environmental, social, technical, and business challenges. They will be engaged in life-long learning and professional development through self-study, continuing education, or graduate/professional school.

Student Outcomes: At graduation, students will have developed and demonstrated:

(a) an ability to apply knowledge of mathematics, science, and engineering;
(b) an ability to design and conduct experiments, as well as to analyze and interpret data;
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability;
(d) an ability to function on multidisciplinary teams;
(e) an ability to identify, formulate, and solve engineering problems;
(f) an understanding of professional and ethical responsibility;
(g) an ability to communicate effectively;
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context;
(i) a recognition of the need for, and an ability to engage in life-long learning;
(j) a knowledge of contemporary issues;
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Well-qualified juniors and seniors in biological systems engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue a bachelor of science degree in biological systems engineering and a master of science degree in agricultural engineering. Under concurrent enrollment, students are eligible for assistantships and simultaneously take undergraduate and graduate courses.

A concurrent bachelor of science and master of business administration program is also offered by the department.

The department also offers a bachelor of science curriculum in agricultural engineering. See College of Engineering. Additionally, the department offers bachelor of science curricula in agricultural systems technology and in industrial technology. See College of Agriculture and Life Sciences.

The department also participates in interdepartmental majors in environmental science, sustainable agriculture, biorenewable resources and technology, human computer interaction, and toxicology (see Index).

Curriculum in Biological Systems Engineering

Administered by the Department of Agricultural and Biosystems Engineering.

Leading to the degree bachelor of science.

Total credits required:
128.0 cr: Biorenewable Resources Option
127.0 cr: Bioenvironmental Engineering Option
128.0 cr: Food Engineering Option
128.0 cr: Open Option.
Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.
International Perspectives: 3 cr.[1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirement:
(Minimum GPA of 2.00 in this set of courses.)

ENGL 150	Critical Thinking and Communication (Must have a C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (Must have a C or better in this course)	3
LIB 160	Information Literacy	1
Communication Elective: One of the following (Must have a C or better in this course)		3
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
ENGL 309	Proposal and Report Writing	
MKT 343	Personal Sales	
ENGL 314	Technical Communication	
SP CM 212	Fundamentals of Public Speaking	

Social Sciences and Humanities: 12 cr. [1,2]

3 credits from international perspectives-university approved list	3
3 credits from U.S. diversity-university approved list	3
6 credits from Social Sciences and Humanities courses-department approved list	6
Total Credits	12

Basic Program: 27 cr.
A minimum GPA of 2.00 required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

A B E 160	Systematic Problem Solving and Computer Programming [3]	3
CHEM 167	General Chemistry for Engineering Students	4
or CHEM 177 and CHEM 178		
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGR 101	Engineering Orientation	R
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4

PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Biological, Math and Physical Science: 23 cr.

BIOL 212	Principles of Biology II	3
CHEM 167L	Laboratory in General Chemistry for Engineering	1
or CHEM 177L	Laboratory in General Chemistry I	
Chemistry Sequence I (select from list of lecture with corresponding lab)		4
CHEM 231	Elementary Organic Chemistry	
CHEM 231L	Laboratory in Elementary Organic Chemistry	
CHEM 331	Organic Chemistry I	
CHEM 331L	Laboratory in Organic Chemistry I	
MATH 267	Elementary Differential Equations and Laplace Transforms	4
MICRO 302	Biology of Microorganisms	3
MICRO 302L	Microbiology Laboratory	1
STAT 305	Engineering Statistics (Chemistry Sequence I)	3
Chemistry Sequence II (select from list of lecture with corresponding lab)		4
CHEM 211	Quantitative and Environmental Analysis	
CHEM 211L	Quantitative and Environmental Analysis Laboratory	
CHEM 332	Organic Chemistry II	
CHEM 332L	Laboratory in Organic Chemistry II	
FS HN 311	Food Chemistry	
FS HN 311L	Food Chemistry Laboratory	
Total Credits		23

Biological Systems Engineering Core: 45 cr.

(A minimum GPA of 2.00 required for this set of courses, including any transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

A B E 216	Fundamentals of Agricultural and Biosystems Engineering	3
A B E 218	Project Management & Design in Agricultural and Biosystems Engineering	2
A B E 273	CAD for Process Facilities and Land Use Planning	1
A B E 316	Applied Numerical Methods for Agricultural and Biosystems Engineering	3
A B E 363	Agri-Industrial Applications of Electric Power and Electronics	4
A B E 380	Principles of Biological Systems Engineering	3
A B E 404	Instrumentation for Agricultural and Biosystems Engineering	3
A B E 415	Agricultural & Biosystems Engineering Design I	2
A B E 416	Agricultural & Biosystems Engineering Design II	2
A B E 451	Food and Bioprocess Engineering	3
A B E 480	Engineering Analysis of Biological Systems	3
E M 274	Engineering Statics	3
E M 324	Mechanics of Materials	3
E M 327	Mechanics of Materials Laboratory	1
E M 378	Mechanics of Fluids	3
I E 305	Engineering Economic Analysis	3
M E 231	Engineering Thermodynamics I	3
Total Credits		45

Other Remaining Courses: 8 cr.

A B E 110	Experiencing Agricultural and Biosystems Engineering	1
A B E 170	Engineering Graphics and Introductory Design	3
A B E 201	Preparing for Workplace Seminar	1
Communication Elective: One of the following (Must have a C or better in this course)		3
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
MKT 343	Personal Sales	
SP CM 212	Fundamentals of Public Speaking	
Total Credits		8

Complete remaining courses from one of the following options:

Biorenewable Resources Engineering Option: 13cr.

A B E 325	Biorenewable Systems	3
A B E 469	Grain Processing and Handling	3
M E 436	Heat Transfer	4
Biorenewable Elective (select 3cr from the following):		3
SCM 301	Supply Chain Management	
FS HN 471	Food Processing I	
Total Credits		13

Bioenvironmental Engineering Option: 12 cr.

A B E 431	Design and Evaluation of Soil and Water Conservation Systems	3
C E 326	Principles of Environmental Engineering	3
C E 372	Engineering Hydrology and Hydraulics	3
Bioenvironmental Elective [2]		3
Total Credits		12

Food Engineering Option: 13 cr.

A B E 469	Grain Processing and Handling	3
FS HN 420	Food Microbiology	3
M E 436	Heat Transfer	4
Food Elective (select 3cr from the following):		3
FS HN 471	Food Processing I	
SCM 301	Supply Chain Management	
Total Credits		13

Open Option: 13 cr.

M E 436	Heat Transfer	4
Sequence I, II & III Elective [2]		9
Total Credits		13

Co-op/Internships (Optional)

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program.
   U.S. Diversity, International Perspectives and Social Science/ Humanities courses may not be taken Pass/Not Pass.
2. Choose from department approved list. (http://www.abe.iastate.edu/undergraduate-students/biological-systems-engineering/bse-curricula)
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

See also: A 4-year plan of study grid showing course template by semester for Biological Systems Engineering.

Biological Systems Engineering, B.S. - bioenvironmental engr option

First Year

Fall	Credits	Spring	Credits
ENGR 101	0	A B E 110	1
A B E 170	3	A B E 160	3
CHEM 167	4	MATH 166	4
CHEM 167L	1	PHYS 221	5
MATH 165	4	ENGL 250	3
ENGL 150	3		
LIB 160	1		
	16		16

Second Year

Fall	Credits	Spring	Credits
A B E 216	3	A B E 218	2
E M 274	3	A B E 201	1
BIOL 212	3	A B E 273	1
Chemistry Sequence I with Lab	4	M E 231	3
US Diversity Elective	3	MATH 267	4
		Chemistry Sequence II with Lab	4
	16		15

Third Year

Fall	Credits	Spring	Credits
A B E 316	3	A B E 363	4
E M 378	3	A B E 380	3
MICRO 302	3	C E 372	3
MICRO 302L	1	E M 324	3
STAT 305	3	I E 305	3
International Perspective Elective	3		
	16		16

Fourth Year

Fall	Credits	Spring	Credits
A B E 415	2	A B E 416	2
A B E 404	3	A B E 451	3
A B E 431	3	C E 326	3
A B E 480	3	E M 327	1
Communication Elective	3	Bioenvironmental Elective	3
Social Science or Humanities Elective	3	Social Science or Humanities Elective	3
	17		15

Biological Systems Engineering, B.S. - biorenewable resources engr option

First Year

Fall	Credits	Spring	Credits
ENGR 101	0	A B E 110	1
A B E 170	3	A B E 160	3
CHEM 167	4	MATH 166	4
CHEM 167L	1	PHYS 221	5
MATH 165	4	ENGL 250	3
ENGL 150	3		
LIB 160	1		
	16		16

Second Year

Fall	Credits	Spring	Credits
A B E 216	3	A B E 218	2

E M 274		3	A B E 201		1
BIOL 212		3	A B E 273		1
Chemistry Sequence I with Lab		4	M E 231		3
US Diversity Elective		3	MATH 267		4
			Chemistry Sequence II with Lab		4
		16			15

Third Year

Fall	Credits	Spring	Credits
A B E 316	3	A B E 363	4
A B E 325	3	A B E 380	3
E M 378	3	E M 324	3
MICRO 302	3	I E 305	3
MICRO 302L	1	International Perspective	3
STAT 305	3		
	16		16

Fourth Year

Fall	Credits	Spring	Credits
A B E 415	2	A B E 416	2
A B E 404	3	A B E 451	3
A B E 480	3	A B E 469	3
Biorenewable Elective	3	E M 327	1
Social Science or Humanities Elective	3	M E 436	4
Communication Elective	3	Social Science or Humanities Elective	3
	17		16

Biological Systems Engineering, B.S. - Open Option

First Year

Fall	Credits	Spring	Credits
ENGR 101	0	A B E 110	1
A B E 170	3	A B E 160	3
CHEM 167	4	MATH 166	4
CHEM 167L	1	PHYS 221	5
MATH 165	4	ENGL 250	3
ENGL 150	3		
LIB 160	1		
	16		16

Second Year

Fall	Credits	Spring	Credits
A B E 216	3	A B E 218	2

E M 274		3	A B E 201		1
BIOL 212		3	A B E 273		1
Chemistry Sequence I with lab		4	M E 231		3
US Diversity Elective		3	MATH 267		4
			Chemistry Sequence II with Lab		4
		16			15

Third Year

Fall	Credits	Spring	Credits
A B E 316	3	A B E 363	4
E M 378	3	A B E 380	3
MICRO 302	3	E M 324	3
MICRO 302L	1	I E 305	3
STAT 305	3	Sequence I Elective	3
International Perspective Elective	3		
	16		16

Fourth Year

Fall	Credits	Spring	Credits
A B E 415	2	A B E 416	2
A B E 404	3	A B E 451	3
A B E 480	3	E M 327	1
Sequence II Elective	3	M E 436	4
Communication Elective	3	Sequence III Elective	3
Social Science or Humanities Elective	3	Social Science or Humanities Elective	3
	17		16

Biological Systems Engineering, B.S. Food Engineering Option

First Year

Fall	Credits	Spring	Credits
ENGR 101	0	A B E 110	1
A B E 170	3	A B E 160	3
MATH 165	4	MATH 166	4
CHEM 167	4	PHYS 221	5
CHEM 167L	1	ENGL 250	3
ENGL 150	3		
LIB 160	1		
	16		16

Second Year

Fall	Credits	Spring	Credits
A B E 216	3	A B E 218	2

E M 274	3 A B E 201	1
Chemistry Sequence I with Lab	4 A B E 273	1
BIOL 212	3 M E 231	3
US Diversity Elective	3 MATH 267	4
	Chemistry Sequence II with Lab	4
	16	15

Third Year

Fall	Credits	Spring	Credits
A B E 316	3	A B E 363	4
E M 378	3	A B E 380	3
MICRO 302	3	A B E 469	3
MICRO 302L	1	E M 324	3
STAT 305	3	I E 305	3
International Perspective Elective	3		
	16		16

Fourth Year

Fall	Credits	Spring	Credits
A B E 415	2	A B E 416	2
A B E 404	3	A B E 451	3
A B E 480	3	E M 327	1
FS HN 420	3	M E 436	4
Food Elective	3	Social Science or Humanities Elective	3
Communication Elective	3	Social Science or Humanities Elective	3
	17		16

Graduate Study

The department offers master of science, master of engineering, and doctor of philosophy degrees with a major in agricultural and biosystems engineering. Within the agricultural and biosystems engineering major the student may specialize in advanced machinery engineering, animal production systems engineering, biological and process engineering, occupational safety engineering, or water and environmental stewardship engineering. Details on current research programs available at http://www.abe.iastate.edu/.

For the master of science program, at least 30 credits of acceptable graduate work must be completed with a minimum of 22 credits of course work; corresponding numbers for the master of engineering program are 32 and 27. For the doctor of philosophy degree, at least 72 credits of acceptable graduate work must be completed with a minimum of 42 credits of course work. All Ph.D. students must complete a teaching/extension experience prior to graduation.

The department also offers both master of science and doctor of philosophy degrees in industrial and agricultural technology.

Courses primarily for undergraduates:

A B E 110: Experiencing Agricultural and Biosystems Engineering
(0-2) Cr. 1. S.
Laboratory-based, team-oriented experiences in a spectrum of topics common to the practice of agricultural and biosystems engineering. Report writing, co-ops, internships, careers, registration planning.

A B E 160: Systematic Problem Solving and Computer Programming
(2-2) Cr. 3. S.
Prereq: Credit or enrollment in MATH 143 or MATH 165
Engineering approach to problem solution and presentation in the context of real world problems. Introduction to basic principles from statics, projectile motion, conservation of mass and energy and electricity and magnetism. Use of spreadsheet programs and computer programming language(s) to solve and present engineering problems. Introduction to interfacing computers to sensor systems for data collection.

A B E 170: Engineering Graphics and Introductory Design
(2-2) Cr. 3.
Prereq: Satisfactory scores in math placement assessments; credit or enrollment in MATH 142.
Applications of multi-view drawings and dimensioning. Techniques for visualizing, analyzing, and communicating 3-D geometries. Application of the design process including written and oral reports.

A B E 201: Preparing for Workplace Seminar
(Cross-listed with TSM). (1-0) Cr. 1. F.S.
Prereq: Prereq: Sophomore classification in AE, AST, BSE, or I TEC
8 week course. Professionalism in the context of the engineering/technical workplace. Development and demonstration of key workplace competencies: teamwork, initiative, communication, and engineering/technical knowledge. Resumes; Cover Letters; Behavioral Based Interviewing; Industry Speakers; Preparation for internships experiences.

A B E 216: Fundamentals of Agricultural and Biosystems Engineering
(2-2) Cr. 3. F.
Prereq: A B E 160 or permission of the instructor
Application of mathematics and engineering sciences to mass and energy balances in agricultural and biological systems. Emphasis is on solving engineering problems in the areas of heat and mass transfer, air and water vapor systems; animal production systems, grain systems; food systems, hydrologic systems, and bioprocessing.

A B E 218: Project Management & Design in Agricultural and Biosystems Engineering
(1-2) Cr. 2. S.
Prereq: A B E 216
Project management - critical path, Gantt charts, resource allocations, basic project budgeting, and project management software. Engineering design approaches. Open-ended design projects to demonstrate the preceding principles through application of technical concepts taught in prerequisite coursework.

A B E 271: Engineering Applications of Parametric Solid Modeling
(1-2) Cr. 1. F.S.
Prereq: A B E 170 or TSM 116 or equivalent
8 week-course. Creating, editing, and documenting part and assembly models using Solidworks.

A B E 272: Parametric Solid Models, Drawings, and Assemblies Using Pro/ENGINEER
(1-2) Cr. 1. F.S.
Prereq: A B E 170 or TSM 116 or equivalent
8 week-course. Applications of Creo Parametric software. Create solid models of parts and assemblies. Utilize the solid models to create design documentation (standard drawing views, dimensions, and notes) and for the geometric analysis of parts and assemblies.

A B E 273: CAD for Process Facilities and Land Use Planning
(1-2) Cr. 1. F.S.
Prereq: ENGR 170 or TSM 116 or equivalent. 8-week course.
8-week course. Application of 2-D AutoCAD software to create and interpret 2-D drawings and 3-D models of facilities. Topics include geometric construction, design documentation: (using views, dimension, notes), and AutoCAD specific features (i.e. Layers, Blocks, Standards, Styles).

A B E 316: Applied Numerical Methods for Agricultural and Biosystems Engineering
(2-2) Cr. 3. F.S.
Prereq: A B E 160, A B E 218; MATH 266 or MATH 267
Computer aided solution of agricultural engineering problems by use of numerical techniques and mathematical models. Systems analysis and optimization applicable to agricultural and biological systems.

A B E 325: Biorenewable Systems
(Cross-listed with TSM). (3-0) Cr. 3. F.
Prereq: ECON 101; CHEM 163 or higher; and MATH 140 or higher
Converting biorenewable resources into bioenergy and biobased products. Biorenewable concepts as they relate to drivers of change, feedstock production, processes, products, co-products, economics, and transportation/logistics.

A B E 340: Functional Analysis and Design of Agricultural Field Machinery
(2-2) Cr. 3. F.
Prereq: A B E 110, A B E 216
Principles of operation, design, selection, testing and evaluation of agricultural field machinery and systems. Functional and mechanical performances. Crop and soil interaction with machines. Machine systems, including land preparation, crop establishment, crop protection, harvesting and post-harvest, materials handling systems.

A B E 342: Agricultural Tractor Power
(2-3) Cr. 3. S.
Prereq: Ch E 381 or M E 231
Thermodynamic principles and construction of tractor engines. Fuels, combustion, and lubrication. Kinematics and dynamics of tractor power applications; drawbar, power take-off and traction mechanisms.

A B E 363: Agri-Industrial Applications of Electric Power and Electronics
(3-2) Cr. 4. F.S.
Prereq: A B E 218
Single phase and three phase circuit design. Electrical safety. Electric motors and controls. Programmable logic controllers. Digital logic, instrumentation and sensors.

A B E 380: Principles of Biological Systems Engineering
(2-2) Cr. 3. S.
Prereq: A B E 316
Unit-operation analysis of biological systems, through the study of mass, energy, and information transport in bioresource production and conversion systems. Quantification and modeling of biomass production, ecological interactions, and bioreactor operations.

A B E 388: Sustainable Engineering and International Development
(Cross-listed with C E, E E). (2-2) Cr. 3. F.
Prereq: Junior classification in engineering
Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report.
Meets International Perspectives Requirement.

A B E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

A B E 398: Cooperative Education
Cr. R. Repeatable. F.S.
Prereq: A B E 218 and permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

A B E 403: Modeling, Simulation, and Controls for Agricultural and Biological Systems
(Dual-listed with A B E 503). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 316, and A B E 363, and MATH 266 or MATH 267
Modeling dynamic systems with ordinary differential equations. Introduction to state variable methods of system analysis. Analysis of mechanical, electrical, and fluid power systems. Analytical and numerical solutions of differential equations. Introduction to classical control theory. Feedback and stability examined in the s domain. Frequency response as an analytical and experimental tool. MATLAB will be used throughout the course for modeling. Individual and/or group projects required for graduate credit.

A B E 404: Instrumentation for Agricultural and Biosystems Engineering
(Dual-listed with A B E 504). (2-2) Cr. 3. F.
Prereq: A B E 316 and A B E 363 or CPR E 281
Interfacing techniques for computer-based data acquisition and control systems. Basic interfacing components including A/D and D/A conversion, signal filtering, multiplexing, and process control. Sensors and theory of operation applied to practical monitoring and control problems. Individual and group projects required for graduate credit.

A B E 408: GIS and Natural Resources Management
(Dual-listed with A B E 508). (Cross-listed with ENSCI). (2-2) Cr. 3. F.
Prereq: Working knowledge of computers and Windows environment
Introduction to fundamental concepts and applications of GIS in natural resources management with specific focus on watersheds. Topics include: basic GIS technology, data structures, database management, spatial analysis, and modeling; visualization and display of natural resource data. Case studies in watershed and natural resource management using ArcView GIS.

A B E 410: Electronic Systems Integration for Agricultural Machinery & Production Systems
(Dual-listed with A B E 510). Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 363
System architecture and design of electronics used in agricultural machinery and production systems. Emphasis on information technology and systems integration for automated agriculture processes. Design of Controller Area Network (CAN BUS) communication systems and discussion of relevant standards (ISO 11783 and SAE J1939). Application of technologies for sensing, distribution control, and automation of agricultural machinery will be emphasized.

A B E 413: Fluid Power Engineering
(Cross-listed with M E). (2-2) Cr. 3. F.
Prereq: Credit or enrollment in E M 378 or M E 335, A B E 216 or M E 270
Properties of hydraulic fluids. Performance parameters of fixed and variable displacement pumps and motors. Hydraulic circuits and systems. Hydrostatic transmissions. Characteristics of control valves. Analysis and design of hydraulic systems for power and control functions.

A B E 415: Agricultural & Biosystems Engineering Design I
(1-2) Cr. 2. F.S.
Prereq: A B E 316 (majors only)
Identification of current design problems in ag & biosystems engineering. Development of alternate solutions using creativity and engineering analysis and synthesis techniques.

A B E 416: Agricultural & Biosystems Engineering Design II
(1-2) Cr. 2. F.S.
Prereq: A B E 415 (majors only)
Selection of promising solutions to design problems identified in 415 for development by design teams. Presentation of designs through oral and written reports and prototypes.

A B E 418: Fundamentals of Engineering Review
(1-0) Cr. 1.
Prereq: senior classification.
8 week course. Review of core concepts covered in the Fundamentals of Engineering examination with emphasis on statics, dynamics, fluid mechanics, heat transfer, electric circuits, and engineering economics. Open to all College of Engineering seniors, however focus is on the general exam, not discipline specific exams.

A B E 424: Air Pollution
(Dual-listed with A B E 524). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 424A: Air Polution: Air quality and effects of pollutants
(Dual-listed with A B E 524A). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 424B: Air Pollution: Climate change and causes
(Dual-listed with A B E 524B). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 424C: Air Pollution: Transportation Air Quality
(Dual-listed with A B E 524C). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

A B E 424D: Air Pollution: Off-gas treatment technology
(Dual-listed with A B E 524D). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

A B E 424E: Air Pollution: Agricultural sources of pollution
(Dual-listed with A B E 524E). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 431: Design and Evaluation of Soil and Water Conservation Systems
(Dual-listed with A B E 531). (2-3) Cr. 3. F.
Prereq: E M 378 or CH E 356
Hydrology and hydraulics in agricultural and urbanizing watersheds. Design and evaluation of systems for the conservation and quality preservation of soil and water resources. Use and analysis of hydrologic data in engineering design; relationship of topography, soils, crops, climate, and cultural practices in conservation and quality preservation of soil and water for agriculture. Small watershed hydrology, water movement and utilization in the soil-plant-atmosphere system, agricultural water management, best management practices, and agricultural water quality. Graduate students will prepare several research literature reviews on topics covered in the class in addition to the other assignments.

A B E 432: Nonpoint Source Pollution and Control
(Dual-listed with A B E 532). (3-0) Cr. 3.
Prereq: A B E 431 or C E 372 or instructor permission
Characteristics and courses of non-point source (NPS) pollution in agricultural and urban watersheds, computer modeling and NPS pollution for terrestrial and aquatic systems, strategies to control and manage NPS pollution of water bodies, total maximum daily loads (TMDLs) and integrated watershed management. Graduate students are required to review research papers and develop/deliver lecture models on assigned topics.

A B E 436: Design and Evaluation of Soil and Water Monitoring Systems
(Dual-listed with A B E 536). (2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 431/A B E 531
Development of monitoring systems that support effective planning, performance evaluation, modeling, or environmental impact assessment of soil-, water-, and waste-management systems. Typical soil and water pollutants and physical, chemical, and biological characteristics that affect sample location and timing. Sample collection, documentation, chain-of-custody, and quality assurance procedures. In addition to other assignments, graduate students will prepare several research literature reviews on topics covered in the class and develop monitoring plans.

A B E 437: Watershed Modeling and Policy
(Dual-listed with A B E 537). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CE 372 or equivalent
A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools.

A B E 451: Food and Bioprocess Engineering
(Dual-listed with A B E 551). (3-0) Cr. 3. S.
Prereq: A B E 216 and credit or enrollment in M E 436 or CH E 357; or FS HN 351 and MATH 266 or MATH 267
Application of engineering principles and mathematical modeling to the quantitative analysis of food and bioprocessing systems. Physical/chemical characteristics of foods and biological systems, flow processes, thermal processes and separation processes. Term paper required for graduate credit.

A B E 466: Multidisciplinary Engineering Design
(Cross-listed with AER E, B M E, CPR E, E E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

A B E 469: Grain Processing and Handling
(Dual-listed with A B E 569). (Cross-listed with BSE). (2-3) Cr. 3. S.
Prereq: A B E 216
Cereal grain and oilseed properties, quality measurement, processing, and end-use value. Design of drying systems using computer simulation. Corn wet and dry milling. Soybean oil extraction. Grain handling systems.

A B E 472: Design of Environmental Modification Systems for Animal Housing
(Dual-listed with A B E 572). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 216, M E 231
Principles and design of animal environmental control systems. Insulation, heat and mass transfer, fans, ventilation, air distribution, heating and cooling equipment, and controls. Individual and group projects required for graduate credit.

A B E 475: Design in Animal Production Systems Engineering
(2-0) Cr. 2. F.S.
Prereq: A B E 271 or A B E 272, E M 324 and enrollment in APSE option of AE program.
Application of engineering fundamentals to the independent solution of an animal production systems engineering problem with well defined criteria and constraints in either environmental control, structural design, manure management, or air quality/mitigation.

A B E 478: Wood Frame Structural Design
(Dual-listed with A B E 578). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 216, E M 324
Design of light-framed wood structures using LRFD and ASD design procedures. Includes analysis of wind, snow, dead, and live loads. Applications include animal housing and machine storage. Fasteners, laminated posts, truss design and use of National Design Specifications.

A B E 480: Engineering Analysis of Biological Systems
(Cross-listed with ENSCI). (2-2) Cr. 3. F.
Prereq: A B E 380 or permission of the instructor
Systems-level quantitative analysis of biological systems, including applications in foods, feeds, biofuels, bioenergy, and other biological systems. Introduction to economic analysis and life-cycle assessment of these systems at multiple production scales. Applying these tools to evaluate and improve cost and sustainability performance of these biological systems.

A B E 490: A B E Independent Study
Cr. 1-5. Repeatable.
Independent Study.

A B E 490A: A B E Independent Study: Animal Production Systems Engineering
Cr. 1-5. Repeatable.
Independent Study.

A B E 490B: A B E Independent Study: Biorenewable Resources
Cr. 1-5. Repeatable. F.S.SS.
Independent study.

A B E 490E: A B E Independent Study: Environmental Bioprocessing Engineering
Cr. 1-5. Repeatable. F.S.SS.
Independent study in environmental bioprocessing engineering.

A B E 490F: A B E Independent Study: Food Engineering
Cr. 1-5. Repeatable. F.S.SS.
Independent study in food engineering.

A B E 490G: A B E Independent Study: General Topics in A B E
Cr. 1-5. Repeatable. F.S.SS.
Independent study in general A B E topics.

A B E 490H: A B E Independent Study: Honors
Cr. 1-5. Repeatable.
Guided instructing in agricultural and biosystems engineering for honors students.

A B E 490L: A B E Independent Study: Land & Water Resources Engineering
Cr. 1-5. Repeatable.
Guided instruction in land and water resources engineering.

A B E 490M: A B E Independent Study: Advanced Machinery Systems Engineering
Cr. 1-5. Repeatable.
Guided instruction in advance machinery systems engineering.

A B E 495: Agricultural and Biosystems Engineering Department Study Abroad Preparation or Follow-up
(Cross-listed with TSM). Cr. 1-2. Repeatable. F.S.SS.
Prereq: Permission of instructor
Preparation for, or follow-up of, study abroad experience (496). For preparation, course focuses on understanding the tour destination through readings, discussions, and research on topics such as the regional industries, climate, crops, culture, economics, food, geography, government, history, natural resources, and public policies. For follow-up, course focuses on presentations by students, report writing, and reflection. Students enrolled in this course intend to register for 496 the following term or have had taken 496 the previous term.
Meets International Perspectives Requirement.

A B E 496: Agricultural and Biosystems Engineering Department Study Abroad
(Cross-listed with TSM). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
Tour and study at international sites relevant to disciplines of industrial technology, biological systems engineering, agricultural systems technology, and agricultural engineering. Location and duration of tours will vary. Trip expenses paid by students. Pre-trip preparation and/or post-trip reflection and reports arranged through 495.
Meets International Perspectives Requirement.

Courses primarily for graduate students, open to qualified undergraduates:

A B E 503: Modeling, Simulation, and Controls for Agricultural and Biological Systems
(Dual-listed with A B E 403). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 316, and A B E 363, and MATH 266 or MATH 267
Modeling dynamic systems with ordinary differential equations. Introduction to state variable methods of system analysis. Analysis of mechanical, electrical, and fluid power systems. Analytical and numerical solutions of differential equations. Introduction to classical control theory. Feedback and stability examined in the s domain. Frequency response as an analytical and experimental tool. MATLAB will be used throughout the course for modeling. Individual and/or group projects required for graduate credit.

A B E 504: Instrumentation for Agricultural and Biosystems Engineering
(Dual-listed with A B E 404). (2-2) Cr. 3. F.
Prereq: A B E 316 and A B E 363 or CPR E 281
Interfacing techniques for computer-based data acquisition and control systems. Basic interfacing components including A/D and D/A conversion, signal filtering, multiplexing, and process control. Sensors and theory of operation applied to practical monitoring and control problems. Individual and group projects required for graduate credit.

A B E 506: Applied Computational Intelligence
(2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A B E 316 or equivalent, MATH 166, STAT 305
Applications of biologically inspired computational intelligence tools for data mining, system modeling, and optimization for agricultural, biological and other engineered systems. Introduction to Artificial Neural Networks, Support Vector Machines, Fuzzy Logic, Genetic Algorithms, Bayesian and Decision Tree learning. Fundamental Machine Vision techniques will be introduced in the first part of course and be integrated into the lab exercises for learning different computational intelligence techniques. MATLAB will be used throughout the course for algorithm implementation.

A B E 508: GIS and Natural Resources Management
(Dual-listed with A B E 408). (Cross-listed with ENSCI). (2-2) Cr. 3. F.
Prereq: Working knowledge of computers and Windows environment
Introduction to fundamental concepts and applications of GIS in natural resources management with specific focus on watersheds. Topics include: basic GIS technology, data structures, database management, spatial analysis, and modeling; visualization and display of natural resource data. Case studies in watershed and natural resource management using ArcView GIS.

A B E 510: Electronic Systems Integration for Agricultural Machinery & Production Systems
(Dual-listed with A B E 410). Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 363
System architecture and design of electronics used in agricultural machinery and production systems. Emphasis on information technology and systems integration for automated agriculture processes. Design of Controller Area Network (CAN BUS) communication systems and discussion of relevant standards (ISO 11783 and SAE J1939). Application of technologies for sensing, distribution control, and automation of agricultural machinery will be emphasized.

A B E 515: Integrated Crop and Livestock Production Systems
(Cross-listed with AGRON, AN S, SUSAG). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: SUSAG 509
Methods to maintain productivity and minimize the negative ecological effects of agricultural systems by understanding nutrient cycles, managing manure and crop residue, and utilizing multispecies interactions. Crop and livestock production within landscapes and watersheds is also considered. Course includes a significant field component, with student teams analyzing Iowa farms.

A B E 524: Air Pollution
(Dual-listed with A B E 424). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 524A: Air Polution: Air quality and effects of pollutants
(Dual-listed with A B E 424A). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 524B: Air Pollution: Climate change and causes
(Dual-listed with A B E 424B). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 524C: Air Pollution: Transportation Air Quality
(Dual-listed with A B E 424C). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

A B E 524D: Air Pollution: Off-gas treatment technology
(Dual-listed with A B E 424D). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

A B E 524E: Air Pollution: Agricultural sources of pollution
(Dual-listed with A B E 424E). (Cross-listed with C E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

A B E 531: Design and Evaluation of Soil and Water Conservation Systems
(Dual-listed with A B E 431). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: E M 378 or CH E 356
Hydrology and hydraulics in agricultural and urbanizing watersheds. Design and evaluation of systems for the conservation and quality preservation of soil and water resources. Use and analysis of hydrologic data in engineering design; relationship of topography, soils, crops, climate, and cultural practices in conservation and quality preservation of soil and water for agriculture. Small watershed hydrology, water movement and utilization in the soil-plant-atmosphere system, agricultural water management, best management practices, and agricultural water quality. Graduate students will prepare several research literature reviews on topics covered in the class in addition to the other assignments.

A B E 532: Nonpoint Source Pollution and Control
(Dual-listed with A B E 432). (Cross-listed with ENSCI). (3-0) Cr. 3.
Prereq: A B E 431 or C E 372 or instructor permission
Characteristics and courses of non-point source (NPS) pollution in agricultural and urban watersheds, computer modeling and NPS pollution for terrestrial and aquatic systems, strategies to control and manage NPS pollution of water bodies, total maximum daily loads (TMDLs) and integrated watershed management. Graduate students are required to review research papers and develop/deliver lecture models on assigned topics.

A B E 533: Erosion and Sediment Transport
(Cross-listed with ENSCI, NREM). (2-3) Cr. 3. F.
Prereq: C E 372 or GEOL/ENSCI/MTEOR 402, MATH 166 or equivalent
Soil erosion processes, soil loss equations and their application to conservation planning, sediment properties, initiation of sediment motion and over land flow, flow in alluvial channels and theory of sediment transport, channel stability, reservoir sedimentation, wind erosion, BMPs for controlling erosion.

A B E 536: Design and Evaluation of Soil and Water Monitoring Systems
(Dual-listed with A B E 436). (Cross-listed with ENSCI). (2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 431/A B E 531
Development of monitoring systems that support effective planning, performance evaluation, modeling, or environmental impact assessment of soil-, water-, and waste-management systems. Typical soil and water pollutants and physical, chemical, and biological characteristics that affect sample location and timing. Sample collection, documentation, chain-of-custody, and quality assurance procedures. In addition to other assignments, graduate students will prepare several research literature reviews on topics covered in the class and develop monitoring plans.

A B E 537: Watershed Modeling and Policy
(Dual-listed with A B E 437). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CE 372 or equivalent
A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools.

A B E 551: Food and Bioprocess Engineering
(Dual-listed with A B E 451). (3-0) Cr. 3. S.
Prereq: A B E 216 and credit or enrollment in M E 436 or CH E 357; or FS HN 351 and MATH 266 or MATH 267
Application of engineering principles and mathematical modeling to the quantitative analysis of food and bioprocessing systems. Physical/chemical characteristics of foods and biological systems, flow processes, thermal processes and separation processes. Term paper required for graduate credit.

A B E 569: Grain Processing and Handling
(Dual-listed with A B E 469). (2-3) Cr. 3. S.
Prereq: A B E 216
Cereal grain and oilseed preservation, quality measurement, and end-use value. Design of drying systems using computer simulation. Corn wet and dry milling. Soybean oil extraction. Grain handling systems. Individual and group projects required for graduate credit.

A B E 572: Design of Environmental Modification Systems for Animal Housing
(Dual-listed with A B E 472). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 216, M E 231
Principles and design of animal environmental control systems. Insulation, heat and mass transfer, fans, ventilation, air distribution, heating and cooling equipment, and controls. Individual and group projects required for graduate credit.

A B E 578: Wood Frame Structural Design
(Dual-listed with A B E 478). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A B E 216, E M 324
Design of light-framed wood structures using LRFD and ASD design procedures. Includes analysis of wind, snow, dead, and live loads. Applications include animal housing and machine storage. Fasteners, laminated posts, truss design and use of National Design Specifications.

A B E 580: Engineering Analysis of Biological Systems
(2-2) Cr. 3. F.
Prereq: A B E 216; MATH 266; BIOL 211 or BIOL 212; M E 231
Systems-level engineering analysis of biological systems. Economic and life-cycle analysis of bioresource production and conversion systems. Global energy and resource issues and the role of biologically derived materials in addressing these issues. Students enrolled in ABE 580 will be required to answer additional exam questions and report on two journal articles.

A B E 590: Special Topics in Agricultural & Biosystems Engineering
Cr. 1-3. Repeatable.
Guided instruction and self-study on special topics relevant to agricultural and biosystems engineering.

A B E 598: Technical Communications for a Master's Degree
(Cross-listed with TSM). Cr. 1. F.S.SS.
A technical paper draft based on the M.S. thesis or creative component is required of all master's students. This paper must be in a form that satisfies the requirements of some specific journal and be ready for submission. A technical presentation based on M.S. thesis or creative component is required of all master's students. This presentation must be in a form that satisfies the normal presentation requirements of a professional society. The presentation itself (oral or poster) may be made at a professional society meeting or at any international, regional, state, or university conference/event as long as the presentation content and form conforms to normal expectations. Offered on a satisfactory-fail basis only.

A B E 599: Creative Component
Cr. arr. Repeatable.
Creative Component.

Courses for graduate students:

A B E 601: Graduate Seminar
(Cross-listed with TSM). (1-0) Cr. 1. F.
Keys to starting a good MS thesis or PhD dissertation project. Learning how to begin formulating research questions. Review of literature, research hypotheses, objectives, methods, making figures and tables, and discussing results. Discussion of appropriate outlets including peer-reviewed journals, patents and intellectual property rights, responsible conduct, plagiarism, authorship, and reproducible research. Using peer review, conducting a peer review, and responding to feedback. Other topics may include on-campus library resources, data management, and time management.

A B E 610: Foundations of Sustainable Agriculture
(Cross-listed with AGRON, ANTHR, SOC, SUSAG). (3-0) Cr. 3. F.
Prereq: Graduate classification, permission of instructor
Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts.

A B E 690: Advanced Topics
Cr. arr. Repeatable.
Advanced topics.

A B E 694: Teaching Practicum
(Cross-listed with TSM). Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and permission of instructor
Graduate student experience in the agricultural and biosystems engineering departmental teaching program.

A B E 697: Engineering Internship
Cr. R. Repeatable.
Prereq: Permission of department chair, graduate classification
One semester and one summer maximum per academic year professional work period.

A B E 698: Technical Communications for a Doctoral Degree
(Cross-listed with TSM). Cr. 1. F.S.SS.
A technical paper draft based on the dissertation is required of all Ph.D. students. This paper must be in a form that satisfies the requirements of some specific journal and be ready for submission. A technical presentation based on the dissertation is required of all Ph.D. students. This presentation must be in a form that satisfies the normal presentation requirements of a professional society. The presentation itself (oral or poster) may be made at a professional society meeting or at any international, regional, state, or university conference/event as long as the presentation content and form conforms to normal expectations. Offered on a satisfactory-fail basis only.

A B E 699: Research
Cr. arr. Repeatable.
Research.

A B E 699B: Research: Biosystems Engineering
Cr. arr. Repeatable.
Guided graduate research in biosystems engineering.

A B E 699C: Research: Computer Aided Design
Cr. arr. Repeatable.
Guided graduate research in computer-aided design.

A B E 699E: Research: Environmental Systems
Cr. arr. Repeatable.
Guided graduate research in environmental systems.

A B E 699F: Research: Food Engineering
Cr. arr. Repeatable.
Guided graduate research in food engineering.

A B E 699O: Research: Occupational Safety
Cr. arr. Repeatable.
Guided graduate research in occupational safety.

A B E 699P: Research: Power and Machinery Engineering
Cr. arr. Repeatable.
Guided graduate research in power and machinery engineering.

A B E 699Q: Research: Structures
Cr. arr. Repeatable.
Guided graduate research in structures.

A B E 699R: Research: Process Engineering
Cr. arr. Repeatable.
Guided graduate research in process engineering.

A B E 699S: Research: Environment and Natural Resources
Cr. arr. Repeatable.
Guided graduate research in environment and natural resources.

A B E 699U: Research: Waste Management
Cr. arr. Repeatable.
Guided graduate research in waste management.

Biomedical Engineering

Undergraduate Study

Minor supervised by an interdisciplinary faculty committee, administered by Chemical and Biological Engineering. The Biomedical engineering minor is a unique opportunity for engineering students to acquire a multi-disciplinary engineering and life sciences background for entering the field of biomedical engineering.

The program is open to all undergraduate engineering students at Iowa State University. This minor will provide students with a foundation of core biology and engineering relevant to further study in biomedical engineering along with an introduction to the application of engineering principles to biomedical problems from a multidisciplinary perspective as well as the applications within the majors of the participating departments. Minor requirements are as follows:

A minimum of 16 cr. meeting the six requirements below with a minimum of 9 of those credits not being used to meet degree requirements and a

minimum of 6 cr. at the 300 level or above. For most students this last stipulation will probably result in 18 cr. being taken.

BIOL 212	Principles of Biology II	3
B M E/CH E 220	Introduction to Biomedical Engineering	3
BIOL 256	Fundamentals of Human Physiology	3
Introductory Engineering Elective *		3
Advanced Engineering Elective **		3
Professional Elective ***		1-3
Total Credits		16-18

*A second (Introductory) engineering course from a department other than that of your major that is not duplicative of material in a course taken in your own department. The topic of the course should have ready application to later B M E-related electives in that discipline (MATE 273; E M 274 or 324; CH E 210, E E 201, 230 or 208X; or other courses approved by Minor Chair).

** 300-500 level engineering course with clear biomedical engineering application (B M E 341, 450, 490; B M E/CH E 440, CH E 542; B M E/MAT E 456; EE 430; I E 571; I E 447 or other courses approved by Minor Chair).

*** 300-500 level engineering or life sciences course with clear biomedical engineering application OR B M E 490 OR departmental 490 with biomedical engineering topic OR 200+-level life sciences laboratory course (If a 200-level course is chosen here, the student will need to meet the required 6 cr. of 300+ courses by substitution of a higher-level course for the other requirements or by taking an additional course.), OR 300-500 level B M E courses, which may be offered on-line from the University of Iowa.

Courses primarily for undergraduates:

B M E 220: Introduction to Biomedical Engineering
(Cross-listed with CH E). (3-0) Cr. 3. S.
Prereq: BIOL 212, ENGR 160 or equiv, MATH 166, CHEM 167 or CHEM 178, PHYS 222
Engineering analysis of basic biology and engineering problems associated with living systems and health care delivery. The course will illustrate biomedical engineering applications in such areas as: biotechnology, biomechanics, biomaterials and tissue engineering, and biosignal and image processing, and will introduce the basic life sciences and engineering concepts associated with these topics.

B M E 341: BioMEMs and Nanotechnology
(3-0) Cr. 3.
Prereq: B M E 220
Overview of Micro-Electro-Mechanical-System (MEMS) technologies for bioengineering, fundamentals of microfluidic device design, fabrication, and characterization, survey of microfluidic functional building blocks for lab-on-a-chip applications including mixers, valves, channels, and chambers. Topics of nanotechnology in bioengineering, nanoscale building block technologies for bioengineering including self-assembling, surface chemical treatment, nano-imprinting, nano-particles, nano-tubes, nano-wires, and stimuli-responsive biomaterials.

B M E 341L: BioMEMS and Nanotechnology Laboratory
(0-3) Cr. 1.
Prereq: B M E 220, concurrent enrollment in B M E 341
Introductory laboratory course accompanying B M E 341. Design, fabrication, and characterization of BioMEMS lab-on-a-chip devices and nanoscale techniques for bioengineering. Student group projects.

B M E 352: Molecular, Cellular and Tissue Biomechanics
(3-0) Cr. 3.
Prereq: B M E 220, E M 324, MAT E 273
Introduction to the anatomy of the musculoskeletal system and connective tissue. Range of movement, joint dislocation, bone deformity and fracture. Application of continuum mechanics to both living and non-living systems. Laws of motion, free-body diagrams and simple force analysis of musculoskeletal system. Biomechanical response of soft and hard tissues with emphasis on microstructure and mechanical properties. Applications to bioengineering design.

B M E 428: Image Processing with Biomedical Applications
(3-0) Cr. 3.
Prereq: E E 324
Review of signal processing, linear algebra, probability. Image sampling and quantization. Image transforms, image enhancement, image denoising/restoration. Tomographic reconstruction, segmentation and registration, recognition and shape analysis and applications in Computer Aided disease Detection (CAD).

B M E 440: Biomedical Applications of Chemical Engineering
(Cross-listed with CH E). (3-0) Cr. 3.
Prereq: CH E 210, MATH 266, PHYS 222
Applications of material and energy balances, transport phenomena, chemical reaction engineering, and thermodynamics to problems in biomedical engineering and applied physiology; survey of biomedical engineering; biomaterials; biomedical imaging.

B M E 450: Biosensing
(Cross-listed with E E). (3-0) Cr. 3.
Prereq: B M E 220
Overview of biosensors and bioanalytical challenges; designing for performance including various analytical problems, ion-selective membranes, characteristics of enzymes and basics of bioaffinity sensing; fundamentals of bioselective layers including depositing films and membranes, surfaces for immobilization and bioselective agents; survey of different biosensing technologies including electroanalytical, biomembrane, optical, and acoustic-wave based sensors.

B M E 450L: Biosensing Laboratory
(Cross-listed with E E). (0-3) Cr. 1.
Prereq: B M E 220, concurrent enrollment in B M E 450
Laboratory course accompanying B M E 450. Design, fabrication, and characterization of various electrical, chemical, polymer, optical and acoustic sensors.

B M E 456: Biomaterials
(Cross-listed with MAT E). (3-0) Cr. 3. F.
Prereq: MAT E 216 or MAT E 273 or MAT E 392
Presentation of the basic chemical and physical properties of biomaterials, including metals, ceramics, and polymers, as they are related to their manipulation by the engineer for incorporation into living systems. Role of microstructure properties in the choice of biomaterials and design of artificial organs, implants, and prostheses.

B M E 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, AER E, CPR E, E E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

B M E 490: Independent Study
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: permission of chair for the bioengineering minor
Investigation of biomedical engineering topics of special interest to student and supervising faculty member with a final written report.

Chemical Engineering

http://www.cbe.iastate.edu/

Administered by the Department of Chemical and Biological Engineering

For undergraduate curriculum in chemical engineering leading to the degree bachelor of science. The Chemical Engineering program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

Chemical engineering is a profession, which provides a link between scientific knowledge and manufactured products. The chemical engineer relies on science, experience, creativity, and ingenuity to produce these materials economically. Almost everything of a material nature used by society today has at some point felt the influence of the chemical engineer. From raw materials such as minerals, coal, petroleum, and agricultural products; chemical engineers create versatile intermediate and commodity chemicals, high performance fuels, new materials for construction, pharmaceuticals, high performance foodstuffs, synthetic textiles, plastics, solid state electronic components, and dozens of other engineered materials. The chemical engineer's influence has been important in the development of catalysts, fuel cells, automatic controls, biochemical processes, artificial kidneys, tissue engineering, nuclear energy, medical instruments and devices, as well as in the development of air and water pollution control systems. Many new and equally exciting challenges await the practicing chemical engineer of the future.

The profession of chemical engineering embraces a wide variety of activities including research, process development, product development, design, manufacturing supervision, technical sales, consulting, and teaching. The engineer can be behind a desk, in a laboratory, in a manufacturing plant, or engaged in nationwide and worldwide travel. Successful chemical engineers find chemistry, mathematics, and physics to be interesting and exciting. Many chemical engineers also have interest in the biological sciences. The curriculum in chemical engineering includes continued study of chemistry, biochemistry, mathematics, and physics as well as intensive study in the engineering sciences such as chemical reaction engineering, thermodynamics, mass transfer, fluid mechanics, heat transfer, system analysis and process synthesis, and design.

The curriculum in chemical engineering is designed to produce graduates who have the ability to apply knowledge of mathematics, science, and engineering; the ability to design, conduct and interpret experiments; and the ability to design a chemical engineering system, component, or process. Graduates should also have the ability to function on multi-disciplinary teams; the ability to identify, formulate, and solve chemical engineering problems; and the ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The curriculum should also assure that graduates have the ability to communicate effectively, the broad education necessary to understand the impact of chemical engineering solutions in a global and societal context, and recognition of the need for, and an ability to engage in life-

long learning, as well as a knowledge of contemporary issues and an understanding of professional and ethical responsibility.

The curriculum assures that graduates have a thorough grounding in chemistry, along with a working knowledge of advanced chemistry such as organic, inorganic, physical, analytical, materials chemistry, or biochemistry. In addition, a working knowledge, including safety and environmental aspects, of material and energy balances applied to chemical processes; thermodynamics of physical and chemical equilibria; heat, mass, and momentum transfer; chemical reaction engineering; continuous and stage-wise separation operations; process dynamics and control; process design; and appropriate modern experimental and computing techniques is assured.

Program Educational Objectives

The objectives of the Chemical Engineering Program at Iowa State University are to produce graduates who:

- will excel in careers as professional chemical engineers in the businesses and industries related to chemical engineering; and
- will successfully pursue research and advanced studies in chemical engineering, or in related fields such as chemistry or biology, or in related professional fields such as medicine, law, and business.

Biological Engineering Option

Students may enhance their academic preparation for the growing opportunities in the biologically-related industries by pursuing a selection of courses with a biological emphasis.

Cooperative Education

A cooperative education program is available to students in chemical engineering.

Curriculum in Chemical Engineering

Administered by the Department of Chemical and Biological Engineering

Leading to the degree bachelor of science.

Total credits required: 129 cr. See also Basic Program and Special Programs.
International Perspectives: 3 cr. [1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirement:

ENGL 150	Critical Thinking and Communication (C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
LIB 160	Information Literacy	1
One of the following (C or better in this course)		3
ENGL 309	Proposal and Report Writing	
ENGL 312	Biological Communication	
ENGL 314	Technical Communication	
JL MC 347	Science Communication	

The CBE Department requires a grade of a C or better for any transfer credit course that is applied to the degree program but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA

Social Sciences and Humanities: 15 cr. [2]
Complete a total of 15 cr. with at least 6 cr. but not more than 9 cr. from the same department.

Basic Program: 27 cr. [3]
A minimum GPA of 2.00 required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 177	General Chemistry I	4
or CHEM 167	General Chemistry for Engineering Students	
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGR 101	Engineering Orientation	R
CH E 160	Chemical Engineering Problems with Computer Applications Laboratory [3]	3
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Math and Physical Science: 30 cr.

MATH 265	Calculus III	4
MATH 267	Elementary Differential Equations and Laplace Transforms	4
PHYS 222	Introduction to Classical Physics II	5
CHEM 177L	Laboratory in General Chemistry I	1
or CHEM 167L	Laboratory in General Chemistry for Engineering	
CHEM 178	General Chemistry II	3
CHEM 178L	Laboratory in College Chemistry II	1
CHEM 325	Chemical Thermodynamics	3
CHEM 331	Organic Chemistry I	3
CHEM 332	Organic Chemistry II	3
BBMB 301	Survey of Biochemistry *	3
Total Credits		30

Chemical Engineering Core: 36 cr.
(A minimum GPA of 2.00 required for this set of courses, including any transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

CH E 210	Material and Energy Balances	3
CH E 202	Chemical Engineering Seminar	1
CH E 205	Chemical Engineering Progress Assessment	R
CH E 310	Computational Methods in Chemical Engineering	3
CH E 325	Chemical Engineering Laboratory I	2
CH E 356	Transport Phenomena I	3
CH E 357	Transport Phenomena II	3
CH E 358	Separations	3
CH E 381	Chemical Engineering Thermodynamics	3
CH E 382	Chemical Reaction Engineering	3
CH E 420	Chemical Process Safety	3
CH E 421	Process Control	3
CH E 426	Chemical Engineering Laboratory II	2
CH E 430	Process and Plant Design	4
Total Credits		36

Other Remaining Courses: 21 cr. [2]

One of the following Communication Elective:		3
ENGL 309	Proposal and Report Writing	
ENGL 312	Biological Communication	
ENGL 314	Technical Communication	
JL MC 347	Science Communication	
Chemistry Electives [2]		3
Statistical Electives [2]		3
Chemical Engineering Electives [2]		6
Engineering Electives [2]		3
Professional Elective [2]		3
Total Credits		21

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CH E 205	Chemical Engineering Progress Assessment	R

* BBMB 301 Survey of Biochemistry may not be used for a technical elective. See department approved list (http://www.cbe.iastate.edu/current-students/guides-and-handbooks) for approved course substitutions for BBMB 301.

Biological Engineering Option
The standard Chemical Engineering program may be modified to meet the option requirements for Biological Engineering:

Math and Physical Science – BBMB 404 Biochemistry I or BIOL 313 Principles of Genetics, 3 cr., may be substituted for BBMB 301 Survey of Biochemistry from list above when taken with BBMB 405 Biochemistry II or BIOL 314 Principles of Molecular Cell Biology, respectively. BBMB 420 must be taken in combination with BBMB 301.

Chemical Engineering Core – Replace CH E 426 Chemical Engineering Laboratory II, 2 cr. with CH E 427 Biological Engineering Laboratory, 2 cr. in required Core.

Other Remaining Courses for Biological Engineering Option [2]

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. diversity and international perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list (http://www.cbe.iastate.edu/current-students/guides-and-handbooks).
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

Note: Transfer students with transfer credits in chemical engineering core courses must earn at least 15 semester credits in ISU courses in this category at the 300-level or above to qualify for the B.S. degree in chemical engineering.

Pass-Not Pass Policy
A maximum of nine Pass-Not Pass semester credits may be used to meet graduation requirements. Courses offered on a Satisfactory-Fail basis may not be taken on a Pass-Not Pass basis. Pass-Not Pass credits can be applied toward requirements for a B.S. degree in chemical engineering only if the course is specified in the curriculum as a social science and humanities elective or is a course not used in the degree program. Pass-Not Pass credits are not acceptable for technical elective courses or for courses used to satisfy the US diversity or international perspectives requirements.

See also: A 4-year plan of study grid showing course template by semester.

Chemical Engineering, B.S.

Freshman

Fall	Credits	Spring	Credits
MATH 165	4	MATH 166	4
ENGR 101	0	PHYS 221	5
CHEM 177	4	CHEM 178	3
CHEM 177L	1	CHEM 178L	1
LIB 160	1	SSH Elective*	3
ENGL 150	3		

CH E 160	3		
	16		16

Sophomore

Fall	Credits	Spring	Credits
MATH 265	4	MATH 267	4
PHYS 222	5	CHEM 325	3
CHEM 331	3	CHEM 332	3
CH E 210	3	CH E 356	3
CH E 202	1	ENGL 250	3
CH E 205	0		
	16		16

Junior

Fall	Credits	Spring	Credits
CH E 381	3	CH E 325	2
BBMB 301	3	CH E 358	3
CH E 357	3	CH E 382	3
CH E 310	3	SSH Elective*	3
Stat Elective*	3	Advanced CHEM Elective*	3
		Communication Elective*	3
	15		17

Senior

Fall	Credits	Spring	Credits
CH E 420	3	CH E 426	2
CH E 421	3	CH E 430	4
SSH Elective*	3	SSH Elective*	3
ENGR Elective*	3	SSH Elective*	3
CH E Elective*	3	CH E Elective*	3
		Professional Elective*	3
	15		18

* Choose from department approved list (http://www.cbe.iastate.edu/current-students/guides-and-handbooks).

Graduate Study

The department offers work for the degrees master of science, master of engineering, and doctor of philosophy with major in chemical engineering, and minor work to students taking major work in other departments. Prerequisite to major graduate work is a bachelor's degree in chemical engineering, chemistry, or other related field. Students with undergraduate background other than chemical engineering should contact the department for further details. A thesis is required for the master of science degree. The master of science degree also requires a minimum of 30 graduate credits (minimum of 15 for coursework, 12 within Ch E and 3 outside). The master of engineering requirements are the same for total credits but include a special project or coursework rather than research thesis. The doctor of philosophy degree requires a minimum of 72 graduate credits (minimum of 30 for coursework, at least 16 inside Ch E and a minimum of 8 credits taken outside of Ch E). Candidates for the doctor of philosophy degree can refer to the department's home page and/or the department's Graduate Student Handbook for degree options and credit requirements.

Well-qualified juniors and seniors in chemical engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science and Master of Science.

Courses primarily for undergraduates:

CH E 104: Chemical Engineering Learning Community
Cr. R. F.
Prereq: Enrollment in Chemical Engineering Learning Team
(1-0) Curriculum in career planning and academic course support for Freshmen learning team.

CH E 160: Chemical Engineering Problems with Computer Applications Laboratory
(2-2) Cr. 3. F.S.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Formulation and solution of engineering problems. Significant figures. Use of SI units. Graphing and curve-fitting. Flowcharting. Introduction to material balances, engineering economics, and design. Use of spreadsheet programs to solve and present engineering problems. Solution of engineering problems using computer programming languages. Chemical Engineering examples.

CH E 202: Chemical Engineering Seminar
(1-0) Cr. 1. F.
Prereq: Sophomore classification in chemical engineering; credit or enrollment in CH E 210.
Professionalism in the context of the engineering/technical workplace. Introduction to chemical engineering career opportunities. Process and workplace safety. Development and demonstration of key workplace competencies: teamwork, professionalism and ethical responsibility, ability to engage in life-long learning, and knowledge of contemporary issues. Resumes; professional portfolios; preparation for internship experiences.

CH E 204: Chemical Engineering Continuing Learning Community
Cr. R.
Prereq: Corequisite-enrollment in Chemical Engineering Learning Team
Curriculum and career planning, academic course support for learning community.

CH E 205: Chemical Engineering Progress Assessment
Cr. R. F.S.
Prereq: CHEM 178, MATH 166; credit or enrollment in CH E 160, CH E 210
Assessment of proficiency in general chemistry, calculus (including infinite series and applications of derivatives and integrals), and material balances, and an ability to use the principles of science and mathematics to identify, formulate, and solve engineering problems. Offered on a satisfactory-fail basis only.

CH E 210: Material and Energy Balances
(3-0) Cr. 3. F.S.
Prereq: Chem 178, Math 166, CH E 160
Introduction to chemical processes. Physical behavior of gases, liquids, and solids. Application of material and energy balances to chemical engineering equipment and processes.

CH E 220: Introduction to Biomedical Engineering
(Cross-listed with B M E). (3-0) Cr. 3. S.
Prereq: BIOL 212, ENGR 160 or equiv, MATH 166, CHEM 167 or CHEM 178, PHYS 222
Engineering analysis of basic biology and engineering problems associated with living systems and health care delivery. The course will illustrate biomedical engineering applications in such areas as: biotechnology, biomechanics, biomaterials and tissue engineering, and biosignal and image processing, and will introduce the basic life sciences and engineering concepts associated with these topics.

CH E 310: Computational Methods in Chemical Engineering
(3-0) Cr. 3. F.S.
Prereq: CH E 160, CH E 205, CH E 210, MATH 265
Numerical methods for solving systems of linear and nonlinear equations, ordinary differential equations, numerical differentiation and integration, and nonlinear regression using chemical engineering examples.

CH E 325: Chemical Engineering Laboratory I
(0-4) Cr. 2. F.S.
Prereq: CH E 357, CH E 381; credit or enrollment in CH E 382; credit or enrollment in ENGL 314 or ENGL 309 or ENGL 312 or JL MC 347
Experiments covering fundamental material and energy balances, momentum and energy transport operations, and thermodynamics. Computer applications.

CH E 356: Transport Phenomena I
(3-0) Cr. 3. F.S.
Prereq: CH E 205, CH E 210, PHYS 221, credit or enrollment in MATH 267
Momentum and mechanical energy balances. Incompressible and compressible fluid flow. Applications to fluid drag, piping system design, filtration, packed beds and settling.

CH E 357: Transport Phenomena II
(3-0) Cr. 3. F.S.
Prereq: Credit or enrollment in CH E 310; CH E 356
Conduction and diffusion, convective heat and mass transfer, boiling and condensation, radiation, and design of heat exchange equipment. Introduction to diffusion.

CH E 358: Separations
(3-0) Cr. 3. F.S.
Prereq: CH E 310, CH E 357
Diffusion and mass transfer in fluids. Analysis and design of continuous contacting and multistage separation processes. Binary and multicomponent distillation, absorption, extraction, evaporation, membrane processes, and simultaneous heat and mass transfer.

CH E 381: Chemical Engineering Thermodynamics
(3-0) Cr. 3. F.S.
Prereq: Credit or enrollment in CH E 310; MATH 267, PHYS 222, CHEM 325
Application of thermodynamic principles to chemical engineering problems. Thermodynamic properties of fluids, phase equilibria, and chemical reaction equilibria.

CH E 382: Chemical Reaction Engineering
(3-0) Cr. 3. F.S.
Prereq: CH E 310; CH E 381, credit or enrollment in CH E 357
Kinetics of chemical reactions. Design of homogeneous and heterogeneous chemical reactors.

CH E 391: Foreign Study Orientation
(3-0) Cr. 3. S.
Prereq: CH E 357 and CH E 381
Offered on a satisfactory-fail basis only. Credit for graduation allowable only upon completion of Ch E 392.
Meets International Perspectives Requirement.

CH E 392: Foreign Study Program
Cr. 4. SS.
Prereq: CH E 391
Study of chemical engineering including laboratories and lectures at collaborating international universities. Comparative study of U.S. and international manufacturing facilities. Expenses required.
Meets International Perspectives Requirement.

CH E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

CH E 398: Cooperative Education
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

CH E 406: Environmental Chemodynamics
(Dual-listed with CH E 506). (3-0) Cr. 3.
Prereq: CH E 381, credit or enrollment in CH E 358
Examines the mechanisms and rates of chemical transport across air, water, and soil interfaces. Applications of transport and thermodynamic fundamentals to movement of chemicals in the environment.

CH E 408: Surface and Colloid Chemistry
(Dual-listed with CH E 508). (3-0) Cr. 3.
Prereq: CH E 381 or equivalent
Examines the factors underlying interfacial phenomena, with an emphasis on the thermodynamics of surfaces, structural aspects, and electrical phenomena. Application areas include emulsification, foaming, detergency, sedimentation, fluidization, nucleation, wetting, adhesion, flotation, and electrophoresis.

CH E 415: Biochemical Engineering
(Dual-listed with CH E 515). (3-0) Cr. 3.
Prereq: CH E 357, CH E 382 recommended, CHEM 331
Application of basic chemical engineering principles in biochemical and biological process industries such as enzyme technology and fermentation.

CH E 420: Chemical Process Safety
(3-0) Cr. 3. F.S.
Prereq: CH E 357, CH E 381; junior classification
Application of transport phenomena, thermodynamics, and chemical kinetics to the study of safety, health, and loss prevention. Government regulations, industrial hygiene, relief sizing, runaway reactions, toxic release, and dispersion models will be used. Fires, explosions, risk assessment, hazard identification, case studies, accident investigations, and design considerations will be studied.

CH E 421: Process Control
(3-0) Cr. 3. F.S.
Prereq: CH E 358, CH E 382, Math 267
Control of industrial chemical processes. Device applications and limitations. Dynamics of chemical process components and process control systems.

CH E 426: Chemical Engineering Laboratory II
(0-4) Cr. 2. F.S.
Prereq: CH E 325, CH E 358, CH E 382
Experiments in heat and mass transfer, staged operations, chemical reactor performance, unit processes. Computer applications. Only one of Ch E 426 or 427 may count toward graduation.

CH E 427: Biological Engineering Laboratory
(0-4) Cr. 2. S.
Prereq: CH E 325, CH E 358, CH E 382; BBMB 301 or BBMB 404
Experiments on biological applications in chemical engineering. Only one of CH E 426 or CH E 427 may count toward graduation.

CH E 430: Process and Plant Design
(2-4) Cr. 4. F.S.
Prereq: CH E 358, CH E 382
Synthesis of chemical engineering processes, equipment and plants. Cost estimation and feasibility analysis.

CH E 440: Biomedical Applications of Chemical Engineering
(Dual-listed with CH E 540). (Cross-listed with B M E). (3-0) Cr. 3.
Prereq: CH E 210, MATH 266, PHYS 222
Applications of material and energy balances, transport phenomena, chemical reaction engineering, and thermodynamics to problems in biomedical engineering and applied physiology; survey of biomedical engineering; biomaterials; biomedical imaging.

CH E 447: Polymers and Polymer Engineering
(Dual-listed with CH E 547). (3-0) Cr. 3.
Prereq: CH E 382 and CHEM 331 or MAT E 351
Chemistry of polymers, addition and condensation polymerization. Physical and mechanical properties, polymer rheology, production methods. Applications of polymers in the chemical industry.

CH E 490: Undergraduate Research/Independent Study
(0-18) Cr. 1-6. Repeatable, maximum of 6 credits.
Prereq: Permission of Department
Investigation of topics of special interest to student and faculty with a final written report or presentation. Election of course and topic must be approved in advance by Department with completion of Study Proposal. No more than 6 credits of ChE 490 may be counted towards technical electives.

CH E 490H: Undergraduate Research/Independent Study, Honors
(0-18) Cr. 1-6. Repeatable, maximum of 6 credits.
Prereq: Permission of Department
Investigation of topics of special interest to student and faculty with a final written report or presentation. Election of course and topic must be approved in advance by Department with completion of Study Proposal. No more than 6 credits of ChE 490 may be counted towards technical electives.

Courses primarily for graduate students, open to qualified undergraduates:

CH E 506: Environmental Chemodynamics
(Dual-listed with CH E 406). (3-0) Cr. 3.
Prereq: CH E 381, credit or enrollment in CH E 358
Examines the mechanisms and rates of chemical transport across air, water, and soil interfaces. Applications of transport and thermodynamic fundamentals to movement of chemicals in the environment.

CH E 508: Surface and Colloid Chemistry
(Dual-listed with CH E 408). (3-0) Cr. 3.
Prereq: CH E 381 or equivalent
Examines the factors underlying interfacial phenomena, with an emphasis on the thermodynamics of surfaces, structural aspects, and electrical phenomena. Application areas include emulsification, foaming, detergency, sedimentation, fluidization, nucleation, wetting, adhesion, flotation, and electrophoresis.

CH E 515: Biochemical Engineering
(Dual-listed with CH E 415). (3-0) Cr. 3.
Prereq: CH E 357, CH E 382 recommended, CHEM 331
Application of basic chemical engineering principles in biochemical and biological process industries such as enzyme technology and fermentation.

CH E 540: Biomedical Applications of Chemical Engineering
(Dual-listed with CH E 440). (3-0) Cr. 3.
Prereq: CH E 210, MATH 266, PHYS 222
Applications of material and energy balances, transport phenomena, chemical reaction engineering, and thermodynamics to problems in biomedical engineering and applied physiology; survey of biomedical engineering; biomaterials; biomedical imaging.

CH E 542: Polymeric Biomaterials
(3-0) Cr. 3.
Prereq: CHEM 331 or a polymers class
Polymeric biomaterials, overview of biomaterial requirements, different classes of polymers used as biomaterials, specific bioapplications of polymers.

CH E 545: Analytical and Numerical Methods
(3-0) Cr. 3. F.
Prereq: CH E 358, MATH 267
Analysis of equipment and processes by analytic and/or numerical solution of descriptive differential equations. Operational and series techniques, boundary value problems, numerical interpolation and approximation, integration techniques.

CH E 547: Polymers and Polymer Engineering
(Dual-listed with CH E 447). (3-0) Cr. 3.
Prereq: CH E 382 and CHEM 331 or MAT E 351
Chemistry of polymers, addition and condensation polymerization. Physical and mechanical properties, polymer rheology, production methods. Applications of polymers in the chemical industry.

CH E 554: Integrated Transport Phenomena
(4-0) Cr. 4. F.
Prereq: CH E 357, CH E 381, Math 267, credit or enrollment in CH E 545
Conservation equations governing diffusive and convective transport of momentum, thermal energy and chemical species. Transport during laminar flow in conduits, boundary layer flow, creeping flow. Heat and mass transport coupled with chemical reactions and phase change. Scaling and approximation methods for mathematical solution of transport models. Diffusive fluxes; conservation equations for heat and mass transfer; scaling and approximation techniques; fundamentals of fluid mechanics; unidirectional flow; creeping flow; laminar flow at high Reynolds number; forced-convection heat and mass transfer in confined and unconfined laminar flows.

CH E 562: Bioseparations
(3-0) Cr. 3.
Prereq: CH E 357 or advanced standing in a science major
Principles and techniques for separation and recovery of biologically-produced molecules, especially proteins. Relationship between the chemistry of biological molecules and efficient separation and preservation of biological activity. Includes centrifugation and filtration, membrane processing, extraction, precipitation and crystallization, chromatography, and electrophoresis.

CH E 572: Turbulence
(Cross-listed with AER E). (3-0) Cr. 3.
Prereq: AER E 541 or M E 538
Qualitative features of turbulence. Statistical representation of turbulent velocity fields: averages, moments, correlations, length and time scales and the energy cascade. Averaged equations of motion, closure requirements, Reynolds averaged models. Homogeneous shear flows, free shear flows, boundary layers. Numerical simulation of turbulence: DNS, LES, DES.

CH E 583: Advanced Thermodynamics
(3-0) Cr. 3. F.
Prereq: CH E 381
Application of thermodynamic principles to chemical engineering problems. Thermodynamic properties of non-ideal fluids and solutions; phase and chemical-reaction equilibria/stability.

CH E 587: Advanced Chemical Reactor Design
(3-0) Cr. 3. S.
Prereq: CH E 382
Analysis of complex reactions and kinetics. Fixed bed, fluidized bed, and other industrial reactors. Analysis and design of non-ideal flow mixing, and residence times. Heterogeneous reactors.

CH E 590: Independent Study
Cr. 2-6. Repeatable.
Investigation of an approved topic on an individual basis.

CH E 595: Special Topics
Cr. 2-3. Repeatable.

CH E 595A: Special Topics: Separations
Cr. 2-3. Repeatable.

CH E 595B: Special Topics: Advanced Control Theory
Cr. 2-3. Repeatable.

CH E 595C: Special Topics: Crystallization
Cr. 2-3. Repeatable.

CH E 595D: Special Topics: Thermodynamics
Cr. 2-3. Repeatable.

CH E 595E: Special Topics: Protein Engineering/Bioseparations
Cr. 2-3. Repeatable.

CH E 595F: Special Topics: Biological Engineering
Cr. 2-3. Repeatable.

CH E 595G: Special Topics: Materials and Biomaterials
Cr. 2-3. Repeatable.

CH E 595H: Special Topics: Surfaces
Cr. 2-3. Repeatable.

CH E 595I: Special Topics: Combinatorial Design
Cr. 2-3. Repeatable.

CH E 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

CH E 601: Seminar
Cr. R. Repeatable. F.S.
Offered on a satisfactory-fail basis only.

CH E 625: Metabolic Engineering
(3-0) Cr. 3.
Prereq: CH E 382, CHEM 331
Principles of metabolic engineering. Emphasis on emerging examples in biorenewables and plant metabolic engineering. Overview of biochemical pathways, determination of flux distributions by stoichiometric and labeling techniques; kinetics and thermodynamics of metabolic networks; metabolic control analysis; genetic engineering for overexpression, deregulation, or inhibition of enzymes; directed evolution; application of bioinformatics, genomics, and proteomics.

CH E 632: Multiphase Flow
(Cross-listed with M E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M E 538
Single particle, mutliparticle and two-phase fluid flow phenomena (gas-solid, liquid-solid and gas-liquid mixtures); particle interactions, transport phenomena, wall effects; bubbles, equations of multiphase flow. Dense phase (fluidized and packed beds) and ducted flows; momentum, heat and mass transfer. Computer solutions.

CH E 642: Principles and Applications of Molecular Simulation
(3-0) Cr. 3.
Prereq: CH E 545
Principles of statistical physics. General features of molecular simulations including Monte Carlo (MC) methods, molecular mechanics (MM), and molecular dynamics (MD). Overview of intermolecular and interatomic potentials. Evaluation of phase equilibria, free energies, and surface/interfacial properties. Coarse-grained methods.

CH E 652: Advanced Transport
(3-0) Cr. 3.
Prereq: CH E 552 and CH E 553
Advanced topics in momentum transport, fluid mechanics, and mass transport including study of recent literature.

CH E 688: Catalysis and Catalytic Processes
(Cross-listed with BR C). (3-0) Cr. 3.
Prereq: CH E 382
Principles and applications of heterogeneous and homogeneous catalysis. Adsorption. Reaction kinetics and mass transfer effects. Catalyst characterization. Industrial catalytic processes.

CH E 692: Independent Study
Cr. 2-6. Repeatable.
Investigation of an approved topic on an individual basis. Election of course and topic must be approved in advance by Program of Study Committee.

CH E 695: Advanced Topics
Cr. arr. Repeatable.

CH E 695A: Advanced Topics: Separations
Cr. arr. Repeatable.

CH E 695B: Advanced Topics: Advanced Statistical Modeling and Control
Cr. arr. Repeatable.

CH E 695C: Advanced Topics: Crystallization
Cr. arr. Repeatable.

CH E 695D: Advanced Topics: Thermodynamics
Cr. arr. Repeatable.

CH E 695E: Advanced Topics: Protein Engineering/Bioseparations
Cr. arr. Repeatable.

CH E 695F: Advanced Topics: Biological Engineering
Cr. arr. Repeatable.

CH E 695G: Advanced Topics: Materials and Biomaterials
Cr. arr. Repeatable.

CH E 695H: Advanced Topics: Surfaces
Cr. arr. Repeatable.

CH E 695I: Advanced Topics: Combinatorial Design
Cr. arr. Repeatable.

CH E 695J: Advanced Topics: Polymeric and Nanostructured Materials
Cr. arr. Repeatable.

CH E 695K: Advanced Topics: Biomaterials and Tissue Engineering
Cr. arr. Repeatable.

CH E 695L: Advanced Topics: Catalysis, Reaction Engineering, and Renewable Energy
Cr. arr. Repeatable.

CH E 697: Engineering Internship
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of major professor, graduate classification
One semester and one summer maximum per academic year professional work period.

CH E 698: Chemical Engineering Teaching Practicum
(1-0) Cr. 1. F.
Prereq: Graduate student classification and permission of instructor
Discussions intended to foster the development of graduate students as teaching assistants and future chemical engineering instructors. Topics include classroom and laboratory instruction, grading, and developing a teaching philosophy. Offered on a satisfactory-fail basis only.

CH E 698A: Chemical Engineering Teaching Practicum: Teaching Practicum
(1-0) Cr. 1. F.
Prereq: Graduate student classification and permission of instructor
Discussions intended to foster the development of graduate students as teaching assistants and future chemical engineering instructors. Topics include classroom and laboratory instruction, grading, and developing a teaching philosophy. Offered on a satisfactory-fail basis only.

CH E 698B: Chemical Engineering Teaching Practicum: Teaching Experience
(1-0) Cr. 1. Repeatable. F.S.SS.
Prereq: CH E 698A
Participation in the instruction of a CH E course under the mentorship of a CBE faculty member. Typical activities may include lecture preparation and delivery, laboratory instruction, design of assessments, problem-solving sessions, office hours, and grading. Offered on a satisfactory-fail basis only.

CH E 699: Research
Cr. arr. Repeatable.
Advanced topic for thesis/dissertation.

Civil Engineering

http://www.ccee.iastate.edu/

Administered by the Department of Civil, Construction and Environmental Engineering

For undergraduate curriculum in civil engineering leading to the degree bachelor of science. This curriculum is accredited under the General Criteria and Civil Engineering Program Criteria by the Engineering Accreditation Commission of ABET, http://www.abet.org.

Civil engineers apply principles of motion and materials to plan, design, construct, maintain, and operate public and private facilities, while working under economic, social, and environmental constraints. Commonly included are transportation systems; bridges and buildings; water supply, pollution control, waste management, irrigation, and drainage systems; river and harbor improvements; dams and reservoirs. Civil engineering also includes planning, designing, and executing surveying operations and locating, delimitating, and delineating physical and cultural features on the earth's surface. Research, testing, sales, management, and related functions are also a part of civil engineering. Work on campus is supplemented by inspection trips, which furnish an opportunity for firsthand study of engineering systems in operation, as well as projects under construction.

Environmental engineering, as a specialty area in civil engineering, is concerned with protecting the public and natural health; providing an ample safe water supply; managing solid and hazardous waste; treating

and disposing of domestic and industrial wastewaters and waste; resource recovery; providing adequate drainage of urban and rural areas for sanitation; and controlling water quality, soil contamination, and air pollution. The environmental option for the civil engineering degree replaces some of the courses and electives in the general curriculum with further courses in chemistry, biology, and microbiology as well as specific topics in environmental engineering and design.

The civil engineering curriculum equips students with a broad education that includes technical skills in analysis and design and professional practices such as communication, teamwork, leadership, and ethics.

By three to five years after graduation, graduates of the civil engineering program will have:

1. Established themselves in successful careers in civil engineering or a related field.
2. Collaborated effectively on multi-disciplinary teams to address the needs of society and the environment.
3. Pursued lifelong learning, professional development, and registration as appropriate for their employers.

The faculty encourages the students to develop their professional skills by participating in cooperative education, internships, or progressive summer engineering employment and study abroad programs. Qualified juniors and seniors interested in graduate studies may apply to the Graduate College to concurrently pursue the bachelor degree and either a master of science in Civil Engineering or a master of business administration in the College of Business Administration. These students would have an the opportunity to graduate in five years with both degrees.

Curriculum in Civil Engineering (General)

Administered by the Department of Civil, Construction and Environmental Engineering.

Leading to the degree bachelor of science.

Total credits required: 129. Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs. Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements.
International Perspectives: 3 cr. [1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirement

ENGL 150	Critical Thinking and Communication (C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
LIB 160	Information Literacy	1

Social Sciences and Humanities: 12 cr. [2]
Complete 12 cr. with 6 cr. at 200-level or above.

Basic Program: 27 cr. [3]
A minimum GPA of 2.00 required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 177	General Chemistry I	4
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGR 101	Engineering Orientation	R
C E 160	Engineering Problems with Computational Laboratory [3]	3
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Math and Physical Science: 18 cr.

CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178 & 178L	General Chemistry II and Laboratory in College Chemistry II [4]	4-5
or PHYS 222	Introduction to Classical Physics II	
GEOL 201	Geology for Engineers and Environmental Scientists	3
MATH 265	Calculus III	4
MATH 266	Elementary Differential Equations	3
Statistics Elective [2]		3
Total Credits		18-19

C E Engineering Core: 30 cr. Minimum GPA of 2.00 required for this set of courses to graduate (including transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

E M 274	Engineering Statics	3
E M 324	Mechanics of Materials	3
E M 345	Engineering Dynamics	3
E M 378	Mechanics of Fluids	3
C E 206	Engineering Economic Analysis and Professional Issues in Civil Engineering	3
C E 326	Principles of Environmental Engineering	3
C E 332	Structural Analysis I	3
C E 355	Principles of Transportation Engineering	3
C E 360	Geotechnical Engineering	3

C E 372	Engineering Hydrology and Hydraulics	3
Total Credits		30

Other Remaining Courses: 42 cr.

C E 105	Introduction to the Civil Engineering Profession	1
C E 111	Fundamentals of Surveying I	3
C E 170	Graphics for Civil Engineering	2
C E 306	Project Management for Civil Engineers	3
Any two of the following three courses:		6
C E 333	Structural Steel Design I	
C E 334	Reinforced Concrete Design I	
C E 460	Foundation Engineering	
C E 382	Design of Concretes	3
C E 485	Civil Engineering Design	3
E M 327	Mechanics of Materials Laboratory	1
SP CM 212	Fundamentals of Public Speaking	3
Civil Engineering Design Elective [2]		3
Technical Communication Elective [2]		3
Engineering Topics Electives [2]		11
Total Credits		42

Seminar/Co-op/Internships: R cr.

C E 403	Program and Outcome Assessment	R

Notes.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. diversity and international perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list (http://www.ccee.iastate.edu/academics/advising/civil-engineering-student-forms). At least six of eleven credits must be C E or Con E courses for the Engineering Topics Electives.
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.
4. Students who transfer in with CHEM 167/CHEM 167L will be able to take CHEM 178/CHEM 178L to complete the program's Chemistry requirement.

See also: A 4-year plan of study grid showing course template by semester for Civil Engineering

Curriculum in Civil Engineering with Environmental Option

Administered by the Department of Civil, Construction and Environmental Engineering.

Leading to the degree bachelor of science.

Total credits required: 130. Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.
International Perspectives: 3 cr. [1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirement:

ENGL 150	Critical Thinking and Communication (C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
LIB 160	Information Literacy	1

Social Sciences and Humanities: 12 cr. [2]
Complete 12 cr. with 6 cr. at 200-level or above.

Basic Program: 27 cr [3]. Minimum GPA of 2.00 required for this set of courses to graduate, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA).

CHEM 177	General Chemistry I	4
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGR 101	Engineering Orientation	R
C E 160	Engineering Problems with Computational Laboratory [3]	3
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Math and Physical Science: 27 cr.

CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II [4]	3
CHEM 178L	Laboratory in College Chemistry II [4]	1
BIOL 173	Environmental Biology	3
or BIOL 211	Principles of Biology I	
CHEM 231	Elementary Organic Chemistry	3
CHEM 231L	Laboratory in Elementary Organic Chemistry	1
GEOL 201	Geology for Engineers and Environmental Scientists	3
MATH 265	Calculus III	4
MATH 266	Elementary Differential Equations	3

MICRO 201	Introduction to Microbiology	2
Statistics Elective [2]		3
Total Credits		27

C E/Env Engineering Core: 27 cr. Minimum GPA of 2.00 required for this set of courses to graduate (including transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

E M 274	Engineering Statics	3
E M 324	Mechanics of Materials	3
E M 378	Mechanics of Fluids	3
C E 206	Engineering Economic Analysis and Professional Issues in Civil Engineering	3
C E 326	Principles of Environmental Engineering	3
C E 332	Structural Analysis I	3
C E 355	Principles of Transportation Engineering	3
C E 360	Geotechnical Engineering	3
C E 372	Engineering Hydrology and Hydraulics	3
Total Credits		27

Other Remaining Courses: 37 cr.

C E 105	Introduction to the Civil Engineering Profession	1
C E 111	Fundamentals of Surveying I	3
C E 170	Graphics for Civil Engineering	2
C E 306	Project Management for Civil Engineers	3
C E 334	Reinforced Concrete Design I	3
C E 382	Design of Concretes	3
C E 420	Environmental Engineering Chemistry	3
C E 421	Environmental Biotechnology	3
C E 428	Water and Wastewater Treatment Plant Design	3
C E 485	Civil Engineering Design	3
E M 327	Mechanics of Materials Laboratory	1
SP CM 212	Fundamentals of Public Speaking	3
Civil Engineering Design Elective [2]		3
Technical Communication Elective [2]		3
Total Credits		37

Seminar/Co-op/Internships: R cr.

C E 403	Program and Outcome Assessment	R

Co-op/Internship optional.
Notes.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. diversity and international perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list. (http://www.ccee.iastate.edu/academics/advising/civil-engineering-student-forms)
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.
4. Students who transfer in with CHEM 167 General Chemistry for Engineering Students/CHEM 167L Laboratory in General Chemistry for Engineering will be able to take CHEM 178 General Chemistry II/CHEM 178L Laboratory in College Chemistry II to complete the program's Chemistry requirement.

See also: A 4-year plan of study grid showing course template by semester for Civil Engineering

Civil Engineering, B.S. - environmental specialization

First Year

Fall	Credits	Spring	Credits
C E 160	3	C E 105	1
CHEM 177	4	C E 111	3
CHEM 177L	1	C E 170	2
ENGL 150	3	PHYS 221	5
LIB 160	1	MATH 166	4
MATH 165	4	SSH Elective	3
ENGR 101	0	C E 120 (optional)	0
C E 120 (optional)	0		
	16		18

Second Year

Fall	Credits	Spring	Credits
CHEM 178	3	C E 206	3
CHEM 178L	1	CHEM 231	3
E M 274	3	CHEM 231L	1
ENGL 250	3	E M 324	3
MATH 265	4	Statistics Elective	3
GEOL 201	3	MATH 266	3
	17		16

Third Year

Fall	Credits	Spring	Credits
C E 332	3	C E 306	3
C E 360	3	C E 334	3
E M 378	3	BIOL 173 or 211	3
Technical Communications Elective	3	C E 355	3
C E 326	3	C E 372	3
E M 327	1	C E 382	3
	16		18

Fourth Year

Fall	Credits	Spring	Credits
C E 420	3	C E 403	0
C E 421	3	C E 428	3
MICRO 201	2	C E 485	3
CE Design Elective	3	SSH Electives	6
SSH Elective	3		
SP CM 212	3		
	17		12

Civil Engineering, B.S. - GENERAL Program

First Year

Fall	Credits	Spring	Credits
C E 160	3	C E 105	1
CHEM 177	4	C E 111	3
CHEM 177L	1	C E 170	2
ENGL 150	3	MATH 166	4
MATH 165	4	PHYS 221	5
LIB 160	1	SP CM 212	3
ENGR 101	0	C E 120 (optional)	0
C E 120 (optional)	0		
	16		18

Second Year

Fall	Credits	Spring	Credits
ENGL 250	3	C E 206	3
CHEM 178	3	E M 324	3
CHEM 178L	1	E M 345	3
E M 274	3	E M 378	3
MATH 265	4	MATH 266	3
GEOL 201	3	Statistics Elective	3
	17		18

Third Year

Fall	Credits	Spring	Credits
C E 326	3	C E 334 (CE 460 may be substituted for CE 333 or CE 334)	3
C E 332	3	C E 372	3
C E 360	3	C E 382	3
E M 327	1	C E 306	3
C E 355	3	Engr Topic Elective	3
Technical Communication	3	SSH Elective	3
	16		18

Fourth Year

Fall	Credits	Spring	Credits
C E 333 (CE 460 may be substituted for CE 333 or CE 334)	3	C E 403	0
Engr Topic Elective	5	C E 485	3
SSH Elective	6	CE Design Elective	3
		Engr Topic Elective	3
		SSH Elective	3
	14		12

Graduate Study

The Department of Civil, Construction and Environmental Engineering offers graduate programs for the degrees of master of engineering, master of science, and doctor of philosophy with a major in civil engineering with areas of specialization in structural engineering, environmental engineering, construction engineering and management, geotechnical engineering, civil engineering materials, and transportation engineering. The department also offers graduate minors of 9 to 15 credits of coursework to students from other engineering departments.

Candidates for the degrees of master of engineering and master of science are required to complete a total of 30 acceptable graduate credits. The master of engineering degree involves all course work. The master of science degree requires the preparation of a thesis or creative component.

Candidates for the doctor of philosophy degree are required to complete a minimum of 72 acceptable graduate credits. Normal prerequisite for major graduate work in civil engineering is the completion of an undergraduate curriculum substantially equivalent to that required of engineering students at this university. Due to the diversity of interests within the graduate programs in civil engineering, a student may qualify for graduate study even though undergraduate or prior graduate training has been in a discipline other than engineering. Supporting work will be required depending upon the student's background and area of interest. The department participates in the interdepartmental graduate programs in transportation, environmental science, wind energy science, engineering and policy and biorenewable resources and technology.

The department also offers graduate certificates in construction management, environmental engineering, and environmental systems. The construction management certificate requires 12 graduate credits (nine credits of "core courses" and three credits of approved "elective courses").

The environmental engineering or environmental systems certificate requires 12 graduate credits (six credits of "core courses", six credits

of approved "elective courses") and a seminar course or an approved equivalent.

Additional information about graduate programs, research and admission criteria are available on the department's website http://www.ccee.iastate.edu/academics/graduate/.

Courses primarily for undergraduates:

C E 105: Introduction to the Civil Engineering Profession
(1-0) Cr. 1. F.S.
Overview of the nature and scope of the civil engineering profession. Exploration of the various specialty areas within civil engineering. Bloom's Taxonomy and creativity. Departmental rules, student services operations, degree requirements, educational objectives, program of study planning, career options, and student organizations.

C E 111: Fundamentals of Surveying I
(2-3) Cr. 3. F.S.
Prereq: C E 160, credit or enrollment in ENGR 170 or C E 170, MATH 165
Introduction to error theory. Fundamentals of observing distances, elevations, and angles. Traversing. Irregular areas. Circular and parabolic curves. Earthwork including mass diagrams. Construction staking. Computer applications and introduction to photogrammetry, geographic information systems and global positioning systems technology.

C E 120: Civil Engineering Learning Community
Cr. R. Repeatable.
Integration of first-year students into the Civil Engineering program. Assignments and activities involving teamwork, academic preparation, study skills, and preparation for entry into the Civil Engineering profession. Completed both individually and in learning teams under the direction of faculty and peer mentors. Offered on a satisfactory-fail basis only.

C E 160: Engineering Problems with Computational Laboratory
(2-2) Cr. 3. F.S.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Formulation of engineering problems using spreadsheets and Visual Basic for Application for solution. Presenting results using word processing, tables, and graphs. Introduction to engineering economics and statics. Civil engineering examples.

C E 170: Graphics for Civil Engineering
(0-4) Cr. 2. F.S.
Fundamental graphics. Introduction to computer aided drafting and modeling. Civil engineering applications.

C E 206: Engineering Economic Analysis and Professional Issues in Civil Engineering
(3-0) Cr. 3. F.S.
Prereq: MATH 166, ENGL 250; C E 105; ECON 101 recommended
Engineering/managerial analysis of the economic aspects of project proposals. Alternative sources of funds; time value of money; expenditure of capital funds and methods of evaluating alternative projects. Professionalism, licensure, liability, ethics, leadership, social responsibility, creative and critical thinking, and applications/impacts of regulations in civil engineering.

C E 306: Project Management for Civil Engineers
(2-3) Cr. 3. F.S.
Prereq: C E 206
Project management, including work breakdown structures, cost estimating, scheduling, and project control. Civil engineering project life cycle, including planning, design, construction, and maintenance processes. Techniques in interpretation of contract documents, plan reading, and in estimating quantities.

C E 326: Principles of Environmental Engineering
(2-2) Cr. 3. F.S.
Prereq: CHEM 177 or CHEM 178, MATH 166, credit or enrollment in E M 378
Introduction to environmental problems, water quality indicators and requirements, potable water quality and quantity objectives, water sources and treatment methods; water pollution control objectives and treatment methods; survey of solid and hazardous waste management and air pollution control.

C E 332: Structural Analysis I
(2-2) Cr. 3. F.S.
Prereq: E M 324
Loads, shear, moment, and deflected shape diagrams for beams and framed structures. Deformation calculations. Approximate methods. Application of consistent deformation methods to continuous beams and frames. Application of displacement or slope deflection methods to continuous beams and frames without sway. Influence lines for determinate and indeterminate structures. Computer applications to analyze beams and frames. Validation of computer results.

C E 333: Structural Steel Design I
(2-2) Cr. 3. F.S.
Prereq: C E 332, E M 327
AISC design methods for structural steel buildings. Design of steel tension members. Design of steel members for flexure. Design of members for compression. Beam-Column member design. Introduction to steel building systems. Steel moment frames and concentrically braced frames. Design of commonly used connections in steel buildings.

C E 334: Reinforced Concrete Design I

(2-2) Cr. 3. F.S.

Prereq: C E 332, E M 327

ACI design methods for structural concrete members. Emphasis on the analysis and design for flexure of singly reinforced and doubly reinforced sections, T-section, one-way slabs, short columns, and isolated footings. Analysis and design for shear, and serviceability. Bond, anchorage, and development of reinforcement.

C E 355: Principles of Transportation Engineering

(3-0) Cr. 3. F.S.

Prereq: C E 111

Introduction to planning, design, and operations of transportation facilities. Road user, vehicle and roadway characteristics. Technological, economic and environmental factors. Asset management, transportation planning, capacity analysis, traffic control, geometric design, traffic safety.

C E 360: Geotechnical Engineering

(2-3) Cr. 3. F.S.

Prereq: E M 324, credit or enrollment in GEOL 201

Introduction to geotechnical engineering and testing. Identification and classification tests, soil water systems, principles of settlement, stresses in soils, and shear strength testing; slope stability, retaining walls, bearing capacity.

C E 372: Engineering Hydrology and Hydraulics

(3-0) Cr. 3. F.S.

Prereq: E M 378, a course in statistics from the approved department list

The hydrologic cycle: precipitation, infiltration, runoff, evapotranspiration, groundwater, and streamflow. Hydrograph analysis, flood routing, frequency analysis and urban hydrology. Applied hydraulics including pipe and channel flow with design applications in culverts, pumping, water distribution, storm and sanitary sewer systems. Design project required.

C E 382: Design of Concretes

(2-3) Cr. 3. F.S.

Prereq: E M 274

Physical and chemical properties of bituminous, portland, and other cements; aggregate properties and blending; mix design and testing of concretes; admixtures, mixing, handling, placing and curing; principles of pavement thickness design.

C E 383: Design of Portland Cement Concrete

(0-2) Cr. 1. F.S.

Prereq: E M 274

For Con E students only. Physical and chemical properties of portland cement and p.c. concrete. Mix design and testing of p.c. concrete. Credit for both C E 382 and C E 383 may not be applied for graduation.

C E 388: Sustainable Engineering and International Development

(Cross-listed with A B E, E E). (2-2) Cr. 3. F.

Prereq: Junior classification in engineering

Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report.

Meets International Perspectives Requirement.

C E 396: Summer Internship

Cr. R. Repeatable. SS.

Prereq: Permission of department and Engineering Career Services

Summer professional work period. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

C E 398: Cooperative Education (Co-op)

Cr. R. Repeatable. F.S.

Prereq: Permission of department and Engineering Career Services

Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

C E 403: Program and Outcome Assessment

Cr. R. F.S.

Prereq: Verification of undergraduate application for graduation by the end of the first week of class. Permission of instructor for students who are scheduled for summer graduation

Assessment of C E Curriculum and educational objectives. Assessments to be reviewed by the CE Department to incorporate potential improvements. Offered on a satisfactory-fail basis only.

C E 417: Land Surveying

(2-3) Cr. 3. S.

Prereq: C E 111

Legal principles affecting the determination of land boundaries, public domain survey systems. Locating sequential and simultaneous conveyances. Record research, plat preparation, and land description. Study of selected court cases.

C E 420: Environmental Engineering Chemistry
(Dual-listed with C E 520). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: C E 326, CHEM 178
Principles of chemical and physical phenomena applicable to the treatment of water and wastewater and natural waters; including chemical equilbria, reaction kinetics, acid-base equilibria, chemical precipitation, redox reactions, and mass transfer principles. Individual laboratory practicals and group projects required.

C E 421: Environmental Biotechnology
(Dual-listed with C E 521). (2-2) Cr. 3. F.
Prereq: C E 326
Fundamentals of biochemical and microbial processes applied to environmental engineering processes, role of microorganisms in wastewater treatment and bioremediation, bioenergetics and kinetics, metabolism of xenobiotic compounds, waterborne pathogens and parasites, and disinfection. Term paper and oral presentation.

C E 424: Air Pollution
(Dual-listed with C E 524). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 424A: Air Polution: Air quality and effects of pollutants
(Dual-listed with C E 524A). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 424B: Air Pollution: Climate change and causes
(Dual-listed with C E 524B). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 424C: Air Pollution: Transportation Air Quality
(Dual-listed with C E 524C). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

C E 424D: Air Pollution: Off-gas treatment technology
(Dual-listed with C E 524D). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

C E 424E: Air Pollution: Agricultural sources of pollution
(Dual-listed with C E 524E). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 428: Water and Wastewater Treatment Plant Design
(2-2) Cr. 3. S.
Prereq: C E 326
Physical, chemical and biological processes for the treatment of water and wastewater including coagulation and flocculation, sedimentation, filtration, adsorption, chemical oxidation/disinfection, fixed film and suspended growth biological processes and sludge management.

C E 440: Bioprocessing and Bioproducts
(Dual-listed with C E 540). (Cross-listed with FS HN). (3-0) Cr. 3. F.
Prereq: C E 326 or equivalent, MATH 160 or MATH 165, CHEM 167 or higher, BIOL 173 or BIOL 211 or higher, senior or graduate classification
Sustainability, cleaner production. Taxonomy, kinetics, metabolism, microbial cultivation, aerobic and anaerobic fermentation. Antibiotics, food supplements, fermented foods, vitamin production. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis.

C E 446: Bridge Design
(Dual-listed with C E 546). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: C E 333, C E 334
Bridge design in structural steel and reinforced concrete. Application of AASHTO Bridge Design Specifications. Analysis techniques for complex structures. Preliminary designs include investigating alternative structural systems and materials. Final designs include preparation of design calculations and sketches.

C E 448: Building Design
(Dual-listed with C E 548). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: C E 333, C E 334
Building design in structural steel and reinforced concrete. Investigation of structural behavior. Gravity and lateral load resisting systems. Application of current building codes and design specifications. In-depth analysis of gravity and wind loads on buildings. Review of building designs. Preliminary designs include investigating alternative structural systems. Approximate methods of structural analysis for gravity and lateral loads. Final designs include preparation of design calculations and sketches.

C E 449: Structural Health Monitoring
(Dual-listed with C E 549). (Cross-listed with MAT E). (3-0) Cr. 3.
Prereq: Senior classification in Engineering or permission of instructor
Introductory and advanced topics in structural health monitoring (SHM) of aeronautical, civil, and mechanical systems. Topics include sensors, signal processing in time and frequency domains, data acquisition and transmission systems, design of integrated SHM solutions, nodestructive evaluation techniques, feature extraction methods, and cutting edge research in the field of SHM. Graduate students will have a supervisory role to assist students in 449 and an additional design project or more in-depth analysis and design.

C E 451: Urban Transportation Planning Models
(Dual-listed with C E 551). (3-0) Cr. 3. F.
Prereq: C E 355, STAT 101 or STAT 105
Urban transportation planning context and process. Project planning and programming. Congestion, mitigation, and air quality issues. Transportation data sources. Travel demand and network modeling. Use of popular travel demand software and applications of geographic information systems.

C E 453: Highway Design
(2-2) Cr. 3. F.S.
Prereq: C E 306, C E 355
Introduction to highway planning and design. Design, construction, and maintenance of highway facilities. Level-of-service, stopping sight distance, highway alignment, earthwork and pavement design. Design project, oral reports and written reports. Computer applications.

C E 460: Foundation Engineering
(3-0) Cr. 3. F.S.
Prereq: C E 360
Fundamentals of foundation engineering. Exploration, sampling, and in-situ tests. Shallow and deep foundations. Settlement and bearing capacity analyses. Stability of excavations and earth retaining structures.

C E 467: Geomaterials Stabilization
(Dual-listed with C E 567). (2-2) Cr. 3. S.
Prereq: C E 360, C E 382 or C E 383
Soil and aggregate physical, chemical and biological stabilization procedures. Stabilization analysis and design. Ground modification and compaction methods. Geosynthetics application and design.

C E 473: Groundwater Hydrology
(Dual-listed with C E 573). (3-0) Cr. 3. F.
Prereq: C E 372
Principles of groundwater flow, hydraulics of wells, superposition, slug and pumping tests, streamlines and flownets, and regional groundwater flow. Contaminant transport. Computer modeling. Design project. Extra assignments required for graduate students.

C E 483: Pavement Analysis and Design
(Dual-listed with C E 583). (3-0) Cr. 3. S.
Prereq: C E 360 and C E 382
Analysis, behavior, performance, and structural design of pavement systems. Topics include climate factors, rehabilitation, life cycle design economics, material and system response, pavement foundations and traffic loadings. Development of models for and analysis of pavement systems. Use of transfer functions relating pavement response to pavement performance. Evaluation and application of current and evolving pavement design practices and procedures. Mechanistic-based pavement design techniques and concepts. Analysis of the effects of maintenance activities on pavement performance and economic evaluation of pavement systems.

C E 484: Advanced Design of Concretes
(Dual-listed with C E 584). (2-2) Cr. 3.
Prereq: C E 382
Asphalt binder characterization, fundamentals of asphalt rheology, asphalt materials behavior under loading and temperature effects. High-strength, light-weight, fiber-reinforced, and self-consolidating portland cement concretes, mix design, properties, advanced performance testing. A term project is required for graduate level only.

C E 485: Civil Engineering Design
(2-2) Cr. 3. F.S.
Prereq: C E 306, C E 326, C E 333 or C E 334, C E 355, C E 360, C E 372, C E 382, SP CM 212. Course enrollment limited to final graduating semester.
The civil engineering design process, interacting with the client, identification of the engineering problems, development of a technical proposal, identification of design criteria, cost estimating, planning and scheduling, codes and standards, development of feasible alternatives, selection of best alternative, and oral presentation.

C E 488: Sustainable Horizontal Civil Infrastructure Systems
(Dual-listed with C E 588). (3-0) Cr. 3. F.
Prereq: Junior or higher classification in engineering of science
Sustainable planning, life cycle analysis, appropriate engineering design, and overall rating assessment of horizontal civil infrastructure (i.e., versus 'vertical building') systems, including highway, bridge, airport, rail, and port facilities. Course readings and final project/design report.

C E 490: Independent Study
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Independent study in any phase of civil engineering. Pre-enrollment contract required. No more than 6 credits of C E 490 may be counted towards engineering topics electives.

C E 490H: Independent Study: Honors
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Independent study in any phase of civil engineering. Pre-enrollment contract required. No more than 6 credits of C E 490H may be counted towards engineering topics electives.

Courses primarily for graduate students, open to qualified undergraduates:

C E 501: Preconstruction Project Engineering and Management
(3-0) Cr. 3.
Prereq: Credit or enrollment in CON E 422 or C E 306
Application of engineering and management control techniques to construction project development from conceptualization to notice to proceed. Emphasis is on managing complex projects using 5-dimensional project management theory.

C E 502: Construction Project Engineering and Management
(3-0) Cr. 3.
Prereq: Credit or enrollment in CON E 422
Application of engineering and management control techniques to complex construction projects. Construction project control techniques, stochastic estimating and scheduling, equipment selection and utilization, project administration, construction process simulation, Quality Management, and productivity improvement programs.

C E 503: Construction Finance and Business Management
(3-0) Cr. 3.
Prereq: Credit or enrollment in CON E 422
Fundamental theories and applied methods for financial management of construction companies. Construction accounting, cash flow analysis, financial planning and management, and risk analysis. Case studies.

C E 505: Design of Construction Systems
(3-0) Cr. 3.
Prereq: C E 334, C E 360, CON E 322 and CON E 340
Advanced design of concrete formwork and falsework systems. Design for excavation and marine construction including temporary retaining structures and cofferdams. Aggregate production operations, including blasting, crushing, and conveying systems. Rigging system design.

C E 506: Case Histories in Construction Documents
(3-0) Cr. 3.
Prereq: CON E 221, credit or enrollment in CON E 422
Study of cases involving disputes, claims, and responsibilities encountered by management in construction contract documents. Analysis of methods of resolving differences among the owner, architect, engineer, and construction contractor for a project.

C E 510: Information Technologies for Construction
(3-0) Cr. 3.
Prereq: CON E 422, ENGR 160 or C E 160 or equivalent
Information technologies including microcomputer based systems, management information systems, automation technologies, computer-aided design, and expert systems and their application in the construction industry. Overview of systems acquisition, communications, and networking.

C E 520: Environmental Engineering Chemistry
(Dual-listed with C E 420). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: C E 326, CHEM 178
Principles of chemical and physical phenomena applicable to the treatment of water and wastewater and natural waters; including chemical equilbria, reaction kinetics, acid-base equilibria, chemical precipitation, redox reactions, and mass transfer principles. Individual laboratory practicals and group projects required.

C E 521: Environmental Biotechnology
(Dual-listed with C E 421). (Cross-listed with ENSCI). (2-2) Cr. 3. F.
Prereq: C E 326
Fundamentals of biochemical and microbial processes applied to environmental engineering processes, role of microorganisms in wastewater treatment and bioremediation, bioenergetics and kinetics, metabolism of xenobiotic compounds, waterborne pathogens and parasites, and disinfection. Term paper and oral presentation.

C E 522: Water Pollution Control Processes
(Cross-listed with ENSCI). (2-2) Cr. 3.
Prereq: C E 521
Fundamentals of biochemical processes, aerobic growth in a single CSTR, multiple events in complex systems, and techniques for evaluating kinetic parameters; unit processes of activated sludge system, attached growth systems, stabilization and aerated lagoon systems, biosolids digestion and disposal, nutrient removal, and anaerobic treatment systems.

C E 523: Physical-Chemical Treatment Process
(Cross-listed with ENSCI). (2-2) Cr. 3.
Prereq: C E 520
Material and energy balances. Principles and design of physical-chemical unit processes; including screening, coagulation, flocculation, chemical precipitation, sedimentation, filtration, lime softening and stabilization, oxidation, adsorption, membrane processes, ion exchange and disinfection; recovery of resources from residuals and sludges; laboratory exercises and demonstrations; case studies in mineral processing and secondary industries.

C E 524: Air Pollution
(Dual-listed with C E 424). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 524A: Air Polution: Air quality and effects of pollutants
(Dual-listed with C E 424A). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 524B: Air Pollution: Climate change and causes
(Dual-listed with C E 424B). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 524C: Air Pollution: Transportation Air Quality
(Dual-listed with C E 424C). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

C E 524D: Air Pollution: Off-gas treatment technology
(Dual-listed with C E 424D). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

C E 524E: Air Pollution: Agricultural sources of pollution
(Dual-listed with C E 424E). (Cross-listed with A B E, ENSCI). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

C E 528: Solid and Hazardous Waste Management
(Cross-listed with ENSCI). (3-0) Cr. 3.
Prereq: C E 326 or background courses in both environmental chemistry and microbiology; junior or higher standing
Evaluation, characterization, assessment, planning and design of solid and hazardous waste management systems, regulatory requirements, material characterization and collection, minimization and recycling, energy and materials recovery, composting, off-gas treatment, incineration, stabilization, and landfill design. Design of treatment and disposal systems, including physical, chemical, and biological treatment, solidification, incineration, secure landfill design, and final disposal site closure plus restoration.

C E 532: Structural Analysis II
(3-0) Cr. 3. F.
Prereq: C E 332
Analysis of indeterminate structural problems by the consistent deformation and generalized direct displacement methods. Direct stiffness method for 2-D frames, grids, 3-D frames. Special topics for the stiffness method.

C E 533: Structural Steel Design II
(3-0) Cr. 3.
Prereq: C E 333
Theoretical background and development of AISC Specification equations. In-depth analysis and design of tension members, columns, beams, beam-columns, and plate girders. Emphasis on Load and Resistance Factor Design. Elastic and inelastic buckling of members and member elements. Investigation of amplification factors for members subject to combined bending and axial load and to combined bending and torsion. Effective Length Method and Direct Analysis Method of design. Approximate Second-Order Analysis. Biaxial bending. Torsion and combined bendin and torsion of W-shapes.

C E 534: Reinforced Concrete Design II
(2-2) Cr. 3.
Prereq: C E 334
Advanced topics in reinforced concrete analysis and design. Moment-curvature and load-deflection behavior. Design of reinforced concrete long columns, two-way floor slabs, and isolated and combined footings. Design and behavior considerations for torsion, biaxial bending, and structural joints. Strut-and-tie modeling.

C E 535: Prestressed Concrete Structures
(3-0) Cr. 3.
Prereq: C E 334
Design of prestressed concrete structures, review of hardware, stress calculations, prestress losses, section proportioning, flexural design, shear design, deflections, and statically indeterminate structures.

C E 540: Bioprocessing and Bioproducts
(Dual-listed with C E 440). (Cross-listed with BRT, FS HN). (3-0) Cr. 3. F.
Prereq: C E 326 or equivalent, MATH 160 or MATH 165, CHEM 167 or higher, BIOL 173 or BIOL 211 or higher, senior or graduate classification
Sustainability, cleaner production. Taxonomy, kinetics, metabolism, microbial cultivation, aerobic and anaerobic fermentation. Antibiotics, food supplements, fermented foods, vitamin production. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis.

C E 541: Dynamic Analysis of Structures
(3-0) Cr. 3.
Prereq: E M 345 and credit or enrollment in C E 532
Single and multi-degree-of-freedom systems. Free and forced vibrations. Linear and nonlinear response. Modal analysis. Response spectra. Seismic analysis.

C E 542: Structural Analysis by Finite Elements
(3-0) Cr. 3.
Prereq: C E 532
Use of the finite element method for the analysis of complex structural configurations. Plane stress, solid, Axisymmetric and plate elements. Numerical integration. Use of general purpose finite element programs.

C E 545: Seismic Design
(3-0) Cr. 3.
Prereq: C E 333, C E 334
Seismic hazard in the United States. Engineering characteristics of ground motions. Structural damage in past earthquakes. Capacity design philosophy for seismic resistant design. Conceptual design of structures. Capacity design process including design of structural members.

C E 546: Bridge Design
(Dual-listed with C E 446). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: C E 333, C E 334
Bridge design in structural steel and reinforced concrete. Application of AASHTO Bridge Design Specifications. Analysis techniques for complex structures. Preliminary designs include investigating alternative structural systems and materials. Final designs include preparation of design calculations and sketches.

C E 547: Analysis and Design of Plate and Slab Structures
(3-0) Cr. 3.
Prereq: C E 334, E M 514, MATH 266
Bending and buckling of thin plate components in structures utilizing classical and energy methods. Analysis of shell roofs by membrane and bending theories.

C E 548: Building Design
(Dual-listed with C E 448). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: C E 333, C E 334
Building design in structural steel and reinforced concrete. Investigation of structural behavior. Gravity and lateral load resisting systems. Application of current building codes and design specifications. In-depth analysis of gravity and wind loads on buildings. Review of building designs. Preliminary designs include investigating alternative structural systems. Approximate methods of structural analysis for gravity and lateral loads. Final designs include preparation of design calculations and sketches.

C E 549: Structural Health Monitoring
(Dual-listed with C E 449). (Cross-listed with M S E). (3-0) Cr. 3.
Prereq: Senior classification in Engineering or permission of instructor
Introductory and advanced topics in structural health monitoring (SHM) of aeronautical, civil, and mechanical systems. Topics include sensors, signal processing in time and frequency domains, data acquisition and transmission systems, design of integrated SHM solutions, nodestructive evaluation techniques, feature extraction methods, and cutting edge research in the field of SHM. Graduate students will have a supervisory role to assist students in 449 and an additional design project or more in-depth analysis and design.

C E 551: Urban Transportation Planning Models
(Dual-listed with C E 451). (3-0) Cr. 3. F.
Prereq: C E 355, STAT 101 or STAT 105
Urban transportation planning context and process. Project planning and programming. Congestion, mitigation, and air quality issues. Transportation data sources. Travel demand and network modeling. Use of popular travel demand software and applications of geographic information systems.

C E 552: Traffic Safety, Operations, and Maintenance
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: C E 355
Engineering aspects of highway traffic safety. Reduction of crash incidence and severity through highway design and traffic control. Accident analysis. Safety in highway design, maintenance, and operation.

C E 553: Traffic Engineering
(3-0) Cr. 3. F.
Prereq: C E 355
Driver, pedestrian, and vehicular characteristics. Traffic characteristics; highway capacity; traffic studies and analyses. Principles of traffic control for improved highway traffic service. Application of appropriate computing software and tools.

C E 556: Transportation Data Analysis
(3-0) Cr. 3.
Prereq: C E 355, a Statistics course at the 300 level or higher
Analysis of transportation data, identification of data sources and limitations. Static and dynamic data elements such as infrastructure characteristics, flow and operations-related data elements. Spatial and temporal extents data for planning, design, operations, and management of transportation systems. Summarizing, analyzing, modeling, and interpreting data. Use of information technologies for highways, transit, and aviation systems.

C E 557: Transportation Systems Analysis
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: C E 355, 3 credits in statistics or probability
Travel studies and analysis of data. Transportation systems forecasts and analyses. Statewide, regional, and local transportation system planning. Network level systems planning and operations. Optimization of systems.

C E 558: Transportation Systems Development and Management
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: C E 355
Study of designated problems in traffic engineering, transportation planning, and development. Forecasting and evaluation of social, economic, and environmental impacts of proposed solutions; considerations of alternatives. Formulation of recommendations and publication of a report. Presentation of recommendations in the host community.

C E 559: Transportation Infrastructure/Asset Management
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: C E 355
Engineering management techniques for maintaining and managing infrastructure assets. Systematic approach to management through value engineering, engineering economics, and life cycle cost analysis. Selection and scheduling of maintenance activities. Analysis of network-wide resource needs. Project level analysis.

C E 560: Fundamentals of Soil Mechanics
(3-0) Cr. 3.
Prereq: C E 360
Nature of soil deposits, seepage, settlement and secondary compression, consolidation theories and analysis, failure theories, stress paths, introduction to critical state soil mechanics, constitutive models, soil strength under various drainage conditions, liquefaction of soil, pore pressure parameters, selection of soil parameters.

C E 561: Applied Foundation Engineering
(3-0) Cr. 3.
Prereq: C E 460
Analysis and design of shallow and deep foundations, lateral earth pressure theories and retaining structures, field investigations, in-situ testing, and foundations on problematic soils. Foundation engineering reports.

C E 562: Site Evaluations for Civil Engineering Projects
(2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: C E 360
Identification and mapping of engineering soils from airphotos, maps, and soil surveys. Planning subsurface investigations, geomaterials prospecting, geotechnical hazards, geomorphology, in situ testing and sampling, geophysical site characterization, instrumentation and monitoring, interpretation of engineering parameter values for design.

C E 563: Experimental Methods in Geo-Engineering
(2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: C E 360
Principles of geo-engineering laboratory testing including the conduct, analysis, and interpretation of permeability, consolidation, triaxial, direct and ring shear, and direct simple shear tests. Issues regarding laboratory testing versus field testing and acquisition, transport, storage, and preparation of samples for geotechnical testing. Field and laboratory geotechnical monitoring techniques, including the measurements of deformation, strain, total stress and pore water pressure.

C E 564: Application of Numerical Methods to Geotechnical Design
(3-0) Cr. 3.
Prereq: C E 560
Application of numerical methods to analysis and design of foundations, underground structures, and soil-structure interaction. Application of slope stability software. Layered soils, bearing capacity and settlement for complex geometries, wave equation for piles, and foundation vibrations.

C E 565: Fundamentals of Geomaterials Behavior
(2-3) Cr. 3. S.
Prereq: C E 382
Atoms and molecules, crystal chemistry, clay minerals, structure of solids, phase transformations and phase equilibria. Surfaces and interfacial phenomena, colloid chemistry, mechanical properties. Applications to soils and civil engineering materials. Overview of state-of-the-art instrumental techniques for analysis of the physicochemical properties of soils and civil engineering materials.

C E 567: Geomaterials Stabilization
(Dual-listed with C E 467). (2-2) Cr. 3. S.
Prereq: C E 360, C E 382 or C E 383
Soil and aggregate physical, chemical and biological stabilization procedures. Stabilization analysis and design. Ground modification and compaction methods. Geosynthetics application and design.

C E 568: Dynamics of Soils and Foundations
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: C E 360, E M 345
Dynamic soil properties and their measurement. Foundation dynamics and soil-structure interaction. Sources and characteristics of dynamic loads. Vibration of single- and multi-degree-of-freedom systems. Vibration of continuous systems; 1D, 2D, and 3D analyses, wave propagation. Liquefaction concepts and analysis methods. Introduction to geotechnical earthquake engineering.

C E 569: Ground Improvement
(3-0) Cr. 3.
Prereq: C E 360
Classification of ground improvement methods. Dynamic compaction, vibrocompaction, preloading using fill surcharge, vacuum or a combination of both and prefabricated vertical drains, vibro replacement or stone columns, dynamic replacement, sand compaction piles, geotextile confined columns, rigid inclusion, column supported embankment, microbial methods, particulate and chemical grouting, lime and cement columns, jet grouting, and deep cement mixing.

C E 570: Applied Hydraulic Design
(2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: C E 372
Flow characteristics in natural and constructed channels; principles of hydraulic design of culverts, bridge waterway openings, spillways, hydraulic gates and gated structures, pumping stations, and miscellaneous water control structures; pipe networks, mathematical modeling. Design project.

C E 571: Surface Water Hydrology
(Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: C E 372
Analysis of hydrologic data including precipitation, infiltration, evapotranspiration, direct runoff and streamflow; theory and use of frequency analysis; theory of streamflow and reservoir routing; use of deterministic and statistical hydrologic models. Fundamentals of surface water quality modeling, point and non-point sources of contamination. Design project.

C E 572: Analysis and Modeling Aquatic Environments
(Cross-listed with ENSCI). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: C E 372
Principles of surface water flows and mixing. Introduction to hydrologic transport and water quality simulation in natural water systems. Advection, diffusion and dispersion, chemical and biologic kinetics, and water quality dynamics. Applications to temperature, dissolved oxygen, primary productivity, and other water quality problems in rivers, lakes and reservoirs. Deterministic vs. stochastic models.

C E 573: Groundwater Hydrology
(Dual-listed with C E 473). (3-0) Cr. 3. F.
Prereq: C E 372
Principles of groundwater flow, hydraulics of wells, superposition, slug and pumping tests, streamlines and flownets, and regional groundwater flow. Contaminant transport. Computer modeling. Design project. Extra assignments required for graduate students.

C E 576: Environmental Flows
(3-0) Cr. 3.
Prereq: E M 378 or equivalent
Analysis and applications of flows in civil engineering, environmental engineering, and water resources. Primary topics include conservation laws, laminar flow, turbulence, mixing, diffusion, dispersion, water waves, and boundary layers. Associated applications include particle settling, transfer at air-water and water-sediment boundaries, flow and friction in pipes and open channels, contaminant transport, waves in lakes, jets, plumes, and salt wedges.

C E 581: Geotechnical and Materials Engineering Seminar
Cr. R. Repeatable.
Prereq: Graduate classification
(1-0) Students and outside/invited speakers give weekly presentations about the ongoing research work and Geotechnical and Materials Engineering issues. Offered on a satisfactory-fail basis only.

C E 583: Pavement Analysis and Design
(Dual-listed with C E 483). (3-0) Cr. 3. S.
Prereq: C E 360 and C E 382
Analysis, behavior, performance, and structural design of pavement systems. Topics include climate factors, rehabilitation, life cycle design economics, material and system response, pavement foundations and traffic loadings. Development of models for and analysis of pavement systems. Use of transfer functions relating pavement response to pavement performance. Evaluation and application of current and evolving pavement design practices and procedures. Mechanistic-based pavement design techniques and concepts. Analysis of the effects of maintenance activities on pavement performance and economic evaluation of pavement systems.

C E 584: Advanced Design of Concretes
(Dual-listed with C E 484). (2-2) Cr. 3.
Prereq: C E 382
Asphalt binder characterization, fundamentals of asphalt rheology, asphalt materials behavior under loading and temperature effects. High-strength, light-weight, fiber-reinforced, and self-consolidating portland cement concretes, mix design, properties, advanced performance testing. A term project is required for graduate level only.

C E 586: Advanced Asphalt Materials
(2-3) Cr. 3.
Prereq: C E 382
Advanced asphalt concrete (SUPERPAVE) mix designs. Aggregates. Admixtures. Production and construction, quality control and inspection. Nondestructive testing. Pavement thickness design. Materials engineering reports.

C E 587: Advanced Portland Cement Concretes
(2-3) Cr. 3.
Prereq: C E 382 or C E 383
Hydraulic cements, aggregates, admixtures, and mix design; concrete production, quality control, early-age properties and durability. Concrete distress examination, identification, prevention, and nondestructive testing; advanced concrete technology, high-strength and high performance concrete.

C E 588: Sustainable Horizontal Civil Infrastructure Systems
(Dual-listed with C E 488). (3-0) Cr. 3. F.
Prereq: Junior or higher classification in engineering of science
Sustainable planning, life cycle analysis, appropriate engineering design, and overall rating assessment of horizontal civil infrastructure (i.e., versus 'vertical building') systems, including highway, bridge, airport, rail, and port facilities. Course readings and final project/design report.

C E 590: Special Topics
Cr. 1-5. Repeatable. F.S.SS.
Pre-enrollment contract required.

C E 591: Seminar in Environmental Engineering
Cr. R. Repeatable. F.S.
Prereq: Graduate classification
(1-0) Contemporary environmental engineering issues. Outside speakers. Review of ongoing research in environmental engineering. Offered on a satisfactory-fail basis only.

C E 594: Special Topics in Construction Engineering and Management
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594A: Special Topics Construction Engineering and Mgt.: Planning and Scheduling
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594B: Special Topics Construction Engineering and Mgt.: Computer Applications for Planning and Scheduling
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594C: Special Topics Construction Engineering and Mgt.: Cost Estimating
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594D: Special Topics Construction Engineering and Mgt.: Computer Applications for Cost Estimating
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594E: Special Topics Construction Engineering and Mgt.: Project Controls
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594F: Special Topics Construction Engineering and Mgt.: Computer Applications for Project Controls
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594G: Special Topics Construction Engr and Mgt: Integration of Planning, Scheduling and Project Controls
Cr. 1-3. Repeatable.
Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor
Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594J: Special Topics Construction Engineering and Mgt.: Trenchless Technologies

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594K: Special Topics Construction Engineering and Mgt.: Electrical and Mechanical Construction

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594L: Special Topics Construction Engineering and Mgt.: Advanced Building Construction Topics

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594M: Special Topics Construction Engineering and Mgt.: Design Build Construction

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594N: Special Topics Construction Engineering and Mgt.: Industrial Construction

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594O: Special Topics Construction Engineering and Mgt.: Highway and Heavy Construction

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594P: Special Topics Construction Engineering and Mgt.: Advanced Technologies

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594Q: Special Topics Construction Engineering and Mgt.: Construction Quality Control

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594R: Special Topics Construction Engineering and Mgt.: Risk Management

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 594S: Special Topics Construction Engineering and Mgt.: Building Information Modeling

Cr. 1-3. Repeatable.

Prereq: CON E 322, CON E 340 or C E 306, and permission of instructor

Some topics have a set number of credits and some topics have the number of credits vary. Emphasis for a particular offering will be selected from the following topics:.

C E 595: Research Methods in Construction Engineering and Management

(1-0) Cr. 1.

Prereq: Credit or enrollment in C E 501, C E 502, C E 503, or C E 505

Assigned readings and reports on research methods to solve construction engineering and management problems such as alternative project delivery methods, asset management, data mining, construction procurement, robotics, project controls, automation, construction visualization, etc. Identification of research methods and priorities, selection and development of research design, and critique of research in construction engineering and management.

C E 595A: Research Methods Seminar in Construction Engineering and Management: Qualitative Methods

(1-0) Cr. 1.

Prereq: Credit or enrollment in C E 501, C E 502, C E 503, or C E 505

Assigned readings and reports on research methods to assess and solve qualitative construction engineering and management problems.

C E 595B: Research Methods Seminar in Construction Engineering and Management: Quantitative Methods
(1-0) Cr. 1.
Prereq: Credit or enrollment in C E 501, C E 502, C E 503, or C E 505
Assigned readings and reports on research methods to assess and solve quantitative construction engineering and management problems.

C E 595C: Research Methods Seminar in Construction Engineering and Management: Technical Reporting
(1-0) Cr. 1.
Prereq: Credit or enrollment in C E 501, C E 502, C E 503, or C E 505
Assigned readings and reports on research methods for planning and preparation of technical reports with construction engineering and management projects.

C E 596: Special Topics in Transportation Engineering
Cr. arr. Repeatable.
Prereq: C E 355

C E 596B: Special Topics in Transportation Engineering: Geographic Information Systems in Transportation
Cr. arr. Repeatable.
Prereq: C E 355

C E 596C: Special Topics in Transportation Engineering: Hazardous Materials Transportation
Cr. arr. Repeatable.
Prereq: C E 355

C E 596D: Special Topics in Transportation Engineering: Transportation and Public Works
Cr. arr. Repeatable.
Prereq: C E 355

C E 596E: Special Topics in Transportation Engineering: Sustainable Transportation
Cr. arr. Repeatable.
Prereq: C E 355

C E 596F: Special Topics in Transportation Engineering: Freight Transportation
Cr. arr. Repeatable.
Prereq: C E 355

C E 599: Creative Component
Cr. 1-3. Repeatable.
Pre-enrollment contract required. Advanced topic for creative component report in lieu of thesis.

Courses for graduate students:

C E 622: Advanced Topics in Environmental Engineering
(2-0) Cr. 2. Repeatable.
Prereq: Permission of environmental engineering graduate faculty
Advanced concepts in environmental engineering. Emphasis for a particular offering will be selected from the following topics:.

C E 622A: Advanced Topics in Environmental Engineering: Water Pollution Control
(2-0) Cr. 2. Repeatable.
Prereq: Permission of environmental engineering graduate faculty
Advanced concepts in environmental engineering. Emphasis for a particular offering will be selected from the following topics:.

C E 622B: Advanced Topics in Environmental Engineering: Water Treatment
(2-0) Cr. 2. Repeatable.
Prereq: Permission of environmental engineering graduate faculty
Advanced concepts in environmental engineering. Emphasis for a particular offering will be selected from the following topics:.

C E 622C: Advanced Topics in Environmental Engineering: Solid and Hazardous Waste
(2-0) Cr. 2. Repeatable.
Prereq: Permission of environmental engineering graduate faculty
Advanced concepts in environmental engineering. Emphasis for a particular offering will be selected from the following topics:.

C E 622D: Advanced Topics in Environmental Engineering: Water Resources
(2-0) Cr. 2. Repeatable.
Prereq: Permission of environmental engineering graduate faculty
Advanced concepts in environmental engineering. Emphasis for a particular offering will be selected from the following topics:.

C E 622E: Advanced Topics in Environmental Engineering: Instrumental Methods for Environmental Analyses
(2-0) Cr. 2. Repeatable.
Prereq: Permission of environmental engineering graduate faculty
Advanced concepts in environmental engineering.

C E 650: Advanced Topics in Transportation Engineering
(3-0) Cr. 3. Repeatable.
Prereq: Permission of Transportation Engineering graduate faculty

C E 650A: Advanced Topics in Transportation Engineering: Highway Design
(3-0) Cr. 3. Repeatable.
Prereq: Permission of Transportation Engineering graduate faculty

C E 650B: Advanced Topics in Transportation Engineering: Traffic Operations
(3-0) Cr. 3. Repeatable.
Prereq: Permission of Transportation Engineering graduate faculty

C E 650C: Advanced Topics in Transportation Engineering: Data Analysis
(3-0) Cr. 3. Repeatable.
Prereq: Permission of Transportation Engineering graduate faculty
Topics in transportation engineering related to data analysis.

C E 690: Advanced Topics
Cr. 1-3. Repeatable. F.S.SS.
Pre-enrollment contract required.

C E 697: Engineering Internship
Cr. R. Repeatable.
Prereq: Permission of coop advisor, graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

C E 699: Research
Cr. 1-30. Repeatable.
Prereq: Pre-enrollment contract required
Advanced topic for thesis/dissertation.

Computer Engineering

www.ece.iastate.edu (http://www.ece.iastate.edu)

Administered by the Department of Electrical and Computer Engineering

For the undergraduate curriculum in computer engineering leading to the degree Bachelor of Science. This curriculum is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

The Department of Electrical and Computer Engineering (ECpE) at Iowa State University provides undergraduate students with the opportunity to learn electrical and computer engineering fundamentals, study applications of the most recent advances in state-of-the-art technologies, and to prepare for the practice of computer engineering. The student-faculty interaction necessary to realize this opportunity occurs within an environment that is motivated by the principle that excellence in undergraduate education is enhanced by an integrated commitment to successful, long-term research and outreach programs.

The computer engineering curriculum offers focus areas in software systems, embedded systems, networking, information security, computer architecture, and VLSI.

Students also may take elective courses in control systems, electromagnetics, microelectronics, VLSI, power systems, and communications and signal processing.

The program objectives for the computer engineering programs describe accomplishments that graduates are expected to attain within five years after graduation. Graduates will have applied their expertise to contemporary problem solving, be engaged professionally, have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. More specifically, the objectives for expertise, engagement, learning, leadership and teamwork are defined below for each program.

The objectives of the computer engineering program at Iowa State University are:

- Graduates, within five years of graduation, should demonstrate peer-recognized **expertise** together with the ability to articulate that expertise and use it for contemporary problem solving in the analysis, design, and evaluation of computer and software systems, including system integration and implementation.
- Graduates, within five years of graduation, should demonstrate **engagement** in the engineering profession, locally and globally, by contributing to the ethical, competent, and creative practice of engineering or other professional careers.
- Graduates, within five years of graduation, should demonstrate sustained **learning** and adapting to a constantly changing field through graduate work, professional development, and self study.
- Graduates, within five years of graduation, should demonstrate **leadership** and initiative to ethically advance professional and organizational goals, facilitate the achievements of others, and obtain substantive results.
- Graduates, within five years of graduation, should demonstrate a commitment to **teamwork** while working with others of diverse cultural and interdisciplinary backgrounds.

As a complement to the instructional activity, the ECpE department provides opportunities for each student to have experience with broadening activities. Through the cooperative education and internship program, students have the opportunity to gain practical industry experience. Students have the opportunity to participate in advanced research activities, and through international exchange programs, students learn about engineering practices in other parts of the world. Well-qualified juniors and seniors in computer engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science and Master of Science, the Bachelor of Science and Master of Business Administration, or the Bachelor of Science and Master of Engineering degrees.

Students are required to prepare and to maintain a portfolio of their technical and non-technical skills. This portfolio is evaluated for student preparation during the student's curriculum planning process. Results

of the evaluation are used to advise students of core strengths and weaknesses.

Curriculum in Computer Engineering

Administered by the Department of Electrical and Computer Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 127
Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.
Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements.
International Perspectives: 3 cr. [1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirement:

ENGL 150	Critical Thinking and Communication (C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
LIB 160	Information Literacy	1
One of the following:		3
ENGL 314	Technical Communication (C or better in this course)	
ENGL 309	Proposal and Report Writing (C or better in this course)	

General Education Electives: 15 cr. [3]
Complete minimum of 6 cr. from Approved General Education Component at 300- or higher level. Complete additional 9 cr. from Approved General Education Component.

Basic Program: 27 cr.
A minimum GPA of 2.00 required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 167	General Chemistry for Engineering Students	4
or CHEM 177	General Chemistry I	
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGR 101	Engineering Orientation	R
CPR E 185	Introduction to Computer Engineering and Problem Solving I [2]	3
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Math and Physical Science: 20 cr.

COM S 227	Introduction to Object-oriented Programming	4
COM S 228	Introduction to Data Structures	3
MATH 265	Calculus III	4
MATH 267	Elementary Differential Equations and Laplace Transforms	4
PHYS 222	Introduction to Classical Physics II	5
Total Credits		20

Computer Engineering Core: 33 cr.
(A minimum GPA of 2.00 required for this set of courses, including any transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

CPR E 281	Digital Logic	4
CPR E 288	Embedded Systems I: Introduction	4
CPR E 308	Operating Systems: Principles and Practice	4
CPR E 310	Theoretical Foundations of Computer Engineering	3
CPR E 381	Computer Organization and Assembly Level Programming	4
COM S 309	Software Development Practices	3
CPR E 315	Applications of Algorithms in Computer Engineering	3
or COM S 311	Design and Analysis of Algorithms	
E E 201	Electric Circuits	4
E E 230	Electronic Circuits and Systems	4
Total Credits		33

Other Remaining Courses: 32 cr.

CPR E 491	Senior Design Project I and Professionalism	3
CPR E 492	Senior Design Project II	2
STAT 330	Probability and Statistics for Computer Science	3
One of the following:		3
ENGL 314	Technical Communication (C or better in this course)	
ENGL 309	Proposal and Report Writing (C or better in this course)	
Computer Science course [3]		3
Computer Engineering [3]		6
Technical Electives [3]		9
Electrical Engineering course [3]		3
Total Credits		32

Seminar/Co-op/Internships:

CPR E 166	Professional Programs Orientation	R
CPR E 294	Program Discovery	R
CPR E 394	Program Exploration	R

CPR E 494	Portfolio Assessment	R

Co-op or internship is optional.

Outcomes Assessment - Students are required to prepare and to maintain a portfolio of their technical and non-technical skills. This portfolio is evaluated for student preparation during the student's curriculum planning process. Results of the evaluation are used to advise students of core strengths and weaknesses.

Transfer Credit Requirements

The degree program must include a minimum of 30 credits at the 300-level or above in professional and technical courses earned at ISU in order to receive a B.S. in computer engineering. These 30 credits must include CPR E 491 Senior Design Project I and Professionalism, CPR E 492 Senior Design Project II, and credits in the core professional curriculum and/or in technical electives. The Electrical and Computer Engineering Department requires a grade of C or better for any transfer credit course that is applied to the degree program.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. diversity and international perspectives courses may not be taken Pass/Not Pass, but are used to meet the general education electives.
2. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.
3. From department approved lists. (http://www.ece.iastate.edu/academics/bachelors-degree-requirements)

See also: A 4-year plan of study grid showing course template by semester.

Note: International perspectives and U.S. diversity courses are used to meet the general education electives.

Computer Engineering, B.S.

First Year

Fall	Credits	Spring	Credits
CHEM 167	4	COM S 227	4
CPR E 185	3	CPR E 166	0
ENGL 150	3	MATH 166	4
ENGR 101	0	PHYS 221	5
LIB 160	1	General Education Elective	3
MATH 165	4		
	15		16

Second Year

Fall	Credits	Spring	Credits
CPR E 281	4	CPR E 288	4
COM S 228	3	ENGL 250	3
MATH 265	4	MATH 267	4
PHYS 222	5	E E 201	4
CPR E 294	0		
	16		15

Third Year

Fall	Credits	Spring	Credits
CPR E 381	4	COM S 311 or CPR E 315	3
CPR E 310	3	CPR E 308	4
COM S 309	3	ENGL 314	3
E E 230	4	General Education Elective	3
CPR E 394	0	E E Elective	3
General Education Elective	3		
	17		16

Fourth Year

Fall	Credits	Spring	Credits
CPR E 491	3	CPR E 492	2
CPR E 494	0	Computer Science Elective	3
STAT 330	3	Technical Elective	3
Technical Electives	6	General Education Elective	3
CPR E Elective	3	CPR E Elective	3
General Education Elective	3		
	18		14

Graduate Study

The department offers work for the degrees Master of Engineering, Master of Science, and Doctor of Philosophy with a major in computer engineering and minor work to students with other majors. Minor work for computer engineering majors is usually selected from a wide range of courses outside computer engineering.

The Master of Engineering degree is course-work only. It is recommended for off-campus students.

The Master of Science degree with thesis is recommended for students who intend to continue toward the Doctor of Philosophy degree or to undertake a career in research and development. The non-thesis Master of Science degree requires a creative component.

The department also offers three graduate certificate programs in embedded systems, computer networking, and software systems.

The normal prerequisite to graduate major work in computer engineering is the completion of undergraduate work substantially equivalent to that required of computer engineering students at this university. It is possible for a student to qualify for graduate study in computer engineering even though the student's undergraduate or prior graduate training has been in a discipline other than computer engineering. Supporting work, if required, will depend on the student's background and area of research interest. Prospective students from a discipline other than computer engineering are required to submit, with the application for admission, a statement of the proposed area of graduate study.

The department requires submission of GRE General test scores by applicants. All students whose first language is not English and who have no U.S. degree must submit TOEFL examination scores. Students pursuing the Doctor of Philosophy must complete the department qualifying process.

The Department of Electrical and Computer Engineering is a participating department in the interdepartmental Master of Science and Doctor of Philosophy degree programs in bioinformatics and computational biology. Students interested in these programs may earn their degrees while working under an adviser in electrical and computer engineering.

The Department of Electrical and Computer Engineering also is a participating department in the interdepartmental certificate, Master of Engineering, and Master of Science in Information Assurance programs. Students interested in studying information assurance topics may earn a degree in computer engineering or in information assurance. (See catalog section on Information Assurance.)

Well-qualified juniors and seniors in computer engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both Bachelor of Science and Master of Science, or Bachelor of Science and Master of Business Administration, or Bachelor of Science and Master of Engineering degrees. Under concurrent enrollment, students are eligible for assistantships and simultaneously take undergraduate and graduate courses. Details are available in the Student Services Office and on the department's web site.

Courses primarily for undergraduates:

CPR E 131: Introduction to Computer Security Literacy
(Cross-listed with INFAS). (1-0) Cr. 1.
Basic concepts of practical computer and Internet security: passwords, firewalls, antivirus software, malware, social networking, surfing the Internet, phishing, and wireless networks. This class is intended for students with little or no background in information technology or security. Basic knowledge of word processing required. Offered on a satisfactory-fail basis only.

CPR E 166: Professional Programs Orientation
(Cross-listed with E E). Cr. R. F.S.
(1-0) Overview of the nature and scope of electrical engineering and computer engineering professions. Overview of portfolios. Departmental rules, student services operations, degree requirements, program of study planning, career options, and student organizations.

CPR E 185: Introduction to Computer Engineering and Problem Solving I
(2-2) Cr. 3.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Introduction to Computer Engineering. Project based examples from computer engineering. Individual interactive skills for small and large groups. Computer-based projects. Solving engineering problems and presenting solutions through technical reports. Solution of engineering problems using a programming language.

CPR E 186: Introduction to Computer Engineering and Problem Solving II
(0-2) Cr. 1. S.
Prereq: CPR E 185
Project based examples from computer engineering. Group skills needed to work effectively in teams. Group problem solving. Computer based projects. Technical reports and presentations. Students will work on 2 or 3 self-directed team based projects that are representative of problems faced by computer engineers.

CPR E 231: Cyber Security Concepts and Tools
(2-3) Cr. 3.
Prereq: COM S 107, COM S 207, COM S 227, or E E 285
Basic concepts of practical computer and Internet security and the tools used to protect and attack systems and networks. Computer and network security methods including: user authentication, access control, firewalls, intrusion detection and wireless networks. Vulnerability assessment tools and methods. Ethics and legal issues in cyber security. Laboratory experiments and exercises including computer and network configuration.

CPR E 261: Transfer Orientation
(Cross-listed with E E). Cr. R.
Introduction to the College of Engineering and the engineering profession specifically for transfer students. Information concerning university and college policies, procedures, and resources. Offered on a satisfactory-fail basis only.

CPR E 281: Digital Logic
(3-3) Cr. 4. F.S.
Prereq: sophomore classification
Number systems and representation. Boolean algebra and logic minimization. Combinational and sequential logic design. Arithmetic circuits and finite state machines. Use of programmable logic devices. Introduction to computer-aided schematic capture systems, simulation tools, and hardware description languages. Design of simple digital systems.

CPR E 288: Embedded Systems I: Introduction
(3-2) Cr. 4. F.S.
Prereq: CPR E 281, COM S 207 or COM S 227 or E E 285
Embedded C programming. Interrupt handling. Memory mapped I/O in the context of an application. Elementary embedded design flow/methodology. Timers, scheduling, resource allocation, optimization, state machine based controllers, real time constraints within the context of an application. Applications laboratory exercises with embedded devices.

CPR E 294: Program Discovery
(Cross-listed with E E). Cr. R.
Prereq: CPR E 166 or E E 166
The roles of professionals in computer and electrical engineering. Relationship of coursework to industry and academic careers. Issues relevant to today's world. Offered on a satisfactory-fail basis only.

CPR E 308: Operating Systems: Principles and Practice
(3-3) Cr. 4. F.S.
Prereq: CPR E 381 or COM S 321
Operating system concepts, processes, threads, synchronization between threads, process and thread scheduling, deadlocks, memory management, file systems, I/O systems,security, Linux-based lab experiments.

CPR E 310: Theoretical Foundations of Computer Engineering
(3-1) Cr. 3. F.S.
Prereq: COM S 228
Propositional logic and methods of proof; set theory and its applications; mathematical induction and recurrence relations; functions and relations; and counting; trees and graphs; applications in computer engineering.

CPR E 315: Applications of Algorithms in Computer Engineering
(3-0) Cr. 3. F.S.SS.
Prereq: CPR E 310
Solving computer engineering problems using algorithms. Emphasis on problems related to the core focus areas in computer engineering. Real world examples of algorithms used in the computer engineering domain. Algorithm engineering. Prototyping of algorithms.

CPR E 329: Software Project Management
(Cross-listed with S E). (3-0) Cr. 3.
Prereq: COM S 309
Process-based software development. Capability Maturity Model (CMM). Project planning, cost estimation, and scheduling. Project management tools. Factors influencing productivity and success. Productivity metrics. Analysis of options and risks. Version control and configuration management. Inspections and reviews. Managing the testing process. Software quality metrics. Modern software engineering techniques and practices.

CPR E 330: Integrated Electronics
(Cross-listed with E E). (3-3) Cr. 4.
Prereq: E E 201, credit or enrollment in E E 230, CPR E 281
Semiconductor technology for integrated circuits. Modeling of integrated devices including diodes, BJTs, and MOSFETs. Physical layout. Circuit simulation. Digital building blocks and digital circuit synthesis. Analysis and design of analog building blocks. Laboratory exercises and design projects with CAD tools and standard cells.

CPR E 332: Cyber Defense Competition
(Cross-listed with INFAS). (0-2) Cr. 1. Repeatable. S.
Participation in cyber defense competition driven by scenario-based network design. Includes computer system setup, risk assessment and implementation of security systems, as well as defense of computer and network systems against trained attackers. Team based. Offered on a satisfactory-fail basis only.

CPR E 339: Software Architecture and Design
(Cross-listed with S E). (3-0) Cr. 3.
Prereq: S E 319
Modeling and design of software at the architectural level. Architectural styles. Basics of model-driven architecture. Object-oriented design and analysis. Iterative development and unified process. Design patterns. Design by contract. Component based design. Product families. Measurement theory and appropriate use of metrics in design. Designing for qualities such as performance, safety, security, reliability, reusability, etc. Analysis and evaluation of software architectures. Introduction to architecture definition languages. Basics of software evolution, reengineering, and reverse engineering. Case studies. Introduction to distributed system software.

CPR E 370: Toying with Technology
(Cross-listed with MAT E). (2-2) Cr. 3. F.S.
Prereq: C I 201 or C I 202
A project-based, hands-on learning course. Technology literacy, appreciation for technological innovations, principles behind many technological innovations, hands-on laboratory experiences based upon simple systems constructed out of LEGOs and controlled by small microcomputers. Future K-12 teachers will leave the course with complete lesson plans for use in their upcoming careers.

CPR E 381: Computer Organization and Assembly Level Programming
(3-2) Cr. 4. F.S.
Prereq: CPR E 288
Introduction to computer organization, evaluating performance of computer systems, instruction set design. Assembly level programming: arithmetic operations, control flow instructions, procedure calls, stack management. Processor design. Datapath and control, scalar pipelines, introduction to memory and I/O systems.

CPR E 388: Embedded Systems II: Mobile Platforms
(3-2) Cr. 4.
Prereq: CPR E 288
Contemporary programming techniques for event driven systems. Mobile platforms and operating systems. Location and motion sensors based user interfaces. Threading and scheduling. Resource management - measurement and control techniques - for memory and energy. Client-server application design. Distributed applications. Laboratory includes exercises based on a mobile platform.

CPR E 394: Program Exploration
(Cross-listed with E E). Cr. R.
Prereq: CPR E 294 or E E 294
Exploration of academic and career fields for electrical and computer engineers. Examination of professionalism in the context of engineering and technology with competencies based skills. Introduction to professional portfolio development and construction. Offered on a satisfactory-fail basis only.

CPR E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

CPR E 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

CPR E 412: Formal Methods in Software Engineering
(Cross-listed with COM S, S E). (3-0) Cr. 3. S.
Prereq: COM S 230 or CPR E 310; COM S 311, STAT 330; for graduate credit: graduate standing or permission of instructor
A study of formal techniques for model-based specification and verification of software systems. Topics include logics, formalisms, graph theory, numerical computations, algorithms and tools for automatic analysis of systems. Graduate credit requires in-depth study of concepts.

CPR E 416: Software Evolution and Maintenance
(Cross-listed with S E). (3-0) Cr. 3.
Prereq: COM S 309
Practical importance of software evolution and maintenance, systematic defect analysis and debugging techniques, tracing and understanding large software, impact analysis, program migration and transformation, refactoring, tools for software evolution and maintenance, experimental studies and quantitative measurements of software evolution. Written reports and oral presentation.

CPR E 418: High Speed System Engineering Measurement and Testing
(Cross-listed with E E). (3-2) Cr. 4. F.
Prereq: E E 230 and E E 311
Measurement of high speed systems and mixed signal systems. Measurement accuracy and error. Network analysis and spectrum analysis used in high speed measurement and testing. Test specification process and parametric measurement. Sampling and digital signal processing concepts. Design for testability. Testing equipment. Applications.

CPR E 419: Software Tools for Large Scale Data Analysis
(Cross-listed with S E). (3-3) Cr. 4.
Prereq: CPR E 308 or COM S 352, COM S 309
Software tools for managing and manipulating large volumes of data, external memory processing, large scale parallelism, and stream processing, data interchange formats. Weekly programming labs that involve the use of a parallel computing cluster.

CPR E 424: Introduction to High Performance Computing
(Cross-listed with COM S, MATH). (2-2) Cr. 3. F.
Prereq: MATH 265; MATH 207 or MATH 317
UNIX, serial programming for high performance, OpenMP for high performance, shared memory parallelization. Semester project required.

CPR E 425: High Performance Computing for Scientific and Engineering Applications
(Cross-listed with COM S). (3-1) Cr. 3. S.
Prereq: COM S 311, COM S 230, ENGL 250, SP CM 212
Introduction to high performance computing platforms including parallel computers and workstation clusters. Discussion of parallel architectures, performance, programming models, and software development issues. Sample applications from science and engineering. Practical issues in high performance computing will be emphasized via a number of programming projects using a variety of programming models and case studies. Oral and written reports.

CPR E 426: Introduction to Parallel Algorithms and Programming
(Dual-listed with CPR E 526). (Cross-listed with COM S). (3-2) Cr. 4. F.
Prereq: CPR E 308 or COM S 321, CPR E 315 or COM S 311
Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms.

CPR E 430: Network Protocols and Security
(Dual-listed with CPR E 530). (Cross-listed with INFAS). (3-0) Cr. 3.
Prereq: CPR E 381 or equivalent
Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

CPR E 431: Basics of Information System Security
(3-0) Cr. 3. S.
Prereq: credit or enrollment in CPR E 308 or COM S 352
Introduction to and application of basic mechanisms for protecting information systems from accidental and intentional threats. Basic cryptography use and practice. Computer security issues including authentication, access control, and malicious code. Network security mechanisms such as intrusion detection, firewalls, IPSEC, and related protocols. Ethics and legal issues in information security. Wireless security. Programming and system configuration assignments.

CPR E 435: Analog VLSI Circuit Design
(Cross-listed with E E). (3-3) Cr. 4. S.
Prereq: E E 324, E E 330, E E 332, and either E E 322 or STAT 330
Basic analog integrated circuit and system design including design space exploration, performance enhancement strategies, operational amplifiers, references, integrated filters, and data converters.

CPR E 444: Bioinformatic Analysis
(Cross-listed with BCB, BCBIO, BIOL, COM S, GEN). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

CPR E 450: Distributed Systems and Middleware
(Dual-listed with CPR E 550). (3-0) Cr. 3.
Prereq: CPR E 308 or COM S 352
Fundamentals of distributed computing, software agents, naming services, distributed transactions, security management, distributed object-based systems, web-based systems, middleware-based application design and development, case studies of middleware and internet applications.

CPR E 454: Distributed Systems
(Dual-listed with CPR E 554). (Cross-listed with COM S). (3-1) Cr. 3. S.
Prereq: COM S 311, COM S 352; for graduate credit: graduate standing or permission of instructor
(3-1) Cr. 3. Theoretical and practical issues of design and implementation of distributed systems. The client server paradigm, inter-process communications, synchronization and concurrency control, naming, consistency and replication, fault tolerance, and distributed file systems. Graduate credit requires additional in-depth study of concepts. Programming projects and written reports.

CPR E 458: Real Time Systems
(Dual-listed with CPR E 558). (3-0) Cr. 3.
Prereq: CPR E 308 or COM S 352
Fundamental concepts in real-time systems. Real time task scheduling paradigms. Resource management in uniprocessor, multiprocessor, and distributed real-time systems. Fault-tolerance, resource reclaiming, and overload handling. Real-time channel, packet scheduling, and real-time LAN protocols. Case study of real-time operating systems. Laboratory experiments.

CPR E 465: Digital VLSI Design
(Cross-listed with E E). (3-3) Cr. 4. S.
Prereq: E E 330
Digital design of integrated circuits employing very large scale integration (VLSI) methodologies. Technology considerations in design. High level hardware design languages, CMOS logic design styles, area-energy-delay design space characterization, datapath blocks: arithmetic and memory, architectures and systems on a chip (SOC) considerations. VLSI chip hardware design project.

CPR E 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, AER E, B M E, E E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

CPR E 467: Multidisciplinary Engineering Design II
(Cross-listed with AER E, E E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: Student must be within two semesters of graduation or receive permission of instructor.
Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

CPR E 480: Graphics Processing and Architecture
(3-3) Cr. 4. S.
Prereq: CPR E 381 or COM S 321
Introduction to hardware architectures for computer graphics and their programming models. System-level view, including framebuffers, video output devices, displays, 2D and 3D graphics acceleration, and device interfacing. Architectural design of GPUs, from 2D and 3D sprite engines to 3D rendering pipelines to unified shader architectures. Computing models for graphics processors. GPGPU and GPU computing.

CPR E 483: Hardware Software Integration
(3-3) Cr. 4. S.
Prereq: CPR E 381
Embedded system design using hardware description language (HDL) and field programmable gate array (FPGA). HDL modeling concepts and styles are introduced; focus on synthesizability, optimality, reusability and portability in hardware design description. Introduction to complex hardware cores for data buffering, data input/output interfacing, data processing. System design with HDL cores and implementation in FPGA. Laboratory-oriented design projects.

CPR E 488: Embedded Systems Design
(3-3) Cr. 4.
Prereq: CPR E 381 or COM S 321
Embedded microprocessors, embedded memory and I/O devices, component interfaces, embedded software, program development, basic compiler techniques, platform-based FPGA technology, hardware synthesis, design methodology, real-time operating system concepts, performance analysis and optimizations.

CPR E 489: Computer Networking and Data Communications
(3-2) Cr. 4. F.S.
Prereq: CPR E 381 or E E 324
Modern computer networking and data communications concepts. TCP/IP, OSI protocols, client server programming, data link protocols, local area networks, and routing protocols.

CPR E 490: Independent Study
Cr. arr. Repeatable.
Prereq: Senior classification in computer engineering
Investigation of an approved topic.

CPR E 490H: Independent Study: Honors
Cr. arr. Repeatable.
Prereq: Senior classification in computer engineering
Investigation of an approved topic.

CPR E 491: Senior Design Project I and Professionalism
(Cross-listed with E E). (2-3) Cr. 3. F.S.
Prereq: E E 322 or CPR E 308, completion of 24 credits in the E E core professional program or 29 credits in the Cpr E core professional program, ENGL 314
Preparing for entry to the workplace. Selected professional topics. Use of technical writing skills in developing project plan and design report; design review presentation. First of two-semester team-oriented, project design and implementation experience.

CPR E 492: Senior Design Project II
(Cross-listed with E E). (1-3) Cr. 2. F.S.
Prereq: CPR E 491 or E E 491
Second semester of a team design project experience. Emphasis on the successful implementation and demonstration of the design completed in E E 491 or Cpr E 491 and the evaluation of project results. Technical writing of final project report; oral presentation of project achievements; project poster.

CPR E 494: Portfolio Assessment
(Cross-listed with E E). Cr. R.
Prereq: CPR E 394 or E E 394, credit or enrollment in CPR E 491 or E E 491
Portfolio update and evaluation. Portfolios as a tool to enhance career opportunities.

Courses primarily for graduate students, open to qualified undergraduates:

CPR E 501: Analog and Mixed-Signal VLSI Circuit Design Techniques
(Cross-listed with E E). (3-3) Cr. 4. F.
Prereq: E E 435
Design techniques for analog and mixed-signal VLSI circuits. Amplifiers; operational amplifiers, transconductance amplifiers, finite gain amplifiers and current amplifiers. Linear building blocks; differential amplifiers, current mirrors, references, cascading and buffering. Performance characterization of linear integrated circuits; offset, noise, sensitivity and stability. Layout considerations, simulation, yield and modeling for high-performance linear integrated circuits.

CPR E 504: Power Management for VLSI Systems
(Cross-listed with E E). (3-3) Cr. 4.
Prereq: E E 435, Credit or Registration for E E 501
Theory, design and applications of power management and regulation circuits (Linear and switching regulators, battery chargers, and reference circuits) including: Architectures, Performance metrics and characterization, Noise and stability analysis, Practical implementation and on-chip integration issues, design considerations for portable, wireless, and RF SoCs.

CPR E 505: CMOS and BiCMOS Data Conversion Circuits
(Cross-listed with E E). (3-3) Cr. 4. Alt. S., offered even-numbered years.
Prereq: E E 501
Theory, design and applications of data conversion circuits (A/D and D/A converters) including: architectures, characterization, quantization effects, conversion algorithms, spectral performance, element matching, design for yield, and practical comparators, implementation issues.

CPR E 506: Design of CMOS Phase-Locked Loops
(Cross-listed with E E). (3-3) Cr. 4.
Prereq: E E 435 or E E 501 or instructor approval
Analysis and design of phase-locked loops implemented in modern CMOS processes including: architectures, performance metrics, and characterization; noise and stability analysis; and design issues of phase-frequency detectors, charge pumps, loop filters (passive and active), voltage controlled oscillators, and frequency dividers.

CPR E 507: VLSI Communication Circuits
(Cross-listed with E E). (3-3) Cr. 4. Alt. S., offered odd-numbered years.
Prereq: E E 435 or E E 501
Phase-locked loops, frequency synthesizers, clock and data recovery circuits, theory and implementation of adaptive filters, low-noise amplifiers, mixers, power amplifiers, transmitter and receiver architectures.

CPR E 511: Design and Analysis of Algorithms
(Cross-listed with COM S). (3-0) Cr. 3. F.
Prereq: COM S 311
A study of basic algorithm design and analysis techniques. Advanced data structures, amortized analysis and randomized algorithms. Applications to sorting, graphs, and geometry. NP-completeness and approximation algorithms.

CPR E 522: Cognitive Radio Networks
(Cross-listed with E E). (3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: Permission of instructor
Topics on cognitive radio networks: Cognitive Radio Networks Architecture; Software Defined Radio Architecture; Spectrum Sensing; Spectrum Management; Spectrum Sharing; Spectrum Mobility; Applications of Cognitive Radio Networks.

CPR E 525: Numerical Analysis of High Performance Computing
(Cross-listed with COM S, MATH). (3-0) Cr. 3. S.
Prereq: CPR E 308 or MATH 481; experience in scientific programming; knowledge of FORTRAN or C
Introduction to parallelization techniques and numerical methods for distributed memory high performance computers. A semester project in an area related to each student's research interests is required.

CPR E 526: Introduction to Parallel Algorithms and Programming
(Dual-listed with CPR E 426). (Cross-listed with COM S). (3-2) Cr. 4. F.
Prereq: CPR E 308 or COM S 321, CPR E 315 or COM S 311
Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms.

CPR E 528: Probabilistic Methods in Computer Engineering
(3-0) Cr. 3.
Prereq: CPR E 315 or COM S 311
The application of randomization and probabilistic methods in the design of computer algorithms, and their efficient implementation. Discrete random variables in modeling algorithm behavior, with applications to sorting, selection, graph algorithms, hashing, pattern matching, cryptography, distributed systems, and massive data set algorithmics.

CPR E 530: Network Protocols and Security
(Dual-listed with CPR E 430). (Cross-listed with INFAS). (3-0) Cr. 3.
Prereq: CPR E 381 or equivalent
Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

CPR E 531: Information System Security
(Cross-listed with INFAS). (3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530 or COM S 586 or MIS 535
Computer, software, and data security: basic cryptography, security policies, multilevel security models, attack and protection mechanisms, legal and ethical issues.

CPR E 532: Information Warfare
(Cross-listed with INFAS). (3-0) Cr. 3. S.
Prereq: CPR E 531
Computer system and network security: implementation, configuration, testing of security software and hardware, network monitoring. Authentication, firewalls, vulnerabilities, exploits, countermeasures. Study and use of attack tools. Ethics in information assurance. Emphasis on laboratory experiments.

CPR E 533: Cryptography
(Cross-listed with INFAS, MATH). (3-0) Cr. 3. S.
Prereq: MATH 301 or CPR E 310 or COM S 330
Basic concepts of secure communication, DES and AES, public-key cryptosystems, elliptic curves, hash algorithms, digital signatures, applications. Relevant material on number theory and finite fields.

CPR E 534: Legal and Ethical Issues in Information Assurance
(Cross-listed with INFAS, POL S). (3-0) Cr. 3. S.
Prereq: Graduate classification; CPR E 531 or INFAS 531
Legal and ethical issues in computer security. State and local codes and regulations. Privacy issues.

CPR E 535: Steganography and Digital Image Forensics
(Cross-listed with INFAS, MATH). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E E 524 or MATH 317 or MATH 407 or COM S 330
Basic principles of covert communication, steganalysis, and forensic analysis for digital images. Steganographic security and capacity, matrix embedding, blind attacks, image forensic detection and device identification techniques. Related material on coding theory, statistics, image processing, pattern recognition.

CPR E 536: Computer and Network Forensics
(Cross-listed with INFAS). (3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530
Fundamentals of computer and network forensics, forensic duplication and analysis, network surveillance, intrusion detection and response, incident response, anonymity and pseudonymity, privacy-protection techniques, cyber law, computer security policies and guidelines, court testimony and report writing, and case studies. Emphasis on hands-on experiments.

CPR E 537: Wireless Network Security
(3-0) Cr. 3. S.
Prereq: Credit or enrollment in CPR E 489 or CPR E 530
Introduction to the physical layer and special issues associated with the security of wireless networks. The basics of wireless communication systems (antennas and propagation, modulation, multiple access, channel modeling, specific security issues of the wireless link), jamming and countermeasures (spread spectrum technologies, channel coding, interleaving), authentication and confidentiality (basics of classic cryptography, common authentication and encryption algorithms). Detailed case studies on authentication, encryption and privacy flaws, and good practices based on the most common wireless technologies, including WiFi, GSM/3G, Bluetooth, and RFID. Individual or team-based class projects.

CPR E 538: Reverse Engineering and Security Testing
(Cross-listed with INFAS). (2-3) Cr. 3. S.
Prereq: COM S 321 or CPR E 381, COM S 352 or CPR E 308
Techniques and tools for understanding the behavior of software/hardware systems based on reverse engineering. Flaw hypothesis, black, grey, and white box testing as well as other methods for testing the security of software systems. Discussion of counter-reverse engineering techniques.

CPR E 539: Cyber Physical System Security for the Smart Grid
(3-0) Cr. 3. S.
Introduction to cyber security, cyber physical system (CPS), and smart grid automation technologies; supervisor control and data acquisition (SCADA) systems; cyber risk modeling, vulnerability analysis, impact analysis, defense and mitigation techniques; cyber security of wide-area monitoring, protection, and control; security and privacy in advanced metering infrastructure (AMI), cyber security compliance and best practices, CPS security test-beds and attack-defense hands-on laboratory experiments.

CPR E 541: High-Performance Communication Networks
(3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530
Computer architectures and protocols designed for high-performance networking environments; software defined networking (SDN) and supporting protocols; cloud and data center networks; network traffic management and congestion control strategies; quality of service; high-speed access network protocols.

CPR E 542: Optical Communication Networks
(3-0) Cr. 3. S.
Prereq: CPR E 489
Optical components and interfaces; optical transmission and reception techniques; wavelength division multiplexing; network architectures and protocol for first generation, single and multihop optical network; routing and wavelength assignment in second generation wavelength routing networks; traffic grooming, optical network control; survivability; access networks; metro networks.

CPR E 543: Wireless Network Architecture
(3-0) Cr. 3.
Prereq: Credit or enrollment in CPR E 489 or CPR E 530
Introduction to the protocol architecture of the data link layer, network layer and transport layer for wireless networking. Operation and management of Medium Access Control in Wireless Local Area Networks (WLAN) and Wireless Metropolitan Area Networks (WMAN); recent developments in IEEE 802.11 & 802.16 and Bluetooth; Mobile IP; Mobile TCP.

CPR E 544: Fundamentals of Bioinformatics
(Cross-listed with BCB, COM S, GDCB). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent
A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies.

CPR E 545: Fault-Tolerant Systems
(3-0) Cr. 3.
Prereq: CPR E 381
Faults and their manifestations, errors, and failures; fault detection, location and reconfiguration techniques; time, space, and information (coding) redundancy management; design for testability; self-checking and fail-safe circuits; system-level fault diagnosis; Byzantine agreement; stable storage and RAID; clock synchronization; fault-tolerant networks; fault tolerance in real-time systems; reliable software design; checkpointing and rollback recovery; atomic actions; replica management protocols; and reliability evaluation techniques and tools.

CPR E 546: Wireless and Sensor Networks
(3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530
Fundamental and well-known protocols for wireless ad hoc and sensor networks at various layers, including physical layer issues, MAC (medium access control) layer protocols, routing protocols for wireless ad hoc and sensor networks, data management in sensor networks, coverage and connectivity, localization and tracking, security and privacy issues. Introduction to TinyOS and the nesC language. Hands-on experiments with Crossbow Mote sensor devices.

CPR E 547: Resource Allocation in Communication Networks
(3-0) Cr. 3.
Analytical approach to resource allocation on communication networks (e.g. the Internet, multihop wireless networks, etc.). Network utility maximization and the internet congestion control algorithm. Layering as optimization decomposition: a cross-layer design approach in multihop wireless networks. Capacity of ad hoc wireless networks.

CPR E 549: Advanced Algorithms in Computational Biology
(Cross-listed with COM S). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: COM S 311 and either COM S 228 or COM S 208
Design and analysis of algorithms for applications in computational biology, pairwise and multiple sequence alignments, approximation algorithms, string algorithms including in-depth coverage of suffix trees, semi-numerical string algorithms, algorithms for selected problems in fragment assembly, phylogenetic trees and protein folding. No background in biology is assumed. Also useful as an advanced algorithms course in string processing.

CPR E 550: Distributed Systems and Middleware
(Dual-listed with CPR E 450). (3-0) Cr. 3.
Prereq: CPR E 308 or COM S 352
Fundamentals of distributed computing, software agents, naming services, distributed transactions, security management, distributed object-based systems, web-based systems, middleware-based application design and development, case studies of middleware and internet applications.

CPR E 554: Distributed Systems
(Dual-listed with CPR E 454). (Cross-listed with COM S). (3-1) Cr. 3. S.
Prereq: COM S 311, COM S 352; for graduate credit: graduate standing or permission of instructor
(3-1) Cr. 3. Theoretical and practical issues of design and implementation of distributed systems. The client server paradigm, inter-process communications, synchronization and concurrency control, naming, consistency and replication, fault tolerance, and distributed file systems. Graduate credit requires additional in-depth study of concepts. Programming projects and written reports.

CPR E 556: Scalable Software Engineering
(3-0) Cr. 3.
Prereq: COM S 309
Design and analysis techniques scalable to large software, project-based learning of problem solving techniques, automation tools for high productivity and reliability of software, analysis-based measurement and estimation techniques for predictable software engineering.

CPR E 557: Computer Graphics and Geometric Modeling
(Cross-listed with COM S, M E). (3-0) Cr. 3. F.
Prereq: M E 421, programming experience in C
Fundamentals of computer graphics technology. Data structures. Parametric curve and surface modeling. Solid model representations. Applications in engineering design, analysis, and manufacturing.

CPR E 558: Real Time Systems
(Dual-listed with CPR E 458). (3-0) Cr. 3.
Prereq: CPR E 308 or COM S 352
Fundamental concepts in real-time systems. Real time task scheduling paradigms. Resource management in uniprocessor, multiprocessor, and distributed real-time systems. Fault-tolerance, resource reclaiming, and overload handling. Real-time channel, packet scheduling, and real-time LAN protocols. Case study of real-time operating systems. Laboratory experiments.

CPR E 566: Physical Design of VLSI Systems
(3-0) Cr. 3.
Prereq: CPR E 465
Physical design of VLSI systems. Partitioning algorithms. Placement and floorplanning algorithms. Routing-global and detailed. Layout compaction. Physical design of FPGA's and MCM's. Performance-driven layout synthesis.

CPR E 567: Bioinformatics I (Bioinformatics Algorithms)
(Cross-listed with BCB, COM S). (3-0) Cr. 3. F.
Prereq: COM S 228; COM S 330; credit or enrollment in BIOL 315, STAT 430
Biology as an information science. A review of the algorithmic principles that are driving the advances in bioinformatics and computational biology.

CPR E 569: Bioinformatics III (Structural Bioinformatics)
(Cross-listed with BBMB, BCB, COM S, GDCB). (3-0) Cr. 3. F.
Prereq: BCB 567, BBMB 316, GEN 409, STAT 430
Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution.

CPR E 570: Bioinformatics IV (Systems Biology)
(Cross-listed with BCB, COM S, GDCB, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or COM S 311, COM S 228, GEN 409, STAT 430
Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration.

CPR E 575: Computational Perception
(Cross-listed with COM S, HCI). (3-0) Cr. 3. S.
Prereq: Graduate standing or permission of instructor
Statistical and algorithmic methods for sensing, recognizing, and interpreting the activities of people by a computer. Focuses on machine perception techniques that facilitate and augment human-computer interaction. Introduce computational perception on both theoretical and practical levels. Participation in small groups to design, implement, and evaluate a prototype of a human-computer interaction system that uses one or more of the techniques covered in the lectures.

CPR E 581: Computer Systems Architecture
(Cross-listed with COM S). (3-0) Cr. 3. F.
Prereq: CPR E 381
Quantitative principles of computer architecture design, instruction set design, processor architecture: pipelining and superscalar design, instruction level parallelism, memory organization: cache and virtual memory systems, multiprocessor architecture, cache coherency, interconnection networks and message routing, I/O devices and peripherals.

CPR E 582: Computer Systems Performance
(3-0) Cr. 3.
Prereq: CPR E 381, CPR E 310 and STAT 330
Review of probability and stochastic processes concepts; Markovian processes; Markovian queues; renewal theory; semi-Markovian queues; queueing networks, applications to multiprocessor architectures, computer networks, and switching systems.

CPR E 583: Reconfigurable Computing Systems
(Cross-listed with COM S). (3-0) Cr. 3.
Prereq: Background in computer architecture, design, and organization
Introduction to reconfigurable computing, FPGA technology and architectures, spatial computing architectures such as systolic and bit serial adaptive network architectures, static and dynamic rearrangeable interconnection architectures, processor architectures incorporating reconfigurabiltiy.

CPR E 584: Models and Techniques in Embedded Systems
(3-0) Cr. 3.
Industry-standard tools and optimization strategies; practical embedded platforms and technology (reconfigurable platforms, multi-core platforms, low-power platforms); instruction augmentation, memory-mapped accelerator design, embedded software optimization. Students will be encouraged to compete as teams in an embedded system design competition.

CPR E 585: Developmental Robotics
(Cross-listed with HCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: knowledge of C/C++ programming language.
An introduction to the emerging interdisciplinary field of Developmental Robotics, which crosses the boundaries between robotics, artificial intelligence, developmental psychology, and philosophy. The main goal of this field is to create autonomous robots that are more intelligent, more adaptable, and more useful than the robots of today, which can only function in very limited domains and situations.

CPR E 586: Pervasive Computing
(3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530
Fundamentals of pervasive computing, including location and context awareness, mobile and location services, ubiquitous data access, low power computing and energy management, middleware, security and privacy issues.

CPR E 588: Embedded Computer Systems
(3-0) Cr. 3.
Prereq: CPR E 308
Hardware/software systems and codesign. Models of computation for embedded systems. System-level design. Modeling, specification, synthesis, and verification. Hardware/software implementation. Design space exploration. Performance analysis and optimization. Multiprocessor system on chip. Platform-based design. Design methodologies and tools. Case studies and design projects.

CPR E 590: Special Topics
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in computer engineering.

CPR E 592: Seminar in Computer Engineering
Cr. 1-4. Repeatable.
Prereq: Permission of instructor
Projects or seminar in Computer Engineering.

CPR E 594: Selected Topics in Computer Engineering
(3-0) Cr. 3. Repeatable.

CPR E 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

CPR E 626: Parallel Algorithms for Scientific Applications
(Cross-listed with COM S). (3-0) Cr. 3.
Prereq: CPR E 526
Algorithm design for high-performance computing. Parallel algorithms for multidimensional tree data structures, space-filling curves, random number generation, graph partitioning and load balancing. Applications to grid and particle-based methods and computational biology.

CPR E 632: Information Assurance Capstone Design
(Cross-listed with INFAS). (3-0) Cr. 3.
Prereq: INFAS 531, INFAS 532, INFAS 534
Capstone design course which integrates the security design process. Design of a security policy. Creation of a security plan. Implementation of the security plan. The students will attack each other's secure environments in an effort to defeat the security systems. Students evaluate the security plans and the performance of the plans. Social, political and ethics issues. Student self-evaluation, journaling, final written report.

CPR E 681: Advanced Topics in Computer Architecture
(Cross-listed with COM S). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: CPR E 581. Repeatable with Instructor permission
Current topics in computer architecture design and implementation. Advanced pipelining, cache and memory design techniques. Interaction of algorithms with architecture models and implementations. Tradeoffs in architecture models and implementations.

CPR E 697: Engineering Internship
(Cross-listed with E E). Cr. R. Repeatable.
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

CPR E 699: Research
Cr. arr. Repeatable.

Construction Engineering

Administered by the Department of Civil, Construction and Environmental Engineering

The curriculum in construction engineering, leading to a bachelor of science degree can be referenced here: http://catalog.iastate.edu/collegeofengineering/constructionengineering/#curriculumtext. This curriculum is accredited under the General Criteria and Construction Engineering Program Criteria by the Engineering Accreditation Commission of ABET, http://www.abet.org.

By three to five years after graduation, graduates of the construction engineering program will have:

1. Established themselves in successful careers in construction engineering or a related field.
2. Collaborated effectively on multi-disciplinary teams to address the needs of society and the environment.
3. Pursued lifelong learning, professional development, and registration as appropriate for their employers.

Students who successfully complete the curriculum will be prepared for entry into the field or for further study at the graduate level in construction engineering or related fields of study, such as law, business and other engineering disciplines.

Construction engineers need to possess a strong fundamental knowledge of engineering design and management principles, including knowledge of business procedures, economics, and human behavior. Graduates of this curriculum may expect to engage in design of temporary structures, coordination of project design, systems design, cost estimating, planning and scheduling, company and project management, materials procurement, equipment selection, and cost control. With the emergence of integrated project delivery methods such as design-build construction, the role of the construction engineer is expanding the need for trained professionals that understand both aspects of the project delivery environment. The curriculum offers opportunities to study emphases concerned with building, heavy, mechanical, or electrical construction. The process of construction involves the organization, administration, and coordination of labor resource requirements, temporary and permanent materials, equipment, supplies and utilities, money, technology and methods. These must be integrated in the most efficient manner possible to complete construction projects on schedule, within the budget, and according to the standards of quality and performance specified by the project owner or designer. The curriculum blends engineering, management and business sciences into a study of the processes of construction whereby designer's plans and specifications are converted into physical structures and facilities.

The curriculum develops the ability of students to be team workers, creative thinkers, and effective communicators. This is achieved by encouraging students to:

- interact with practicing professionals
- gain work experience during summer jobs, internship, and cooperative education assignments that emphasize the knowledge required of construction engineers
- develop leadership skills by participating in student organizations
- develop, analyze, and interpret alternative solutions to open-ended problems
- study abroad

The construction industry is becoming increasingly global. Courses in humanities, social sciences, U.S. diversity, and international perspectives are included in the curriculum to broaden the student's perspective of the work environment. In addition, the department has several exchange program opportunities for students to participate in study abroad programs.

Qualified construction engineering students within 30 credits of completing their degree may apply for concurrent enrollment in the Graduate College. See Civil Engineering (http://www.ccee.iastate.edu/academics/graduate) Graduate Study for more information.

Curriculum in Construction Engineering

Administered by the Department of Civil, Construction and Environmental Engineering; leading to the degree bachelor of science.

Total credits required: Building Option -126.0, Heavy Option - 125.0, Electrical - 124.0, Mechanical - 125.0 cr.
The Construction Engineering program requires a grade of a C or better for any transfer credit course that is applied to the degree program (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). Note: Department does not allow Pass/Not Pass credits to

be used to meet graduation requirements for either required or elective courses.

International Perspectives: 3 cr. [1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirements:

ENGL 150	Critical Thinking and Communication (C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
LIB 160	Information Literacy	1
Business Communication Elective: one course of the following with a minimum grade of C.		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
Total Credits		10

Social Sciences and Humanities: 12 cr.

One of the following		3
PSYCH 101	Introduction to Psychology	
PSYCH 230	Developmental Psychology	
PSYCH 250	Psychology of the Workplace	
PSYCH 280	Social Psychology	
SOC 134	Introduction to Sociology	
ECON 101	Principles of Microeconomics	3
or ECON 102	Principles of Macroeconomics	
International Perspectives [1]		3
U.S. Diversity [1]		3
Total Credits		12

Basic Program: 27 cr. [3]
Minimum GPA of 2.00 required for this set of courses to graduate, (please note that transfer course grades will not be calculated into the Basic Program GPA).[3]

CHEM 167	General Chemistry for Engineering Students	4
or CHEM 177	General Chemistry I	
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGR 101	Engineering Orientation	R
C E 160	Engineering Problems with Computational Laboratory [3]	3
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Math and Physical Science: 11 cr. (B, H); 12 cr. (E, M).

STAT 305	Engineering Statistics	3
or STAT 231	Probability and Statistical Inference for Engineers	
MATH 266	Elementary Differential Equations (B, H)	3
MATH 267	Elementary Differential Equations and Laplace Transforms (E, M)	4
PHYS 222	Introduction to Classical Physics II	5
Total Credits		15

Construction Engineering Core: 27 cr. (B, H); 28 cr. (E, M). Minimum 2.00 GPA for this set of courses to graduate (please note that transfer course grades will not be calculated into the Core GPA):

E M 274	Engineering Statics	3
E M 324	Mechanics of Materials	3
CON E 422	Construction Cost Estimating and Cost Engineering	3
CON E 441	Construction Planning, Scheduling, and Control	3
E M 378	Mechanics of Fluids	3
C E 332	Structural Analysis I	3
See options for remaining core courses		9-10
Total Credits		27-28

Select remaining courses from one of the following options:

Building Option: Remaining Core courses (9 cr.)

C E 360	Geotechnical Engineering	3
CON E 322	Construction Equipment and Heavy Construction Methods	3
CON E 340	Concrete and Steel Construction	3
Total Credits		9

Building Option: Remaining courses 17 cr.

C E 333	Structural Steel Design I	3
C E 334	Reinforced Concrete Design I	3
C E 383	Design of Portland Cement Concrete	1
CON E 352	Mechanical Systems in Buildings	3
CON E 353	Electrical Systems in Buildings	3
E M 327	Mechanics of Materials Laboratory	1
Engineering Topics Elective [2]		3
Total Credits		17

Heavy Option: Remaining Core courses (9 cr.)

C E 360	Geotechnical Engineering	3
CON E 322	Construction Equipment and Heavy Construction Methods	3

CON E 340	Concrete and Steel Construction	3
Total Credits		9

Heavy Option: Remaining courses 16 cr.

C E 333	Structural Steel Design I	3
C E 334	Reinforced Concrete Design I	3
C E 382	Design of Concretes	3
E M 327	Mechanics of Materials Laboratory	1
Engineering Topics Electives		6
Engineering Topics Electives - A (Student must complete at least 3 credits from List A)		
CON E 381A	Bidding Construction Projects I: Heavy and Highway	
CON E 481A	Bidding Construction Projects II: Heavy and Highway	
C E 594E	Special Topics Construction Engineering and Mgt.: Project Controls	
C E 594F	Special Topics Construction Engineering and Mgt.: Computer Applications for Project Controls	
C E 505	Design of Construction Systems	
C E 594O	Special Topics Construction Engineering and Mgt.: Highway and Heavy Construction	
Engineering Topics Electives - B		
C E 501	Preconstruction Project Engineering and Management	
C E 502	Construction Project Engineering and Management	
C E 503	Construction Finance and Business Management	
C E 355	Principles of Transportation Engineering	
C E 372	Engineering Hydrology and Hydraulics	
C E 417	Land Surveying	
C E 460	Foundation Engineering	
Any other C E 500 level course		
Total Credits		16

Electrical Option: Remaining Core courses (10 cr.)

E E 230	Electronic Circuits and Systems	4
E E 303	Energy Systems and Power Electronics	3
E E 456	Power System Analysis I	3
Total Credits		10

Electrical Option: Remaining courses - 13 cr.

CON E 352	Mechanical Systems in Buildings	3
CON E 353	Electrical Systems in Buildings	3
E E 201	Electric Circuits	4
E E 457	Power System Analysis II	3
Total Credits		13

Mechanical Option: Remaining Core courses (10 cr.)

M E 231	Engineering Thermodynamics I	3
M E 436	Heat Transfer	4
M E 441	Fundamentals of Heating, Ventilating, and Air Conditioning	3
Total Credits		10

Mechanical Option: Remaining courses - 13 cr.

CON E 352	Mechanical Systems in Buildings	3
CON E 353	Electrical Systems in Buildings	3
E E 442	Introduction to Circuits and Instruments	2
E E 448	Introduction to AC Circuits and Motors	2
M E 442	Heating and Air Conditioning Design	3
Total Credits		13

Additional Required Courses: 32 cr. (B,E,H), 33 cr. (M)

CON E 121	Cornerstone Learning Community: Orientation to Academic Life	1
CON E 122	Cornerstone Learning Community: Orientation to Professional Life	1
C E 170	Graphics for Civil Engineering	2
C E 111	Fundamentals of Surveying I	3
CON E 222	Contractor Organization and Management of Construction	3
I E 305	Engineering Economic Analysis	3
CON E 241	Construction Materials and Methods	3
CON E 251	Mechanical/Electrical Materials and Methods	1
Law Elective		3
CON E 380	Engineering Law	
ACCT 215	Legal Environment of Business	
CON E 487	Construction Engineering Design I	3
CON E 488	Construction Engineering Design II	3
Business Communication Elective (minimum grade of C)		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
Complete one course from Math or Stat Elective, 3 cr. (B, E, H); MATH 265, 4 cr. (M) [2]		3-4
Total Credits		32-33

Co-op/Internships - Optional

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by

the department to meet other course requirements within the degree program. U.S. diversity and international perspectives courses may not be taken Pass/Not Pass.

2. Choose from department approved list (http://www.ccee.iastate.edu/academics/advising/construction-engineering-student-forms).
3. See Basic Program for Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program

See also: A 4-year plan of study grid showing course template by semester for a building emphasis in Construction Engineering.

See also: A 4-year plan of study grid showing course template by semester for an electrical emphasis in Construction Engineering.

See also: A 4-year plan of study grid showing course template by semester for a heavy/highway emphasis in Construction Engineering.

See also: A 4-year plan of study grid showing course template by semester for a mechanical emphasis in Construction Engineering.

Construction Engineering, B.S. building emphasis

First Year

Fall	Credits Spring	Credits
ENGR 101	0 C E 170	2
C E 160	3 MATH 166	4
MATH 165	4 PHYS 221	5
CHEM 167	4 ENGL 250	3
ENGL 150	3 CON E 122	1
CON E 121	1 LIB 160	1
	15	16

Second Year

Fall	Credits Spring	Credits
CON E 222	3 CON E 241	3
C E 111	3 CON E 251	1
E M 274	3 MATH 266	3
Math or Stat Elective	3 PHYS 222	5
ECON 101 or 102	3 E M 324	3
	15	15

Third Year

Fall	Credits Spring	Credits
CON E 353	3 CON E 340	3
STAT 231 or 305	4-3 CON E 322	3
E M 378	3 C E 332	3
CON E 352	3 C E 360	3
I E 305	3 E M 327	1
SSH Elective (Psych 101/230/280 or Soc 134)	3 Law Elective (ConE 380 or Acct 215)	3
	19-18	16

Fourth Year

Fall	Credits Spring	Credits
CON E 422	3 CON E 487	3
CON E 441	3 CON E 488	3
C E 383	1 C E 334	3
C E 333	3 SSH Elective (US Diversity)	3
SSH Elective (Intl Perspective)	3 Business Comm Elective (ENGL 302 or 309 or 314)	3
Engr Topics Elective	3	
	16	15

Construction Engineering, B.S. electrical emphasis

First Year

Fall	Credits Spring	Credits
ENGR 101	0 C E 170	2
C E 160	3 MATH 166	4
MATH 165	4 PHYS 221	5
CHEM 167	4 ENGL 250	3
ENGL 150	3 CON E 122	1
CON E 121	1 LIB 160	1
	15	16

Second Year

Fall	Credits Spring	Credits
CON E 222	3 CON E 241	3
C E 111	3 CON E 251	1
PHYS 222	5 MATH 267	4
MATH or STAT Elective	3 E M 274	3
SSH Elective (Psych 101/230/280 or Soc 134)	3 E E 201	4
	17	15

Third Year

Fall	Credits Spring	Credits
STAT 231 or 305	4-3 E E 303	3
E M 324	3 Law Elective (ConE 380 or Acct 215)	3
CON E 352	3 E E 230	4
CON E 353	3 E M 378	3
I E 305	3 ECON 101 or 102	3
	16-15	16

Fourth Year

Fall	Credits	Spring	Credits
CON E 422	3	CON E 487	3
CON E 441	3	CON E 488	3
E E 456	3	E E 457	3
C E 332	3	SSH Elective (US Diversity)	3
SSH Elective (Intl Perspective)	3	Business Comm Elective (ENGL 302 or 309 or 314)	3
	15		15

Construction Engineering, B.S. heavy/highway emphasis

First Year

Fall	Credits	Spring	Credits
ENGR 101	0	C E 170	2
C E 160	3	MATH 166	4
MATH 165	4	PHYS 221	5
CHEM 167	4	ENGL 250	3
ENGL 150	3	CON E 122	1
CON E 121	1	LIB 160	1
	15		16

Second Year

Fall	Credits	Spring	Credits
CON E 222	3	CON E 241	3
C E 111	3	CON E 251	1
PHYS 222	5	MATH 266	3
E M 274	3	E M 324	3
Math or Stat Elective	3	ECON 101 or 102	3
		SSH Elective (PSYCH 101/230/250/280 or SOC 134)	3
	17		16

Third Year

Fall	Credits	Spring	Credits
CON E 322	3	CON E 340	3
E M 378	3	C E 360	3
I E 305	3	C E 332	3
STAT 231 or 305	4-3	E M 327	1
Engr Topics Elective	3	Law Elective (ConE 380 or Acct 215)	3
		Engr Topics Elective	3
	16-15		16

Fourth Year

Fall	Credits	Spring	Credits
CON E 422	3	CON E 487	3
CON E 441	3	CON E 488	3
C E 382	3	C E 334	3
C E 333	3	Business Comm Elective (ENGL 302 or 309 or 314)	3
SSH Elective (Intl Perspective)	3	SSH Elective (US Diversity)	3
	15		15

Construction Engineering, B.S. mechanical emphasis

First Year

Fall	Credits	Spring	Credits
ENGR 101	0	C E 170	2
C E 160	3	MATH 166	4
MATH 165	4	PHYS 221	5
CHEM 167	4	ENGL 250	3
ENGL 150	3	CON E 122	1
CON E 121	1	LIB 160	1
	15		16

Second Year

Fall	Credits	Spring	Credits
CON E 222	3	CON E 241	3
C E 111	3	CON E 251	1
MATH 265	4	MATH 267	4
PHYS 222	5	E M 274	3
		SSH Elective (PSYCH 101/230/250/280 or SOC 134)	3
		STAT 231 or 305	4-3
	15		18-17

Third Year

Fall	Credits	Spring	Credits
M E 231	3	E E 442	2
CON E 352	3	Law Elective (ConE 380 or ACCT 215)	3
CON E 353	3	E M 378	3
E M 324	3	C E 332	3
I E 305	3	International Perspective	3
US Diversity	3	E E 448	2
	18		16

Fourth Year

Fall	Credits	Spring	Credits
CON E 422	3	CON E 487	3
CON E 441	3	CON E 488	3
M E 436	4	M E 442	3
M E 441	3	Business Comm Elective (ENGL 302 or 309 or 314)	3
ECON 101 or 102	3		
	16		12

Graduate Study

An area of specialization in construction engineering and management is offered within the graduate program of the Department of Civil, Construction and Environmental Engineering. See Civil Engineering, Courses and Programs.

A graduate certificate in Construction Management is also available which requires 12 credits:

C E 501	Preconstruction Project Engineering and Management	3
C E 502	Construction Project Engineering and Management	3
C E 503	Construction Finance and Business Management	3
One of the following:		3
C E 505	Design of Construction Systems	
C E 506	Case Histories in Construction Documents	
C E 510	Information Technologies for Construction	
C E 594A	Special Topics Construction Engineering and Mgt.: Planning and Scheduling	
C E 594C	Special Topics Construction Engineering and Mgt.: Cost Estimating	
C E 594E	Special Topics Construction Engineering and Mgt.: Project Controls	
C E 594F	Special Topics Construction Engineering and Mgt.: Computer Applications for Project Controls	
C E 594L	Special Topics Construction Engineering and Mgt.: Advanced Building Construction Topics	
C E 594M	Special Topics Construction Engineering and Mgt.: Design Build Construction	
Total Credits		12

Courses are offered for minor work to students taking major work in other curricula or in interdepartmental programs.

Courses primarily for undergraduates:

CON E 121: Cornerstone Learning Community: Orientation to Academic Life
(0-2) Cr. 1. F.
Integration of first-year and transfer students into the engineering profession and the Construction Engineering program. Assignments and activities completed both individually and in learning teams involving teamwork, academic preparation, and study skills. Introduction to construction industry professionals. Teamwork topics include interdisciplinary teamwork, skills for academic success, diversity issues and leadership. Introduction to organization of program, department, college, and university. Overview of faculty, staff, policies, procedures and resources.

CON E 122: Cornerstone Learning Community: Orientation to Professional Life
(0-2) Cr. 1. S.
Continuation of Con E 121. Integration of first-year and transfer students into the engineering profession. Career preparation, professional ethics, construction research, leadership. Introduction to construction industry professionals including how they interact with engineers in other disciplines. Continued introduction to program, department, college, and university organization. Overview of faculty, staff, policies, procedures and resources.

CON E 222: Contractor Organization and Management of Construction
(2-2) Cr. 3. F.S.
Prereq: Completion of basic program
Entry level course for construction engineering: integration of significant engineering and management issues related to construction company operations. Company organization and operations; construction and project administration; construction contracts; delivery systems; construction safety; contract documents.

CON E 241: Construction Materials and Methods
(2-3) Cr. 3. F.S.
Prereq: CON E 222
Introduction to materials and methods of building construction and to construction drawings. Foundation, structural framing, floor, roof, and wall systems. Blueprint reading and quantity takeoff techniques.

CON E 251: Mechanical/Electrical Materials and Methods
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in CON E 241
Introduction to the materials and methods for mechanical and electrical construction systems and drawings. HVAC, water and waste water, power distribution, lighting, and fire protection. Blueprint reading and quantity takeoff.

CON E 322: Construction Equipment and Heavy Construction Methods
(2-2) Cr. 3. F.S.
Prereq: CON E 241 or C E 306
Selection and acquisition of construction equipment. Application of engineering fundamentals and economics to performance characteristics and production of equipment. Heavy construction methods and economic applications.

CON E 340: Concrete and Steel Construction
(2-2) Cr. 3. F.S.
Prereq: E M 324, credit or enrollment in CON E 322
Planning and field engineering for concrete and steel construction. Design and applications of concrete formwork to construction. Erection of structural steel. Emerging industry themes.

CON E 352: Mechanical Systems in Buildings
(2-2) Cr. 3. F.S.
Prereq: CON E 251, PHYS 222
Comprehensive coverage of mechanical systems, plumbing, fire protection. Analysis techniques and design principles for each system. Required comprehensive design project for a major building project.

CON E 353: Electrical Systems in Buildings
(2-2) Cr. 3. F.S.
Prereq: PHYS 222 and credit or enrollment in CON E 352
Comprehensive coverage of building electrical systems including power, lighting, fire alarm, security and communications. Analysis techniques and design principles for each system. Required comprehensive design project for a major building project.

CON E 354: Building Energy Performance
(3-0) Cr. arr. F.
Prereq: Junior Classification
Energy performance of buildings, building shells, HVAC, electrical and other building systems. Analysis and evaluation of building performance, energy efficiency, environmental quality, first costs, and operating costs. Strategies to exceed energy code requirements through the ASHRAE Standard 90.1.

CON E 380: Engineering Law
(3-0) Cr. 3. F.S.
Prereq: Junior classification
Introduction to law and judicial procedure as they relate to the practicing engineer. Contracts, professional liability, professional ethics, licensing, bidding procedures, intellectual property, products liability, risk analysis. Emphasis on development of critical thinking process, abstract problem analysis and evaluation.

CON E 381: Bidding Construction Projects I
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 381A: Bidding Construction Projects I: Heavy and Highway
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 381B: Bidding Construction Projects I: Building
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 381C: Bidding Construction Projects I: Mechanical
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 381D: Bidding Construction Projects I: Electrical
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 381E: Bidding Construction Projects I: Mechanical and Electrical
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 381F: Bidding Construction Projects I: Miscellaneous
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Team development of construction process designs and cost estimates for transportation construction projects under closely simulated conditions. Examine project sites, consult with construction industry mentors, obtain subcontractor and supplier quotations, and submit bids. Offered in the following specialities:.

CON E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

CON E 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

CON E 422: Construction Cost Estimating and Cost Engineering
(2-2) Cr. 3. F.S.
Prereq: CON E 241 and 251
Conceptual and detailed cost estimating. Theory and practice of estimating construction costs of materials, labor, equipment, contingency, overhead and markup. Estimating competencies and bid ethics. Electronic quantity take off and pricing methods. Assemblies costs, unit costs, production rates. Analysis of project profitability, cost analysis and cost control methods. Value engineering. Life cycle cost analysis.

CON E 441: Construction Planning, Scheduling, and Control
(2-2) Cr. 3. F.S.
Prereq: Credit or enrollment in CON E 421
Integration of previous construction coursework into the planning, scheduling, and management of time, costs, and other resources. Emphasis on preparation and analysis of network schedules. Comprehensive planning and scheduling project. Computer project management applications.

CON E 481: Bidding Construction Projects II
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 481A: Bidding Construction Projects II: Heavy and Highway
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 481B: Bidding Construction Projects II: Building
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 481C: Bidding Construction Projects II: Mechanical
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 481D: Bidding Construction Projects II: Electrical
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 481E: Bidding Construction Projects II: Mechanical and Electrical
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 481F: Bidding Construction Projects II: Miscellaneous
(0-3) Cr. 1. F.
Prereq: Permission from the instructor
Similar to Con E 381, except students with previous experience attempt projects with larger scope or lead students with less experience.

CON E 487: Construction Engineering Design I
(2-2) Cr. 3. F.S.
Prereq: CON E 380 or ACCT 215, CON E 340 (B, H), CON E 352 (B, E, M), CON E 353 (B, E, M), CON E 421, CON E 441. Student must be within two semesters of graduation
The integrated delivery of project services as a team, including preliminary engineering design process, constructability review, interaction with the client, identification of engineering problems, developments of a proposal, identification of design criteria, cost estimating, planning and scheduling, application of codes and standards, development of feasible alternatives, selection of best alternative, and delivery of oral presentations.

CON E 488: Construction Engineering Design II
(1-5) Cr. 3. F.S.
Prereq: CON E 380 or ACCT 215. Coreq: CON E 487
Application of team design concepts to a construction engineering project. Project planning. Advanced construction and project management.

CON E 490: Independent Study
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor
Individual study in any phase of construction engineering. Pre-enrollment contract required.

Cyber Security Minor

The minor is intended for students studying computer engineering, computer science, software engineering, or management information systems with the goal of enabling them to work in cyber security. The minor consists of a series of lab based courses that are designed to provide students with both the technical background and the hands-on experiences along with the theoretical background to allow them to compete to jobs in cyber security.

The minor requires 15 credits and at least 9 credits can not be used to meet any other department, college, or university requirement. Below is the list of courses used in the minor.

Core		9
CPR E 231	Cyber Security Concepts and Tools	
CPR E 431	Basics of Information System Security	
Plus one of the following (3-4 cr.):		
CPR E 308	Operating Systems: Principles and Practice	
COM S 252	Linux Operating System Essentials	
COM S 352	Introduction to Operating Systems	
Capstone		3
CPR E 332	Cyber Defense Competition (Take 3 times)	
Electives-one of the following:		3
CPR E 419	Software Tools for Large Scale Data Analysis	
CPR E 430	Network Protocols and Security	
Total Credits		15

Objectives

The minor in cyber security is designed to prepare students with the technical skills for entry into cybersecurity positions in industry or government agencies.

A few years after graduation, students completing the cyber security minor should be:

1. Contributing to their communities and society in the area of cyber security technology and applications and demonstrate an understanding of contemporary security issues, both technological and societal.
2. Advancing in their careers through application of their knowledge of cyber security
3. Working effectively as team members and demonstrating ethics and responsible behavior
4. Applying cyber security methods and concepts to the general area of their BS degree
5. Continuing their professional development through life-long learning

Learning Outcomes

After earning the minor in cyber security students will

1. demonstrate the ability to apply knowledge of cyber security concepts, tools and technologies to computer systems.
2. understand cyber security risks, threats and countermeasures and apply this understanding to develop cyber defense strategies.
3. demonstrate the ability to design cyber security systems to meet organizational needs within realistic constraints such as economic, environmental, social, and ethical expectations.
4. demonstrate the ability to function on teams.

Electrical Engineering

For the undergraduate curriculum in electrical engineering leading to the degree Bachelor of Science. This curriculum is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org.

The Department of Electrical and Computer Engineering (ECpE) at Iowa State University provides undergraduate students with the opportunity to learn electrical and computer engineering fundamentals, study applications of the most recent advances in state-of-the-art technologies, and prepare for the practice of electrical engineering. The student-faculty interaction necessary to realize this opportunity occurs within

an environment that is motivated by the principle that excellence in undergraduate education is enhanced by an integrated commitment to successful, long-term research and outreach programs.

The electrical engineering curriculum offers a number of emphasis areas at the undergraduate level, including control systems, electromagnetics and nondestructive evaluation, microelectronics and photonics, VLSI, electric power and energy systems, and communications and signal processing. Students are required to choose at least one course sequence that focuses on one of these areas; therefore graduates have substantial depth in specific areas to complement the breadth obtained in the required curriculum. Students also may take elective courses in computer networking, security, computer architecture, digital systems, and software.

The program objectives for the electrical engineering program describe accomplishments that graduates are expected to attain within five years after graduation. Graduates will have applied their expertise to contemporary problem solving, be engaged professionally, have continued to learn and adapt, and have contributed to their organizations through leadership and teamwork. More specifically, the objectives for expertise, engagement, learning, leadership and teamwork are defined below for each program.

The objectives of the electrical engineering program at ISU are:

- Graduates, within five years of graduation, should demonstrate peer-recognized **expertise** together with the ability to articulate that expertise and use it for contemporary problem solving in the analysis, design, and evaluation of electrical and electronic devices and systems.
- Graduates, within five years of graduation, should demonstrate **engagement** in the engineering profession, locally and globally, by contributing to the ethical, competent, and creative practice of engineering or other professional careers.
- Graduates, within five years of graduation, should demonstrate sustained **learning** and adapting to a constantly changing field through graduate work, professional development, and self study.
- Graduates, within five years of graduation, should demonstrate **leadership** and initiative to ethically advance professional and organizational goals, facilitate the achievements of others, and obtain substantive results.
- Graduates, within five years of graduation, should demonstrate a commitment to **teamwork** while working with others of diverse cultural and interdisciplinary backgrounds.

As a complement to the instructional activity, the ECpE department provides opportunities for each student to have experience with broadening activities. Through the cooperative education and internship program, students have the opportunity to gain practical industry experience.

Students have the opportunity to participate in advanced research activities, and through international exchange programs, students learn about engineering practices in other parts of the world. Well-qualified juniors and seniors in electrical engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science and Master of Science, the Bachelor of Science and Master of Business Administration, or the Bachelor of Science and Master of Engineering degrees.

Students are required to prepare and to maintain a portfolio of their technical and non-technical skills. This portfolio is evaluated for student preparation during the student's curriculum planning process. Results of the evaluation are used to advise students of core strengths and weaknesses.

Courses for students who are not in the electrical engineering program: E E 442 Introduction to Circuits and Instruments, E E 448 Introduction to AC Circuits and Motors. Credit in these courses may not be counted toward a degree in either electrical engineering or computer engineering.

Curriculum in Electrical Engineering

Administered by the Department of Electrical and Computer Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 128. Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.
Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements.
International Perspectives: 3 cr. [1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirement:

ENGL 150	Critical Thinking and Communication (C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
LIB 160	Information Literacy	1
One of the following:		3
ENGL 314	Technical Communication (C or better in this course)	
ENGL 309	Proposal and Report Writing (C or better in this course)	

General Education Electives: 15 cr. [3]

Complete minimum of 6 cr. from Approved General Education Component at 300 or higher level. Complete additional 9 cr. from Approved General Education Component.

Basic Program: 27 cr.
A minimum GPA of 2.00 required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 167	General Chemistry for Engineering Students	4
or CHEM 177	General Chemistry I	
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGR 101	Engineering Orientation	R
E E 185	Introduction to Electrical Engineering and Problem-Solving I [2]	3
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Math and Physical Science: 16 cr.

MATH 265	Calculus III	4
MATH 267	Elementary Differential Equations and Laplace Transforms	4
MATH 207	Matrices and Linear Algebra	3
PHYS 222	Introduction to Classical Physics II	5
Total Credits		16

Electrical Engineering Core: 41 cr.
(A minimum GPA of 2.00 required for this set of courses, including any transfer courses; please note that transfer course grades will not be calculated into the Core GPA).

E E 285	Problem Solving Methods and Tools for Electrical Engineering	4
CPR E 281	Digital Logic	4
CPR E 288	Embedded Systems I: Introduction	4
E E 201	Electric Circuits	4
E E 230	Electronic Circuits and Systems	4
E E 224	Signals and Systems I	4
E E 303	Energy Systems and Power Electronics	3
E E 311	Electromagnetic Fields and Waves	4
E E 322	Probabilistic Methods for Electrical Engineers	3
Core Elective: one of the following:		7
E E 321	Communication Systems I	
E E 324	Signals and Systems II	
Core Elective: one of the following:		
E E 330	Integrated Electronics	
E E 332	Semiconductor Materials and Devices	
Total Credits		41

Note: E E 321 and E E 332 are 3-credit courses, whereas E E 324 and E E 330 are 4-credit courses. The core credit requirement (41 credits) assumes 7 credits taken for these options. Any core credit surplus or deficiency can be used as credits for E E technical electives.

Other Remaining Courses: 29 cr.

E E 491	Senior Design Project I and Professionalism	3
E E 492	Senior Design Project II	2
I E 305	Engineering Economic Analysis	3
One of the following:		3
ENGL 309	Proposal and Report Writing (C or better in this course)	
ENGL 314	Technical Communication (C or better in this course)	
E E/Cpr E Technical Electives including one approved sequence [3]		12
Elective from Math, E E, Cpr E and/or non-E E/Cpr E [3]		6
Total Credits		29

Seminar/Co-op/Internships:

E E 166	Professional Programs Orientation	R
E E 294	Program Discovery	R
E E 394	Program Exploration	R
E E 494	Portfolio Assessment	R

Co-op or internship is optional

Outcomes Assessment - Students are required to prepare and to maintain a portfolio of their technical and non-technical skills. This portfolio is evaluated for student preparation during the student's curriculum planning process. Results of the evaluation are used to advise students of core strengths and weaknesses.

Transfer Credit Requirements

The degree program must include a minimum of 30 credits at the 300-level or above in professional and technical courses earned at ISU in order to receive a B.S. in electrical engineering. These 30 credits must include E E 491 Senior Design Project I and Professionalism, E E 492 Senior Design Project II, and credits in the core professional curriculum and/or in technical electives. The Electrical and Computer Engineering Department requires a grade of C or better for any transfer credit course that is applied to the degree program.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree

program. U.S. diversity and international perspectives courses may not be taken Pass/Not Pass.

2. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.
3. From department approved lists (http://www.ece.iastate.edu/academics/bachelors-degree-requirements).

See also: A 4-year plan of study grid showing course template by semester.

Note: International perspectives and U.S. diversity courses are used to meet the general education electives.

Electrical Engineering, B.S.

First Year

Fall	Credits	Spring	Credits
ENGR 101	0	MATH 166	4
E E 185	3	PHYS 221	5
MATH 165	4	E E 285	4
CHEM 167	4	E E 166	0
ENGL 150	3	General Education Elective	3
LIB 160	1		
	15		16

Second Year

Fall	Credits	Spring	Credits
E E 201	4	CPR E 281	4
PHYS 222	5	E E 230	4
E E 294	0	E E 224	4
MATH 267	4	MATH 265	4
ENGL 250	3		
	16		16

Third Year

Fall	Credits	Spring	Credits
CPR E 288	4	EE 330 or EE 332	3-4
E E 303	3	EE 321 or EE 324	3-4
E E 311	4	E E 322	3
MATH 207	3	ENGL 314	3
E E 394	0	General Education Elective	3
General Education Elective	3		
	17		15-17

Fourth Year

Fall	Credits	Spring	Credits
E E 491	3	E E 492	2
E E 494	0	Technical Electives	9
I E 305	3	General Education Electives	6
Technical Electives	9		
	15		17

Actual Total Credits: 128

Graduate Study

The department offers work for the degrees Master of Engineering, Master of Science, and Doctor of Philosophy with a major in electrical engineering and minor work to students with other majors. Minor work for electrical engineering majors is usually selected from a wide range of courses outside electrical engineering.

Master of Engineering degree is coursework only. It is recommended for off-campus students.

The degree Master of Science with thesis is recommended for students who intend to continue toward the Doctor of Philosophy degree or to undertake a career in research and development. The non-thesis Master of Science degree requires a creative component.

The department also offers a graduate certificate program in power systems engineering.

The normal prerequisite to major in graduate work in electrical engineering is the completion of undergraduate work substantially equivalent to that required of electrical engineering students at this university. Because of the diversification in the electrical engineering graduate program, however, it is possible for a student to qualify for graduate study in certain areas of electrical engineering even though the student's undergraduate or prior graduate training has been in a discipline other than electrical engineering. Supporting work, if required, will depend on the student's background and area of research interest. Prospective students from a discipline other than electrical engineering are required to submit, with the application for admission, a statement of the proposed area of graduate study.

The department requires submission of GRE General test scores by applicants. All students whose first language is not English and who have no U.S. degree must submit TOEFL examination scores. Students pursuing the Doctor of Philosophy must complete the department qualifying process.

The Department of Electrical and Computer Engineering is a participating department in the interdepartmental graduate minor in complex adaptive systems. Students interested in this program should see the Complex Adaptive Systems section of the catalog for requirements.

The Department of Electrical and Computer Engineering is a participating department in the interdepartmental Master of Science and Doctor

of Philosophy degree programs in bioinformatics and computational biology. Students interested in these programs may earn their degrees while working under an adviser in electrical and computer engineering.

Well-qualified juniors or seniors in electrical engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science and Master of Science degrees, the Bachelor of Science and Master of Business Administration, or the Bachelor of Science and Master of Engineering degrees. Under concurrent enrollment, students are eligible for assistantships and simultaneously take undergraduate and graduate courses. Details are available in the Student Services Office and on the department's website.

Courses primarily for undergraduates:

E E 166: Professional Programs Orientation
(Cross-listed with CPR E). Cr. R. F.S.
(1-0) Overview of the nature and scope of electrical engineering and computer engineering professions. Overview of portfolios. Departmental rules, advising center operations, degree requirements, program of study planning, career options, and student organizations.

E E 185: Introduction to Electrical Engineering and Problem-Solving I
(2-2) Cr. 3. F.S.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Project based examples from electrical engineering. Systematic thinking process for engineering problem solving. Group problem solving. Mathematical, conceptual and computer based projects. Solving engineering problems and presenting solutions through technical reports and oral presentations. Solutions of engineering problems using computation tools and basic programming.

E E 186: Introduction to Electrical Engineering and Problem Solving II
(0-2) Cr. 1. S.
Prereq: E E 185
Project based and hands on continuation of 185. Group skills needed to work effectively in teams. Individual interactive skills for small and large groups. Learning to use tools and methods for solving electrical engineering problems.

E E 188: Bio-Electrical Engineering Fundamentals Laboratory
(1-3) Cr. 2.
Prereq: E E 185 or equivalent
Fundamental laboratory based course in bio-electrical engineering with an emphasis on acquiring and analyzing biomedical signals to obtain relevant information. Topics covered include an overview of basic medical terminology and anatomy, labs illustrating data acquisition from different body systems, and an introduction to statistical significance and its relationship to biological variability.

E E 201: Electric Circuits
(3-3) Cr. 4. F.S.
Prereq: Credit or enrollment in MATH 267 and PHYS 222
Emphasis on mathematical tools. Circuit elements (resistors, inductors, capacitors) and analysis methods including power and energy relationships. Network theorems. DC, sinusoidal steady-state, and transient analysis. AC power. Frequency response. Two port models. Diodes, PSPICE. Laboratory instrumentation and experimentation. Credit for only E E 201 or 442 may be used towards graduation.

E E 224: Signals and Systems I
(3-3) Cr. 4. F.S.
Prereq: E E 201, MATH 267, PHYS 222
Mathematical preliminaries. Introduction to signals and systems. Signal manipulations. System properties. LTI systems, impulse response and convolution. Fourier Series representation and properties. Continuous and discrete-time Fourier Transforms and properties. Sampling and reconstruction. Modulation and demodulation. Applications and demonstrations using Matlab.

E E 230: Electronic Circuits and Systems
(3-3) Cr. 4. F.S.
Prereq: E E 201, MATH 267, PHYS 222
Frequency domain characterization of electronic circuits and systems, transfer functions, sinusoidal steady state response. Time domain models of linear and nonlinear electronic circuits, linearization, small signal analysis. Stability and feedback circuits. Operational amplifiers, device models, linear and nonlinear applications, transfer function realizations. A/D and D/A converters, sources of distortions, converter linearity and spectral characterization, applications. Design and laboratory instrumentation and measurements.

E E 261: Transfer Orientation
(Cross-listed with CPR E). Cr. R.
Introduction to the College of Engineering and the engineering profession specifically for transfer students. Information concerning university and college policies, procedures, and resources. Offered on a satisfactory-fail basis only.

E E 285: Problem Solving Methods and Tools for Electrical Engineering
(3-3) Cr. 4.
Integration of field-specific computational tools for practically solving electrical engineering problems. Methods for systematically reducing problems into sequential steps compatible with computer based tools. Structuring computer programs for efficiency and maintainability. Integration of multi-platform operating systems and multi-vendor tools for solving engineering problems. Hands-on laboratory experiences using Matlab, C, and other computational tools.

E E 294: Program Discovery
(Cross-listed with CPR E). Cr. R.
Prereq: CPR E 166 or E E 166
The roles of professionals in computer and electrical engineering. Relationship of coursework to industry and academic careers. Issues relevant to today's world. Offered on a satisfactory-fail basis only.

E E 303: Energy Systems and Power Electronics
(3-0) Cr. 3. F.S.
Prereq: MATH 267, PHYS 222; credit or enrollment in E E 224 and E E 230
Structure of competitive electric energy systems. System operation and economic optimization. Mutual inductance, transformers. Synchronous generators. Balanced three-phase circuit analysis and power calculations. Network calculations and associated numerical algorithms. Two-port circuits. Voltage regulation. Resonance and power factor correction. DC and induction motors. Power electronic circuit applications to power supplies and motor drives.

E E 311: Electromagnetic Fields and Waves
(4-0) Cr. 4. F.S.
Prereq: E E 201, MATH 265, PHYS 222, credit or enrollment in MATH 267
Fundamentals and applications of electric and magnetic fields and materials. Electrostatics and magentostatics, potentials, capacitance and inductance, energy, force, torque. Uniform plane electromagnetic waves, Poynting vector. Transmission lines: transient and sinusoidal steady-state conditions, reflection coefficient.

E E 314: Electromagnetics for non Electrical Engineers
(3-0) Cr. 3.
Prereq: PHYS 222, PHYS 112, or equivalent
Conceptual study of electomagnetism and its application in engineering and related fields. EM fundamentals, EM spectrum, radiation, radiating systems, wireless, modern concepts of physics, quantum computing, transmission lines, high speed effects, waveguides, GPS and other related phenomena will be discussed and explained with the application in mind.

E E 321: Communication Systems I
(3-0) Cr. 3. F.
Prereq: E E 224
Frequency domain analysis, spectral filtering, bandwidth. Linear modulation systems. Angle modulation systems. Phase locked loop, super-heterodyne receiver. Sampling and pulse code modulation. Digital data transmission, line coding, pulse shaping, multiplexing.

E E 322: Probabilistic Methods for Electrical Engineers
(Cross-listed with STAT). (3-0) Cr. 3. F.S.
Prereq: E E 224
Introduction to probability with applications to electrical engineers. Sets and events, probability space, conditional probability, total probability and Bayes' rule. Discrete and continuous random variables, cumulative distribution function, probability mass and density functions, expectation, moments, moment generating function, multiple random variables, functions of random variables. Elements of statistics, hypothesis testing, confidence intervals, least squares. Introduction to random processes.

E E 324: Signals and Systems II
(3-3) Cr. 4. F.S.
Prereq: E E 224
Laplace and z-Transforms, properties and inverses. Applications to LTI systems and analog/digital filters. Feedback systems and stability. State-space representation and analysis.

E E 330: Integrated Electronics
(Cross-listed with CPR E). (3-3) Cr. 4.
Prereq: E E 201, credit or enrollment in E E 230, CPR E 281
Semiconductor technology for integrated circuits. Modeling of integrated devices including diodes, BJTs, and MOSFETs. Physical layout. Circuit simulation. Digital building blocks and digital circuit synthesis. Analysis and design of analog building blocks. Laboratory exercises and design projects with CAD tools and standard cells.

E E 332: Semiconductor Materials and Devices
(Cross-listed with MAT E). (3-0) Cr. 3. S.
Prereq: PHYS 222; MAT E majors: MAT E 317; CPR E and E E majors: E E 230
Introduction to semiconductor material and device physics. Quantum mechanics and band theory of semiconductors. Charge carrier distributions, generation/recombination, transport properties. Physical and electrical properties and fabrication of semiconductor devices such as MOSFETs, bipolar transistors, laser diodes and LED's.

E E 333: Electronic Systems Design
(3-3) Cr. 4. F.
Prereq: E E 230, credit or enrollment in CPR E 288
Further topics in electronic systems design: Use of sensors and actuators. High-power amplifying and switching components. Linear and switched-mode power supplies. Linear and switched-mode amplifiers. Interfacing electronic components with programmable microcontrollers. Printed circuit board technology and design tools. Laboratory exercises and design projects incorporating printed circuit technology.

E E 336: Biomedical Instrumentation
(2-2) Cr. 3.
Prereq: E E 188, E E 224, E E 230
Principles and practices of biomedical instrumentation. Topics include: the physics and measurement of biopotentials including electrocardiography (EKG), electromyohgraphy (EMG) and electro-occulography (EOG), mechanical and chemical sensors, amplifiers and filters, recording and processing biological signals from nerve cells, muscles and human body, electrode polarization, surface electrodes, power line interference, heart sound sensors, respiratory gas concentration, blood-gas sensors, noninvasive blood-gas sensors.

E E 351: Analysis of Energy Systems
(3-0) Cr. 3.
Prereq: PHYS 222
Energy-scientific, engineering and economic foundations. Energy utilization-global and national. Sectoral analysis of energy consumption. Relationship of energy consumption and production to economic growth and environment. Technology for energy production. Economic evaluation of energy utilization and production. Scientific basis for global warming. Environmental impact of energy production and utilization. Renewable energy.
Meets International Perspectives Requirement.

E E 388: Sustainable Engineering and International Development
(Cross-listed with A B E, C E). (2-2) Cr. 3. F.
Prereq: Junior classification in engineering
Multi-disciplinary approach to sustainable engineering and international development, sustainable development, appropriate design and engineering, feasibility analysis, international aid, business development, philosophy and politics of technology, and ethics in engineering. Engineering-based projects from problem formulation through implementation. Interactions with partner community organizations or international partners such as nongovernment organizations (NGOs). Course readings, final project/design report.
Meets International Perspectives Requirement.

E E 391: Open Laboratory and Design Studio
(2-2) Cr. 2.
Prereq: E E 224
Studio-based activity (guided problem-based learning and design) focusing on elements of design, measurement, data capture, and data interpretation. Team building, engineering professionalism, engineering process of review and critique, and presentation. Open design activities that may include working with other studios.

E E 394: Program Exploration
(Cross-listed with CPR E). Cr. R.
Prereq: CPR E 294 or E E 294
Exploration of academic and career fields for electrical and computer engineers. Examination of professionalism in the context of engineering and technology with competencies based skills. Introduction to professional portfolio development and construction. Offered on a satisfactory-fail basis only.

E E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

E E 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

E E 414: Microwave Engineering
(Dual-listed with E E 514). (3-3) Cr. 4. F.
Prereq: E E 230, E E 311
Principles, analyses, and instrumentation used in the microwave portion of the electromagnetic spectrum. Wave theory in relation to circuit parameters. S parameters, couplers, discontinuities, and microwave device equivalent circuits. RF amplifier design, microwave sources, optimum noise figure and maximum power designs. Microwave filters and oscillators.

E E 417: Electromagnetic Radiation, Antennas, and Propagation
(Dual-listed with E E 517). (3-3) Cr. 4. S.
Prereq: E E 311
Fundamental antenna concepts. Radiation from wire-and aperture-type sources. Radio transmission formulas. Wave and antenna polarization. Antenna arrays. Modern antenna topics. Practical antenna design. Antenna noise. Radiowave propagation in the presence of the earth and its atmosphere. Antenna measurements and computer aided analysis.

E E 418: High Speed System Engineering Measurement and Testing
(Cross-listed with CPR E). (3-2) Cr. 4. F.
Prereq: E E 230 and E E 311
Measurement of high speed systems and mixed signal systems. Measurement accuracy and error. Network analysis and spectrum analysis used in high speed measurement and testing. Test specification process and parametric measurement. Sampling and digital signal processing concepts. Design for testability. Testing equipment. Applications.

E E 422: Communication Systems II
(3-0) Cr. 3.
Prereq: E E 321 and enrollment in E E 423
Introduction to probability and random processes; Performance of analog systems with noise; Performance of digital communication with noise; optimum receivers, transmission impairments, and error rates; Introduction to information theory and coding: source coding, channel coding, channel capacity.

E E 423: Communication Systems Laboratory
(0-3) Cr. 1.
Prereq: E E 321, enrollment in E E 422
Construction and evaluation of modulators, demodulators and other components for analog and digital communications. Design, simulate,and evaluate wireless communication systems and their key components. Noise measurement.

E E 424: Introduction to Digital Signal Processing
(3-3) Cr. 4.
Prereq: E E 224
Sampling and reconstruction. Concepts and mathematical tools in discrete-time signal processing with examples from digital signal processing and communications. Discrete-time correlation and matched-filter receivers. Discrete Fourier transform (DFT). Fast Fourier algorithms. Z transforms. Design of finite impulse response (FIR) and infinite impulse response (IIR) filters. Realizations of discrete-time systems and quantization effects. Multi-rate signal processing. Laboratory experiments illustrating DSP implementations and applications.

E E 432: Microelectronics Fabrication Techniques
(Dual-listed with E E 532). (Cross-listed with MAT E). (2-4) Cr. 4.
Prereq: credit or enrollment in E E 332
Techniques used in modern integrated circuit fabrication, including diffusion, oxidation, ion implantation, lithography, evaporation, sputtering, chemical-vapor deposition, and etching. Process integration. Process evaluation and final device testing. Extensive laboratory exercises utilizing fabrication methods to build electronic devices. Use of computer simulation tools for predicting processing outcomes. Recent advances in processing CMOS ICs and micro-electro-mechanical systems (MEMS).

E E 435: Analog VLSI Circuit Design
(Cross-listed with CPR E). (3-3) Cr. 4. S.
Prereq: E E 324, E E 330, E E 332, and either E E 322 or STAT 330
Basic analog integrated circuit and system design including design space exploration, performance enhancement strategies, operational amplifiers, references, integrated filters, and data converters.

E E 438: Optoelectronic Devices and Applications
(Dual-listed with E E 538). (3-0) Cr. 3.
Prereq: E E 311, E E 332
Transmission and reflection of electromagnetic plane waves. Propagation in dielectric and fiber optic waveguides. LED and laser operating principles and applications. Photodetectors and solar cells. Optical modulation and switching.

E E 439: Nanoelectronics
(3-0) Cr. 3. S.
Prereq: E E 332 or MAT E 334
Concepts of quantum mechanics relevant to nanoelectronic devices, including quantization, tunneling, and transport; overview of some of the leading technologies for nanoelectronics, including carbon nanotubes, quantum dots, and molecular transistors; fabrication methods for building nanoelectronic devices.

E E 442: Introduction to Circuits and Instruments
(3-2) Cr. 2. F.S.
Prereq: PHYS 222, MATH 267
Half-semester course. Basic circuit analysis using network theorems with time domain and Laplace transform techniques for resistive, resistive-inductive, resistive-capacitive, and resistive- inductive-capacitive circuits. Transient circuit behavior. Basic operational amplifiers and applications. Familiarization with common E E instrumentation and demonstration of basic principles. Credit for only 201 or 442 may be counted toward graduation; credit for 442 will not count toward graduation for E E or Cpr E majors.

E E 448: Introduction to AC Circuits and Motors
(3-2) Cr. 2. F.S.
Prereq: E E 442
Half-semester course. Basics of DC machines, stepper motors, AC induction motors, and synchronous generators. AC steady state analysis, transformers, and three-phase circuit analysis.

E E 450: Biosensing
(Cross-listed with B M E). (3-0) Cr. 3.
Prereq: B M E 220
Overview of biosensors and bioanalytical challenges; designing for performance including various analytical problems, ion-selective membranes, characteristics of enzymes and basics of bioaffinity sensing; fundamentals of bioselective layers including depositing films and membranes, surfaces for immobilization and bioselective agents; survey of different biosensing technologies including electroanalytical, biomembrane, optical, and acoustic-wave based sensors.

E E 450L: Biosensing Laboratory
(Cross-listed with B M E). (0-3) Cr. 1.
Prereq: B M E 220, concurrent enrollment in B M E 450
Laboratory course accompanying B M E 450. Design, fabrication, and characterization of various electrical, chemical, polymer, optical and acoustic sensors.

E E 451: Engineering Acoustics
(Cross-listed with E M, M E). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: PHYS 221 and MATH 266 or MATH 267
Properties of sounds waves and noise metrics (pressure, power levels, etc). Sound sources and propagation. Principles of wave propagation in one-, two-, and three-dimensions. Wave reflection and transmission. Wave propagation in rectangular, cylindrical, and annular ducts. Acoustics fields for model noise sources. Introduction to aerodynamic noise sources in aircraft, aircraft engines, and wind turbines. Selected laboratory experiments.

E E 452: Electrical Machines and Power Electronic Drives
(2-3) Cr. 3. S.
Prereq: E E 303, E E 324
Basic concepts of electromagnetic energy conversion. DC motors and three-phase induction motors. Basic introduction to power electronics. Adjustable speed drives used for control of DC, induction, and AC motors. Experiments with converter topologies, DC motors, AC motors and adjustable speed drives.

E E 455: Introduction to Energy Distribution Systems
(3-0) Cr. 3. F.
Prereq: E E 303, credit or registration in E E 324
Overhead and underground distribution system descriptions and characteristics, load descriptions and characteristics, overhead line and underground cable models, distribution transformers, power flow and fault analysis, overcurrent protection, power factor correction, system planning and automation, and economics in a deregulated environment.

E E 456: Power System Analysis I
(3-0) Cr. 3. F.
Prereq: E E 303, credit or registration in E E 324
Power transmission lines and transformers, synchronous machine modeling, network analysis, power system representation, load flow.

E E 457: Power System Analysis II
(3-0) Cr. 3. S.
Prereq: E E 303, credit or registration in E E 324
Power system protection, symmetrical components, faults, stability. Power system operations including the new utility environment.

E E 458: Economic Systems for Electric Power Planning
(Cross-listed with ECON). (3-0) Cr. 3.
Prereq: E E 303 or ECON 301
Evolution of electric power industry. Power system operation and planning and related information systems. Linear and integer optimization methods. Short-term electricity markets and locational marginal prices. Risk management and financial derivatives. Basics of public good economics. Cost recovery models including tax treatment for transmission investments.

E E 459: Electromechanical Wind Energy Conversion and Grid Integration
(Dual-listed with E E 559). (3-0) Cr. 3.
Prereq: Credit or enrollment in E E 452, E E 456
Summary of industry status and expected growth; power extraction from the air stream; operation and modeling of electric machines, and power electronics topologies for wind energy conversion; analysis of machine-grid power electronic circuits, controller interface, and collector (distribution) networks; treatment of harmonics, flicker, over/under-voltages, filters, low-voltage ride-through, and reactive compensation; relaying; effects on transmission expansion, planning and grid operation and coordination including variability, frequency control, reserves, and electricity markets; overview of storage technologies and hybrid configurations.

E E 465: Digital VLSI Design
(Cross-listed with CPR E). (3-3) Cr. 4. S.
Prereq: E E 330
Digital design of integrated circuits employing very large scale integration (VLSI) methodologies. Technology considerations in design. High level hardware design languages, CMOS logic design styles, area-energy-delay design space characterization, datapath blocks: arithmetic and memory, architectures and systems on a chip (SOC) considerations. VLSI chip hardware design project.

E E 466: Multidisciplinary Engineering Design

(Cross-listed with A B E, AER E, B M E, CPR E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.

Prereq: Student must be within two semesters of graduation; permission of instructor.

Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

E E 467: Multidisciplinary Engineering Design II

(Cross-listed with AER E, CPR E, ENGR, I E, M E, MAT E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.

Prereq: Student must be within two semesters of graduation or receive permission of instructor.

Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

E E 475: Automatic Control Systems

(3-0) Cr. 3. F.

Prereq: E E 324

Stability and performance analysis of automatic control systems. The state space, root locus, and frequency response methods for control systems design. PID control and lead-lag compensation. Computer tools for control system analysis and design.

E E 476: Control System Simulation

(2-3) Cr. 3. S.

Prereq: E E 475

Computer aided techniques for feedback control system design, simulation, and implementation.

E E 488: Eddy Current Nondestructive Evaluation

(Dual-listed with E E 588). (Cross-listed with MAT E). (3-0) Cr. 3. Alt. F., offered odd-numbered years.

Prereq: MATH 265 and (MAT E 216 or MAT E 273 or E E 311 or PHYS 364)

Electromagnetic fields of various eddy current probes. Probe field interaction with conductors, cracks and other material defects. Ferromagnetic materials. Layered conductors. Elementary inversion of probe signals to characterize defects. Special techniques including remote-field, transient, potential drop nondestructive evaluation and the use of Hall sensors. Practical assignments using a 'virtual' eddy current instrument will demonstrate key concepts.

E E 489: Survey of Remote Sensing Technologies

(Dual-listed with E E 589). (Cross-listed with GEOL, MTEOR, NREM). (3-0) Cr. 3. F.

Prereq: Four courses in physical or biological sciences or engineering

Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

E E 489L: Satellite Remote Sensing Laboratory

(Dual-listed with E E 589L). (Cross-listed with GEOL, MTEOR, NREM). (0-3) Cr. 1. S.

Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589

Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

E E 490: Independent Study

Cr. arr. Repeatable.

Prereq: Senior classification in electrical engineering

Investigation of an approved topic commensurate with the student's prerequisites.

E E 490H: Independent Study: Honors

Cr. arr.

Prereq: Senior classification in electrical engineering

Investigation of an approved topic commensurate with the student's prerequisites.

E E 491: Senior Design Project I and Professionalism

(Cross-listed with CPR E). (2-3) Cr. 3. F.S.

Prereq: E E 322 or CPR E 308, completion of 24 credits in the E E core professional program or 29 credits in the Cpr E core professional program, ENGL 314

Preparing for entry to the workplace. Selected professional topics. Use of technical writing skills in developing project plan and design report; design review presentation. First of two-semester team-oriented, project design and implementation experience.

E E 492: Senior Design Project II
(Cross-listed with CPR E). (1-3) Cr. 2. F.S.
Prereq: CPR E 491 or E E 491
Second semester of a team design project experience. Emphasis on the successful implementation and demonstration of the design completed in E E 491 or Cpr E 491 and the evaluation of project results. Technical writing of final project report; oral presentation of project achievements; project poster.

E E 494: Portfolio Assessment
(Cross-listed with CPR E). Cr. R.
Prereq: CPR E 394 or E E 394, credit or enrollment in CPR E 491 or E E 491
Portfolio update and evaluation. Portfolios as a tool to enhance career opportunities.

E E 496: Modern Optics
(Cross-listed with PHYS). (3-0) Cr. 3. S.
Prereq: Credit or enrollment in PHYS 322, PHYS 365, and PHYS 480
Review of wave and electromagnetic theory; topics selected from: reflection/refraction, interference, geometrical optics, Fourier analysis, dispersion, coherence, Fraunhofer and Fresnel diffraction, holography, quantum optics, nonlinear optics.

Courses primarily for graduate students, open to qualified undergraduates:

E E 501: Analog and Mixed-Signal VLSI Circuit Design Techniques
(Cross-listed with CPR E). (3-3) Cr. 4. F.
Prereq: E E 435
Design techniques for analog and mixed-signal VLSI circuits. Amplifiers; operational amplifiers, transconductance amplifiers, finite gain amplifiers and current amplifiers. Linear building blocks; differential amplifiers, current mirrors, references, cascading and buffering. Performance characterization of linear integrated circuits; offset, noise, sensitivity and stability. Layout considerations, simulation, yield and modeling for high-performance linear integrated circuits.

E E 504: Power Management for VLSI Systems
(Cross-listed with CPR E). (3-3) Cr. 4.
Prereq: E E 435, Credit or Registration for E E 501
Theory, design and applications of power management and regulation circuits (Linear and switching regulators, battery chargers, and reference circuits) including: Architectures, Performance metrics and characterization, Noise and stability analysis, Practical implementation and on-chip integration issues, design considerations for portable, wireless, and RF SoCs.

E E 505: CMOS and BiCMOS Data Conversion Circuits
(Cross-listed with CPR E). (3-3) Cr. 4. Alt. S., offered even-numbered years.
Prereq: E E 501
Theory, design and applications of data conversion circuits (A/D and D/A converters) including: architectures, characterization, quantization effects, conversion algorithms, spectral performance, element matching, design for yield, and practical comparators, implementation issues.

E E 506: Design of CMOS Phase-Locked Loops
(Cross-listed with CPR E). (3-3) Cr. 4.
Prereq: E E 435 or E E 501 or instructor approval
Analysis and design of phase-locked loops implemented in modern CMOS processes including: architectures, performance metrics, and characterization; noise and stability analysis; and design issues of phase-frequency detectors, charge pumps, loop filters (passive and active), voltage controlled oscillators, and frequency dividers.

E E 507: VLSI Communication Circuits
(Cross-listed with CPR E). (3-3) Cr. 4. Alt. S., offered odd-numbered years.
Prereq: E E 435 or E E 501
Phase-locked loops, frequency synthesizers, clock and data recovery circuits, theory and implementation of adaptive filters, low-noise amplifiers, mixers, power amplifiers, transmitter and receiver architectures.

E E 508: Filter Design and Applications
(3-3) Cr. 4.
Prereq: E E 501
Filter design concepts. Approximation and synthesis. Transformations. Continuous-time and discrete time filters. Discrete, active and integrated synthesis techniques.

E E 509: Mixed-Signal IC Testing and Built In Self Test
(3-0) Cr. 3.
Prereq: E E 424 or equivalent and E E 435 or E E 501
Introduction to mixed-signal IC testing; measurement uncertainty and test validity; IEEE standard test algorithms; high performance test and built-in self test challenges; new mixed-signal test algorithms and techniques to reduce data acquisition to relax instrumentation requirements, to simplify test setup, to improve test validity, and/or to enable co-testing of heterogeneous functions.

E E 510: Topics in Electromagnetics
Cr. 1-3. Repeatable.
Prereq: E E 311

E E 511: Modern Optical Communications
(3-0) Cr. 3. S.
Prereq: E E 311
Propagation in optical media. Optical fibers. Optical sources and detectors. Fiber optic communications systems. DWDM considerations.

E E 512: Advanced Electromagnetic Field Theory I
(3-0) Cr. 3. F.
Prereq: E E 311
Review of static electric and magnetic fields. Maxwell's equations. Circuit concepts and impedance elements. Propagation and reflection of plane waves in isotropic media. Guided electromagnetic wave. Characteristics of common waveguides and transmission lines. Propagation in anisotropic media. Special theorems and concepts. Radiation and scattering.

E E 513: Advanced Electromagnetic Field Theory II
(3-0) Cr. 3. S.
Prereq: E E 512
Green's functions, perturbational and variational techniques. Analysis of microstrip lines and interconnects. Spectral domain approach, waves in layered media. Integral equations and method of moments. Inverse scattering. Electromagnetic applications.

E E 514: Microwave Engineering
(Dual-listed with E E 414). (3-3) Cr. 4. F.
Prereq: E E 230, E E 311
Principles, analyses, and instrumentation used in the microwave portion of the electromagnetic spectrum. Wave theory in relation to circuit parameters. S parameters, couplers, discontinuities, and microwave device equivalent circuits. RF amplifier design, microwave sources, optimum noise figure and maximum power designs. Microwave filters and oscillators.

E E 516: Computational Methods in Electromagnetics
(3-0) Cr. 3. S.
Prereq: E E 311
Maxwell's equations. Differential equation based methods. Finite difference and finite difference time domain methods, boundary conditions. Finite element method and applications to the analysis of practical devices. Integral equation based methods. Electric and magnetic field integral equations. Matrix solvers. Fast solution methods.

E E 517: Electromagnetic Radiation, Antennas, and Propagation
(Dual-listed with E E 417). (3-3) Cr. 4. S.
Prereq: E E 311
Fundamental antenna concepts. Radiation from wire-and aperture-type sources. Radio transmission formulas. Wave and antenna polarization. Antenna arrays. Modern antenna topics. Practical antenna design. Antenna noise. Radiowave propagation in the presence of the earth and its atmosphere. Antenna measurements and computer aided analysis.

E E 518: Microwave Remote Sensing
(Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Math 265 or equivalent
Microwave remote sensing of Earth's surface and atmosphere using satellite-based or ground-based instruments. Specific examples include remote sensing of atmospheric temperature and water vapor, precipitation, ocean salinity, and soil moisture.

E E 519: Magnetism and Magnetic Materials
(Cross-listed with M S E). (3-0) Cr. 3. F.
Prereq: E E 311 or MAT E 317 or PHYS 364
Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, magnetic measurements of properties for materials evaluation.

E E 520: Selected Topics in Communications and Signal Processing
(3-0) Cr. 3. Repeatable.

E E 521: Advanced Communications
(3-0) Cr. 3. F.
Prereq: E E 422, credit or enrollment in E E 523
Digital communication systems overview. Characterization of communication channels. Digital modulation and demodulation design and performance analysis. Channel capacity and error-control coding concepts. Waveform design for band-limited channels. Equalization. Wireless fading channels and performance.

E E 522: Cognitive Radio Networks
(Cross-listed with CPR E). (3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: Permission of instructor
Topics on cognitive radio networks: Cognitive Radio Networks Architecture; Software Defined Radio Architecture; Spectrum Sensing; Spectrum Management; Spectrum Sharing; Spectrum Mobility; Applications of Cognitive Radio Networks.

E E 523: Random Processes for Communications and Signal Processing
(3-0) Cr. 3.
Prereq: E E 322, MATH 317
Axioms of probability; Repeated trials; Functions of a random variable and multiple random variables: covariance matrix, conditional distribution, joint distribution, moments, and joint moment generating function; Mean square estimation; stochastic convergence; Some important stochastic processes: Random walk, Poisson, Wiener, and shot noise; Markov chaines; Power spectral analysis; Selected applications.

E E 524: Digital Signal Processing
(3-0) Cr. 3. F.
Prereq: E E 322, E E 424, MATH 317
Review: sampling and reconstruction of signals; discrete-time signals, systems, and transforms. Multi-rate digital signal processing and introduction to filter banks. Optimal linear filtering and prediction. Introductions to adaptive filtering and spectral estimation. Applications.

E E 527: Detection and Estimation Theory
(3-0) Cr. 3. S.
Prereq: E E 422
Statistical estimation theory and performance measures: maximum likelihood estimation, Cramer-Rao bound, Bayesian estimation, optimal demodulation, signal design. Introduction to graphical models. Hidden Markov models and Kalman filter. Classical statistical decision theory, decision criteria, binary and composite hypothesis tests. Error probability and Chernoff bound. Applications.

E E 528: Digital Image Processing
(3-0) Cr. 3. S.
Prereq: E E 322, E E 424
Review of sampling, linear algebra and probability. Classical image processing topics such as image sampling and quantization, image transforms (2D Fourier, KLT, DCT, etc), image enhancement, restoration and filtering. Image analysis topics including edge detection, segmentation, registration and tracking (uses least squares estimation, EM, Kalman filter). Medical image reconstruction from tomographic projections (Radon transform, Fourier slice theorem and reconstruction algorithms using them) and Magnetic Resonance Imaging (MRI). Basic introduction to image and video compression methods.

E E 530: Selected Topics in Electronics, Microelectronics and Photonics
(3-0) Cr. 3. Repeatable.
Prereq: E E 332

E E 532: Microelectronics Fabrication Techniques
(Dual-listed with E E 432). (Cross-listed with M S E). (2-4) Cr. 4.
Prereq: credit or enrollment in E E 332
Techniques used in modern integrated circuit fabrication, including diffusion, oxidation, ion implantation, lithography, evaporation, sputtering, chemical-vapor deposition, and etching. Process integration. Process evaluation and final device testing. Extensive laboratory exercises utilizing fabrication methods to build electronic devices. Use of computer simulation tools for predicting processing outcomes. Recent advances in processing CMOS ICs and micro-electro-mechanical systems (MEMS).

E E 535: Physics of Semiconductors
(Cross-listed with PHYS). (3-3) Cr. 4.
Prereq: E E 311 and E E 332
Basic elements of quantum theory, Fermi statistics, motion of electrons in periodic structures, crystal structure, energy bands, equilibrium carrier concentration and doping, excess carriers and recombination, carrier transport at low and high fields, space charge limited current, photo-conductivity in solids, phonons, optical properties, amorphous semiconductors, heterostructures, and surface effects. Laboratory experiments on optical properties, carrier lifetimes, mobility, defect density, doping density, photo-conductivity, diffusion length of carriers.

E E 536: Physics of Semiconductor Devices
(Cross-listed with PHYS). (3-0) Cr. 3.
Prereq: E E 535
P-n junctions, band-bending theory, tunneling phenomena, Schottky barriers, heterojunctions, bipolar transistors, field-effect transistors, negative-resistance devices and optoelectronic devices.

E E 538: Optoelectronic Devices and Applications
(Dual-listed with E E 438). (3-0) Cr. 3.
Prereq: E E 311, E E 332
Transmission and reflection of electromagnetic plane waves. Propagation in dielectric and fiber optic waveguides. LED and laser operating principles and applications. Photodetectors and solar cells. Optical modulation and switching.

E E 547: Pattern Recognition
(3-0) Cr. 3. F.
Prereq: E E 324
Mathematical formulation of pattern recognition problems and decision functions. Statistical approaches: Bayes classifier, probability density function estimation and expectation minimization. Clustering (supervised and unsupervised), learning, and neural network algorithms. Fuzzy recognition systems. Feature selection systems. Classifier comparison. Current applications.

E E 552: Energy System Planning
(3-0) Cr. 3.
Prereq: E E 456, E E 457 or equivalent
Characteristics of bulk energy conversion, storage, and transport technologies. Environmental legislation. Modeling of electricity markets. Evaluation of sustainability and resiliency. Types of planning analyses: economic, multi-sector, long-term, national. Planning tools and associated optimization methods.

E E 553: Steady State Analysis
(3-0) Cr. 3. F.
Prereq: E E 456, E E 457
Power flow, economic dispatch, unit commitment, electricity markets, automatic generation control, sparse matrix techniques, interconnected operation, voltage control.

E E 554: Power System Dynamics
(3-0) Cr. 3. S.
Prereq: E E 456, E E 457, E E 475
Dynamic performance of power systems with emphasis on stability. Modeling of system components and control equipment. Analysis of the dynamic behavior of the system in response to small and large disturbances.

E E 555: Advanced Energy Distribution Systems
(3-0) Cr. 3.
Prereq: E E 455
Transient models of distribution components, automated system planning and distribution automation, surge protection, reliability, power quality, power electronics and intelligent systems applications.

E E 556: Power Electronic Systems
(3-0) Cr. 3.
Prereq: E E 452
Converter topologies, AC/DC, DC/DC, DC/AC, AC/AC. Converter applications to do motor drives, power supplies, AC motor drives, power system utility applications (var compensators) and power quality.

E E 559: Electromechanical Wind Energy Conversion and Grid Integration
(Dual-listed with E E 459). (3-0) Cr. 3.
Prereq: Credit or enrollment in E E 452, E E 456
Summary of industry status and expected growth; power extraction from the air stream; operation and modeling of electric machines, and power electronics topologies for wind energy conversion; analysis of machine-grid power electronic circuits, controller interface, and collector (distribution) networks; treatment of harmonics, flicker, over/under-voltages, filters, low-voltage ride-through, and reactive compensation; relaying; effects on transmission expansion, planning and grid operation and coordination including variability, frequency control, reserves, and electricity markets; overview of storage technologies and hybrid configurations.

E E 565: Systems Engineering and Analysis
(Cross-listed with AER E, I E). (3-0) Cr. 3.
Prereq: Coursework in basic statistics
Introduction to organized multidisciplinary approach to designing and developing systems. Concepts, principles, and practice of systems engineering as applied to large integrated systems. Life-cycle costing, scheduling, risk management, functional analysis, conceptual and detail design, test, evaluation and systems engineering planning and organization. Not available for degrees in industrial engineering.

E E 566: Avionics Systems Engineering
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: E E 565
Avionics functions. Applications of systems engineering principles to avionics. Top down design of avionics systems. Automated design tools.

E E 570: Systems Engineering Analysis and Design
(3-0) Cr. 3.
Prereq: E E 475, E E 577
Selected topics in abstract algebra, linear algebra, real analysis, functional analysis, and optimization methods in electrical engineering.

E E 571: Introduction to Convex Optimization
(3-0) Cr. 3.
Introduction to convex optimization problems emerging in electrical engineering. Efficiently solving convex optimization problems with the use of interior point algorithms software. Review of linear algebra, convex functions, convex sets, convex optimization problems, duality, disciplined convex programming, applications to optimal filtering, estimation, control and resources allocations, sensor network, distributed systems.

E E 573: Random Signal Analysis and Kalman Filtering
(Cross-listed with AER E, M E). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or M E 370 or M E 411 or MATH 341
Elementary notions of probability. Random processes. Autocorrelation and spectral functions. Estimation of spectrum from finite data. Response of linear systems to random inputs. Discrete and continuous Kalman filter theory and applications. Smoothing and prediction. Linearization of nonlinear dynamics.

E E 574: Optimal Control
(Cross-listed with AER E, M E). (3-0) Cr. 3. S.
Prereq: E E 577
The optimal control problem. Variational approach. Pontryagin's principle, Hamilton-Jacobi equation. Dynamic programming. Time-optimal, minimum fuel, minimum energy control systems. The regulator problem. Structures and properties of optimal controls.

E E 575: Introduction to Robust Control
(Cross-listed with AER E, M E). (3-0) Cr. 3.
Prereq: E E 577
Introduction to modern robust control. Model and signal uncertainty in control systems. Uncertainty description. Stability and performance robustness to uncertainty. Solutions to the H2, Hoo, and l1 control problems. Tools for robustness analysis and synthesis.

E E 576: Digital Feedback Control Systems
(Cross-listed with AER E, M E). (3-0) Cr. 3. F.
Prereq: E E 475 or AER E 432 or M E 411 or MATH 415; and MATH 267
Sampled data, discrete data, and the z-transform. Design of digital control systems using transform methods: root locus, frequency response and direct design methods. Design using state-space methods. Controllability, observability, pole placement, state estimators. Digital filters in control systems. Microcomputer implementation of digital filters. Finite wordlength effects. Linear quadratic optimal control in digital control systems. Simulation of digital control systems.

E E 577: Linear Systems
(Cross-listed with AER E, M E, MATH). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or MATH 415; and MATH 207
Linear algebra review. Least square method and singular value decomposition. State space modeling of linear continuous-time systems. Solution of linear systems. Controllability and observability. Canonical description of linear equations. Stability of linear systems. State feedback and pole placements. Observer design for linear systems.

E E 578: Nonlinear Systems
(Cross-listed with AER E, M E, MATH). (3-0) Cr. 3. S.
Prereq: E E 577
Linear vs nonlinear systems. Phase plane analysis. Bifurcation and center manifold theory. Lyapunov stability. Absolute stability of feedback systems. Input-output stability. Passivity theory and feedback linearization. Nonlinear control design techniques.

E E 588: Eddy Current Nondestructive Evaluation
(Dual-listed with E E 488). (Cross-listed with M S E). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 265 and (MAT E 216 or MAT E 273 or E E 311 or PHYS 364)
Electromagnetic fields of various eddy current probes. Probe field interaction with conductors, cracks and other material defects. Ferromagnetic materials. Layered conductors. Elementary inversion of probe signals to characterize defects. Special techniques including remote-field, transient, potential drop nondestructive evaluation and the use of Hall sensors. Practical assignments using a 'virtual' eddy current instrument will demonstrate key concepts.

E E 589: Survey of Remote Sensing Technologies
(Dual-listed with E E 489). (Cross-listed with GEOL, MTEOR, NREM). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

E E 589L: Satellite Remote Sensing Laboratory
(Dual-listed with E E 489L). (Cross-listed with MTEOR, NREM). (0-3) Cr. 1. S.
Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589
Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

E E 590: Special Topics
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590A: Special Topics: Electromagnetic Theory
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590B: Special Topics: Control Systems
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590C: Special Topics: Communication Systems
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590E: Special Topics: Computer Engineering
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590F: Special Topics: Electric Power
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590G: Special Topics: Electrical Materials
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590H: Special Topics: Electronic Devices and Circuits
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 590I: Special Topics: Signal Processing
Cr. 1-6. Repeatable.
Formulation and solution of theoretical or practical problems in electrical engineering.

E E 591: Seminar in Electronics, Microelectronics, and Photonics
Cr. 1-3. Repeatable.

E E 594: Seminar in Electric Power
Cr. 1-3. Repeatable.

E E 596: Seminar in Control Systems
Cr. 1-3. Repeatable.

E E 597: Seminar in Communications and Signal Processing
Cr. 1. Repeatable.
Offered on a satisfactory-fail basis only.

E E 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

E E 621: Coding Theory
(3-0) Cr. 3.
Prereq: E E 521
Fundamentals of error-control coding techniques: coding gain, linear block codes. Galois fields. Cyclic codes: BCH, Reed-Solomon. Convolutional codes and the Viterbi algorithm. Trellis-coded modulation. Iterative decoding. Recent developments in coding theory.

E E 622: Information Theory
(3-0) Cr. 3.
Prereq: E E 521, E E 523
Information system overview. Entropy and mutual information. Data Compression and source encoding. Discrete memoryless channel capacity. Noisy channel coding theorem. Rate distortion theory. Waveform channels. Advanced topics in information theory.

E E 653: Advanced Topics in Electric Power System Engineering
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Advanced topics of current interest in electric power system engineering.

E E 674: Advanced Topics in Systems Engineering
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Advanced topics of current interest in the areas of control theory, stochastic processes, digital signal processing, and image processing.

E E 697: Engineering Internship
(Cross-listed with CPR E). Cr. R. Repeatable.
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

E E 699: Research
Cr. arr. Repeatable.

Energy Systems Minor

http://www.me.iastate.edu/energy-systems-minor/

Energy systems are pervasive in our society. A list of energy-related subjects and applications in the engineering curriculum would be nearly endless, but here are some examples:

• Mechanical engineers have a core area in thermo-fluids where courses in thermodynamics, fluid mechanics, and heat transfer form a base for energy systems.

• Electrical engineers address power transmission and distribution as well as electric motors and power systems.

• Civil engineers develop structures for wind turbines and hydroelectric dams.

• Construction engineers need to understand how building systems impact energy utilization.

• Chemical engineers develop alternative fuels and clean burning technologies.

• Material engineers develop new materials for batteries and fuel cells.

• Aerospace engineers develop wind turbines.

• Industrial engineers address manufacturing efficiency and energy reduction.

• Agricultural engineers develop biorenewable energy sources.

Energy systems are also a significant focus of the grand challenges of engineering (http://www.engineeringchallenges.org), and this minor will help our students address these issues in their engineering careers.

The goal of the minor in energy systems is to provide ISU engineering students with focused educational opportunities in the broad area of energy systems. Successful energy systems minor students will understand broad energy perspectives, the language of energy systems, and the economic, environmental, and policy issues related to energy in the two required courses (six credits) for the minor (EE 351 and Econ 380). The remaining nine credits in the minor can be selected from a list of approved engineering courses related to energy systems to give students the opportunity to extend their knowledge.

The Energy Systems minor is administered by the mechanical engineering department and is open to all undergraduates in the College of Engineering. The minor may be earned by completing 15 credits from the following courses. The complete list of approved elective courses can be found here (http://www.me.iastate.edu/energy-systems-minor).

Required Courses		
ECON 380	Energy, Environmental and Resource Economics	3
E E 351	Analysis of Energy Systems	3
Electives: Choose from a list of approved courses		9
Total Credits		15

The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

Engineering Mechanics

Administered by the Department of Aerospace Engineering

Undergraduate Study

The undergraduate courses in mechanics are intermediate between those in physics and mathematics and the professional and design courses of the several engineering curricula. In these courses the student is expected to acquire an understanding of the basic principles and analysis techniques pertaining to the static and dynamic behavior of rigid media, deformable solids, fluids, and gasses. Physical properties of engineering materials are studied in the classroom and are tested in the laboratory. General physical laws are given mathematical expression and are made suitable for use in the solution of specific problems in machine and structural design, and in the flow and measurement of fluids.

Graduate Study

The department offers graduate programs that lead to the degrees master of science, master of engineering, and doctor of philosophy with major in engineering mechanics, and minor work to students taking major work in other departments.

The master of science degree requires a thesis and has strong research emphasis. The master of science degree is recommended for students who anticipate entering a doctoral program later. The master of engineering degree does not require either research credits or a thesis. The program is intended to give students additional instruction at the graduate level to better qualify them for advanced professional engineering work. By careful selection of electives and perhaps additional courses during the senior undergraduate year, students should be able to qualify for the master of engineering degree with an additional year of full-time study after receiving their baccalaureate degree in one of the several engineering curricula.

The master of engineering degree does require a creative component which will be obtained by registering for E M 599 Creative Component. A written report and an oral presentation will be given to the student's graduate committee.

At least 30 credits of acceptable graduate work are required for both the master of science and the master of engineering degrees. For specific course, research, and creative component requirements, see the departmental Graduate Student Handbook (http://www.aere.iastate.edu/wp-content/blogs.dir/13/files/2011/09/Graduate-Handbook-Fall-2011.pdf).

The normal prerequisite to major graduate work is the completion of a curriculum substantially equivalent to that required of undergraduate students in engineering at this university. However, because of the diversity of interests in graduate work in engineering mechanics, it is possible for a student to qualify for graduate study even though undergraduate or prior graduate training has been in a discipline other than engineering—e.g., physics or mathematics.

Courses primarily for undergraduates:

E M 274: Engineering Statics
(3-0) Cr. 3. F.S.SS.
Prereq: PHYS 221, credit or enrollment in MATH 166
Vector analysis; analysis of force systems; resultant in two and three dimensions; free-body diagrams; equilibrium; analysis of trusses, frames, and machines; friction, belts and pulleys; shear and bending moment in beams, centroid and center of mass; second moments of areas.

E M 324: Mechanics of Materials
(3-0) Cr. 3. F.S.SS.
Prereq: E M 274
Plane stress, plane strain, stress-strain relationships, and elements of material behavior. Application of stress and deformation analysis to members subject to centric, torsional, flexural, and combined loadings. Elementary considerations of theories of failure, buckling.

E M 327: Mechanics of Materials Laboratory
(0-2) Cr. 1. F.S.SS.
Prereq: E M 324
Experimental determination of mechanical properties of selected engineering materials. Experimental verification of assumptions made in 324. Use of strain measuring devices. Preparation of reports.

E M 345: Engineering Dynamics
(3-0) Cr. 3. F.S.SS.
Prereq: E M 274, credit or enrollment in MATH 266 or MATH 267
Particle and rigid body kinematics, Newton's laws of motion, kinetics of plane motion, rigid body problems using work-energy, linear, and angular impulse-momentum principles, vibrations.

E M 362: Principles of Nondestructive Testing
(Cross-listed with MAT E). (3-0) Cr. 3. S.
Prereq: PHYS 112 or PHYS 222
Radiography, ultrasonic testing, magnetic particle inspection, eddy current testing, dye penetrant inspection, and other techniques. Physical bases of tests, materials to which applicable, types of defects detectable, calibration standards, and reliability safety precautions.

E M 362L: Nondestructive Testing Laboratory
(Cross-listed with MAT E). (0-3) Cr. 1. S.
Prereq: Credit or enrollment in MAT E 362
Application of nondestructive testing techniques to the detection and sizing of flaws in materials and to the characterization of material's microstructure. Included are experiments in hardness, dye penetrant, magnetic particle, x-ray, ultrasonic and eddy current testing. Field trips to industrial laboratories.

E M 378: Mechanics of Fluids
(2-2) Cr. 3. F.S.SS.
Prereq: E M 274
Properties of fluids. Fluid statics. Kinematics and kinetics of fluid flow. Mass, momentum, and energy conservation laws; dimensional analysis; flow in pipes and channels. Selected laboratory experiments.

E M 417: Experimental Mechanics
(Dual-listed with E M 517). (Cross-listed with AER E). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324; MAT E 273
Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments.

E M 424: Intermediate Mechanics of Materials
(3-0) Cr. 3. F.S.
Prereq: E M 324
Analysis of stresses, strains, and deflections. Torsion and bending of unsymmetrical members. Analysis of thick wall pressure vessels and shrink fit problems. Dynamic load effects, fatigue and fracture mechanics introduction. Work-strain energy methods.

E M 425: Introduction to the Finite Element Method
(3-0) Cr. 3. S.
Prereq: E M 324, MATH 266 or MATH 267
Introduction of finite element analysis through applications to one-dimensional, steady-state problems such as elastic deformation, heat and fluid flow, consolidation, beam bending, and mass transport. Transient heat conduction and wave propagation. Two-dimensional triangular and quadrilateral elements. Plane problems of torsion, thermal and potential flow, stress analysis. Simple computer programs for one- and two-dimensional problems.

E M 451: Engineering Acoustics
(Cross-listed with E E, M E). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: PHYS 221 and MATH 266 or MATH 267
Properties of sounds waves and noise metrics (pressure, power levels, etc). Sound sources and propagation. Principles of wave propagation in one-, two-, and three-dimensions. Wave reflection and transmission. Wave propagation in rectangular, cylindrical, and annular ducts. Acoustics fields for model noise sources. Introduction to aerodynamic noise sources in aircraft, aircraft engines, and wind turbines. Selected laboratory experiments.

E M 480: Ultrasonic Nondestructive Evaluation
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: E M 324, MATH 266 or MATH 267, PHYS 222
Introduction to stress/strain, Hooke's law, and elastic wave propagation in two dimensions in isotropic media. Ultrasonic plane-wave reflection and transmission; and simple straight-crested guided waves. Transducer construction, behavior, and performance. Simple signal analysis and discrete signal processing. The last few weeks of the course are devoted to case studies.

E M 490: Independent Study
Cr. arr. Repeatable.
Prereq: Permission of instructor

E M 490H: Independent Study: Honors
Cr. arr. Repeatable.
Prereq: Permission of instructor

Courses primarily for graduate students, open to qualified undergraduates:

E M 510: Continuum Mechanics
(3-0) Cr. 3. F.
Prereq: MATH 385
Introduction to Cartesian tensors as linear vector transformations. Kinematics of continuous deformations, Lagrangian and Eulerian descriptions of motion. Fundamental equations or balance laws of continuous media, linear and angular momentum balance. Conservation laws of momentum and energy. Introduction to constitutive equations of classical elastic solids and simple fluids. Formulations and solutions of some canonical problems.

E M 514: Advanced Mechanics of Materials
(Cross-listed with AER E). (3-0) Cr. 3. F.
Prereq: E M 324
Theory of stress and strain, stress-strain relationships. Unsymmetrical bending, curved beams, shear center. Torsion of thin-walled noncircular sections. Equilibrium, compatibility equations. Airy stress functions. Membrane stresses in shells, thick-walled cylinders.

E M 516: Applied Elasticity and Mechanics of Deformable Solids
(3-0) Cr. 3. S.
Prereq: E M 510
Fundamental mechanics of linear elasticity, formulation and solution of simple elastostatic boundary value problems. Kinematics of small deformations, constitutive equations for isotropic and anisotropic media. Field equations for elastic solids, plane strain/plane stress and some classic analytical solutions such as Boussinesq, Hertz, Kirsch, Lamé, and Mitchell. Stress functions and potential methods and introduction to finite elements.

E M 517: Experimental Mechanics
(Dual-listed with E M 417). (Cross-listed with AER E). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324; MAT E 273
Introduction to fundamental concepts for force, displacement, stress and strain measurements for structures and materials applications. Strain gage theory and application. Full field deformation measurements with laser interferometry and digital image processing. Advanced experimental concepts at the micro- and nano-scale regimes. Selected laboratory experiments.

E M 518: Waves in Elastic Solids with Applications to Ultrasonic Nondestructive Evaluation
(3-0) Cr. 3. F.
Prereq: MATH 385
Propagation of bulk waves, surface waves, and guided waves in isotropic and anisotropic elastic media. Transmission and reflection of waves at plane and curved interfaces. Radiation of sources with application to ultrasonic transducer beam modeling. Elastic wave scattering from cracks and inclusions. Reciprocity principles and their use in the development of an ultrasonic measurement model. Characterization and measurement of material attenuation.

E M 525: Finite Element Analysis
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: E M 425, MATH 385
Variational and weighted residual approach to finite element equations. Emphasis on two- and three-dimensional problems in solid mechanics. Isoparametric element formulation, higher order elements, numerical integration, imposition of constraints and penalty, convergence, and other more advanced topics. Use of two- and three-dimensional computer programs. Dynamic and vibrational problems, eigenvalues, and time integration. Introduction to geometric and material nonlinearities.

E M 526: Boundary Element Methods in Engineering
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 514 or E M 516
Introductory boundary element methods through plane problems. Singular integrals, Cauchy principal values, integral representations and boundary integrals in one dimension. Direct and indirect formulations. Plane potential and elastostatic problems. Higher order elements, numerical integration. Regularizations. Body forces and infinite regions. Specialized fundamental solutions, half-plane and axisymmetric problems. Diffusion and wave problems. Coupling with finite elements.

E M 543: Introduction to Random Vibrations and Nonlinear Dynamics
(Cross-listed with M E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Vibrations of continuous systems. Nonlinear vibration phenomena, perturbation expansions; methods of multiple time scales and slowly-varying amplitude and phase. Characteristics of random vibrations; random processes, probability distributions, spectral density and its significance, the normal or Gaussian random process. Transmission of random vibration, response of simple single and two-degree-of-freedom systems to stationary random excitation. Fatigue failure due to random excitation.

E M 548: Advanced Engineering Dynamics
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E M 345, MATH 266 or MATH 267
3-D kinematics and dynamics of particles and rigid bodies. Coordinate systems, calculus of variations. Lagrange's equations with constraints, modified Euler's equations, torque-free motion of rigid bodies in 3-D, moment equations with constraints.

E M 550: Nondestructive Evaluation
(Cross-listed with M S E). (3-2) Cr. 4. S.
Prereq: E M 324, MATH 385
Principles of five basic NDE methods and their application in engineering inspections. Materials behavior and simple failure analysis. NDE reliability, and damage-tolerant design. Advanced methods such as acoustic microscopy, laser ultrasonics, thermal waves, and computed tomography are analyzed. Computer-based experiments on a selection of methods: ultrasonics, eddy currents, x-rays are assigned for student completion.

E M 552: Advanced Acoustics
(Cross-listed with M E). (3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: E M 451
Theoretical acoustics: wave propagation in fluids; acoustic radiation, diffraction and scattering; nonlinear acoustics; radiation force; cavitation; and ray acoustics.

E M 564: Fracture and Fatigue
(Cross-listed with AER E, M E, M S E). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324 and either MAT E 216 or MAT E 273 or MAT E 392. Undergraduates: Permission of instructor
Materials and mechanics approach to fracture and fatigue.
Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue.

E M 566: Phase Transformation in Elastic Materials
(Cross-listed with M E). (3-0) Cr. 3. S.
Prereq: EM 510 or EM 516 or EM 514
Continuum thermodynamics and kinetics approaches to phase transformations. Phase field approach to stress- and temperature-induced martensitic transformations and twinning at the nanoscale. Nucleation and growth. Nanostructural evaluation. Analytical and numerical solutions. Surface stresses and energy. Surface-induced phase transformations. Large Strain formulation.

E M 569: Mechanics of Composite and Combined Materials
(Cross-listed with AER E, M S E). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E M 324
Mechanics of fiber-reinforced materials. Micromechanics of lamina. Macromechanical behavior of lamina and laminates. Strength and interlaminar stresses of laminates. Failure criteria. Stress analysis of laminates. Thermal moisture and residual stresses. Joints in composites.

E M 570: Wind Engineering
(Cross-listed with AER E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: E M 378, E M 345
Atmospheric circulations, atmospheric boundary layer wind, bluff-body aerodynamics, aeroelastic phenomena, wind-tunnel and full-scale testing, wind-load code and standards, effect of tornado and thunderstorm winds, design applications.

E M 590: Engineering Mechanics Special Topics
Cr. 1-4. Repeatable.
Prereq: Permission of instructor

E M 590F: Engineering Mechanics Special Topics: Introduction to Dislocation and Plasticity
Cr. 1-4. Repeatable.
Prereq: Permission of instructor

E M 590H: Engineering Mechanics Special Topics: Mechanics of Thin Films and Adhesives
Cr. 1-4. Repeatable.
Prereq: Permission of instructor

E M 590I: Engineering Mechanics Special Topics: Mechanics of Cellular and Porous Media
Cr. 1-4. Repeatable.
Prereq: Permission of instructor

E M 590J: Engineering Mechanics Special Topics: Other
Cr. 1-4. Repeatable.
Prereq: Permission of instructor

E M 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

E M 690: Engineering Mechanics Special Topics
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 690N: Engineering Mechanics Special Topics: Advanced Experimental Methods
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 690O: Engineering Mechanics Special Topics: Advanced Wave Propagation
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 690P: Engineering Mechanics Special Topics: Advanced Materials
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 690Q: Engineering Mechanics Special Topics: Advanced Computational Methods
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 690R: Engineering Mechanics Special Topics: Reliability and Failure
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 690S: Engineering Mechanics Special Topics: Other
Cr. 1-6. Repeatable.
Prereq: Permission of instructor

E M 697: Engineering Internship
Cr. R. Repeatable.
Prereq: Permission of DOGE (Director of Graduate Education), graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

E M 699: Research
Cr. arr. Repeatable.

Engineering Sales Minor

With approximately 15% of engineering job postings involving product sales, marketing or customer field support, a minor in engineering sales can be a critical step towards a great job offer. Besides being one of the best paid positions in engineering, technical sales offers substantial travel opportunities and the ability to solve customers' engineering problems in the field working with people. Talk to your adviser to see how just a few additional courses could fit into your schedule and fast-track your job prospects.

To fill this need, the Department of Industrial and Manufacturing Systems Engineering has developed a minor in sales engineering. The engineering sales minor is a 15 credit minor that complements the technical training in the student's major discipline by providing the tools and knowledge required for technical (i.e. business-to-business) sales careers. The minor is available only to engineering students and is administered by a supervisory faculty committee. At least 9 of the 15 credits must not be used to meet any other department, college or university requirements.

Requirements:

- I E 450 Technical Sales for Engineers I
- I E 451 Technical Sales for Engineers II
- Mkt 340 Principles of Marketing
- Mkt 343 Personal Sales

AND
One of the following:

- I E 305 Engineering Economic Analysis
- Fin 301 Principles of Finance

The objectives of the minor are to provide a broad understanding of the technical sales process, primarily from the business-to-business perspective. At the conclusion of the minor, students will be able to:

- Calculate a return on investment and communicate to customer
- Determine payback period for a given solution and communicate to customer
- Perform a market segmentation
- Develop a client value analysis
- Perform prospecting and business-to-business marketing
- Identify decision makers and processes
- Manage a sales process
- Use sales automation software
- Apply knowledge of underlying international sales issues
- Prepare written and verbal sales presentations
- Provide information about product/service pricing
- Lead a team selling process
- Establish sales channel management procedures
- Develop sound distribution strategies and global sales processes
- Formulate bid strategies/negotiation strategies
- Employ good time management skills

Those students interested in pursuing this minor should contact an academic adviser in their home department and fill out a REQUEST FOR MINOR form. Evaluation of all students requesting this minor will be

conducted in the Department of Industrial and Manufacturing Systems Engineering. Any questions should be directed to Ms. Devna Popejoy-Sheriff at devna@iastate.edu.

Industrial Engineering

Administered by the Department of Industrial and Manufacturing Systems Engineering

For the undergraduate curriculum in industrial engineering leading to the degree Bachelor of Science. The Industrial Engineering Program is accredited by the Engineering Accreditation Commission of ABET, http://www.abet.org/.

The Industrial Engineering (IE) Program educates its future graduates to accomplish its educational objectives in their early careers. Specifically, the IE curriculum prepares its majors so that, within a few years after graduation, graduates' attainments are

1. industrial engineering decisions that result in well-reasoned, value-added solutions;

2. communications with stakeholders that are informative, persuasive, and constructive;

3. contributions to team goals through effective team interactions and leadership;

4. new skills and knowledge that advance professional practice and enable career advancement.

Details on industrial engineering program outcomes that foster the attainment of these objectives are available at appropriate sections of: www.imse.iastate.edu (http://www.imse.iastate.edu)

The industrial engineering undergraduate curriculum provides students with fundamental knowledge in mathematics and science, engineering science, social science, and humanities as well as professional industrial engineering course work. Management electives provide students with an opportunity to become familiar with modern business practices that they will encounter in their career. A senior capstone design course provides students with an opportunity to solve open-ended industrial problems with an industrial partner. The cooperative education program provides students with real world experience in the profession and a good perspective on career choices. Students are encouraged to participate in international experiences through exchange programs and industrial internships.

Qualified juniors and seniors interested in graduate studies may apply to the Graduate College to concurrently pursue both B.S. and M.S. or M.Eng. degrees in Industrial Engineering, or B.S. and M.B.A. degrees.

Engineering Sales

The Engineering Sales Minor is multidisciplinary and open to undergraduates in the College of Engineering. The minor is earned by completing 15 credits including:

I E 450	Technical Sales for Engineers I	3
I E 451	Technical Sales for Engineers II	3
MKT 340	Principles of Marketing	3
MKT 343	Personal Sales	3
And one of the following:		3
I E 305	Engineering Economic Analysis	
FIN 301	Principles of Finance	
Total Credits		15

The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

Curriculum in Industrial Engineering

Administered by the Department of Industrial and Manufacturing Systems Engineering.

Leading to the degree Bachelor of Science.

Total credits required: 122 cr. See also Basic Program and Special Programs. Grades of C or better are required for any transfer credit course that is applied to the degree program but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA. Note: Department does not allow Pass/Not Pass credits to be used to meet graduation requirements.
International Perspectives: 3 cr. [1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirements:

ENGL 150	Critical Thinking and Communication (C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
LIB 160	Information Literacy	1

Remaining Communication courses: 6 cr.

ENGL 314	Technical Communication	3
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		6

Social Sciences and Humanities Electives: 12 cr. [2]
Six of twelve credits must be from 200-level or above courses. Six credits must be sequential or related courses.

Basic Program: 27 cr. [3]
A minimum GPA of 2.00 required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 167	General Chemistry for Engineering Students	4

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGR 101	Engineering Orientation	R
I E 148	Information Engineering [3]	3
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Math and Physical Science: 17 cr.

MATH 265	Calculus III	4
MATH 267	Elementary Differential Equations and Laplace Transforms	4
PHYS 222	Introduction to Classical Physics II	5
STAT 231	Probability and Statistical Inference for Engineers	4
Total Credits		17

Industrial Engineering Core: 34 cr.

A minimum GPA of 2.00 required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Core GPA):

I E 222	Design & Analysis Methods for System Improvements	3
I E 248	Engineering System Design, Manufacturing Processes and Specifications	3
I E 271	Applied Ergonomics and Work Design	3
I E 305	Engineering Economic Analysis	3
I E 312	Optimization	3
I E 341	Production Systems	3
I E 348	Solidification Processes	3
I E 361	Statistical Quality Assurance	3
I E 413	Stochastic Modeling, Analysis and Simulation	4
I E 441	Industrial Engineering Design	3
I E 448	Manufacturing Systems Engineering	3
Total Credits		34

Other Remaining Courses: 26 cr. [2]

MAT E 273	Principles of Materials Science and Engineering	3
E M 274	Engineering Statics	3
E E 442	Introduction to Circuits and Instruments	2
M E 231	Engineering Thermodynamics I	3
Focus Electives		6
Management Electives		3
Engineering Topic Electives		6
Total Credits		26

Seminar/Co-op/Internships:

I E 101	Industrial Engineering Profession	R
Optional co-op/internship courses		

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also allowed by the department to meet other course requirements within the degree program.
   U.S. diversity and international perspectives courses may not be taken Pass/Not Pass.
2. For Social Sciences and Humanities, Focus, Management, and Engineering Topic Electives, choose from the department approved list. (http://www.imse.iastate.edu/wp-content/blogs.dir/16/files/2011/06/Elective-List-2013-2014-8-12-2013.pdf)
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

See also the following grid showing course template by semester: 4-Year Plan of Study for Industrial Engineering.

Industrial Engineering, B.S.

First Year

Fall	Credits	Spring	Credits
I E 148	3	SSH Elective	3
SSH Elective	3	MATH 166	4
MATH 165	4	PHYS 221	5
CHEM 167	4	ENGL 150	3
ENGR 101	0	I E 101	0
		LIB 160	1
	14		16

Second Year

Fall	Credits	Spring	Credits
MATH 265	4	MATH 267	4
I E 248	3	STAT 231	4
MAT E 273	3	I E 222	3
PHYS 222	5	I E 271	3
ENGL 250	3		
	18		14

Third Year

Fall	Credits	Spring	Credits
I E 305	3	ENGR Topic Elective	3
I E 341	3	SSH Elective	3

I E 312	3 I E 348	3
SP CM 212	3 I E 361	3
E M 274	3 E E 442	2
	15	14

Fourth Year

Fall	Credits Spring	Credits
Focus Elective	3 Focus Elective	3
SSH Elective	3 Managment Elective	3
I E 413	4 ENGR Topic Elective	3
ENGL 314	3 I E 441	3
M E 231	3 I E 448	3
	16	15

Graduate Study

The Department offers programs for the degrees Master of Engineering (M.Eng.), Master of Science (M.S.), and Doctor of Philosophy (Ph.D.) with a major in Industrial Engineering (I.E.). A formal minor is available at the M.S. and Ph.D. levels to graduate students having a major in another department. The M.Eng. degree consists of coursework designed to improve professional expertise in Industrial Engineering. The M.S. and Ph.D. degrees are designed to improve the student's capability to conduct research as well as their professional expertise.

The prerequisite to major graduate work is the completion of a curriculum similar to that required of undergraduate students in engineering at this institution. Because of the diversity of Industrial Engineering topics, it is possible for a student to qualify for graduate study even though undergraduate or prior graduate training has been in a discipline other than engineering; e.g., mathematics or physics. However, completion of a math sequence of calculus through differential equations is required.

With the help of a Program of Study Committee (P.O.S.C.), a graduate student develops an educational program in areas within Industrial Engineering. Typical areas of concentration include Advanced Manufacturing, Ergonomics/Human Factors, Operations Research/ Analytics, and Systems Engineering/Engineering Management.

The Department offers a certificate in Advanced Manufacturing, in collaboration with the Mechanical Engineering Department, which consists of four graduate courses selected from an approved list in both departments.

For additional information about graduate degree programs, admission criteria, and procedures refer to https://www.imse.iastate.edu/graduate-program/.

Courses primarily for undergraduates:

I E 101: Industrial Engineering Profession

Cr. R. F.S.

(1-0) Introduce students to the industrial engineering profession, its scope, industrial engineering tools, and future trends.

I E 148: Information Engineering

(2-2) Cr. 3. F.S.

Prereq: Credit or enrollment in MATH 143

Development of information solutions for engineering problems. Fundamentals of the software development process. Engineering computations and the human/computer interface. Data models and database development. Program connectivity and network applications.

I E 222: Design & Analysis Methods for System Improvements

(3-0) Cr. 3. S.

Prereq: I E 248; credit or enrollment in I E 271.

Study of system improvement methods and strategies. Specific areas of lean system improvements include continuous improvement, setup reduction, workplace organization, inventory and waste minimization. Methods and strategies to analyze and quantify the impact of changes.

I E 248: Engineering System Design, Manufacturing Processes and Specifications

(2-2) Cr. 3. F.

Prereq: MATH 166 and PHYS 221. Credit or enrollment in I E 101 and MAT E 273.

Introduction to metrology, engineering drawings and specifications. Engineering methods for designing and improving systems. Theory, applications, and quality issues related to machining processes.

I E 271: Applied Ergonomics and Work Design

(3-0) Cr. 3. S.

Prereq: PHYS 221

Basic concepts of ergonomics and work design. Their impact on worker and work place productivity, and cost. Investigations of work physiology, biomechanics, anthropometry, work methods, and their measurement as they relate to the design of human-machine systems.

I E 305: Engineering Economic Analysis

(3-0) Cr. 3. F.S.SS.

Prereq: MATH 166

Economic analysis of engineering decisions under uncertainty. Financial engineering basics including time value of money, cash flow estimation, and asset evaluation. Make versus buy decisions. Comparison of project alternatives accounting for taxation, depreciation, inflation, and risk.

I E 312: Optimization
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in MATH 267.
Concepts, optimization and analysis techniques, and applications of operations research. Formulation of mathematical models for systems, concepts, and methods of improving search, linear programming and sensitivity analysis, network models, and integer programming.

I E 341: Production Systems
(3-0) Cr. 3. F.
Prereq: STAT 231; credit or enrollment in I E 312
Introduction of key concepts in the design and analysis of production systems. Topics include inventory control, forecasting, material requirement planning, project planning and scheduling, operations scheduling, and other production systems such as Just-In-Time (JIT), warehousing, and global supply chains.

I E 348: Solidification Processes
(Cross-listed with MAT E). (2-2) Cr. 3. S.
Prereq: I E 248 and MAT E 273, or MAT E 215
Theory and applications related to metal casting, welding, polymer processing, powder metallurgy, and composites manufacturing, and related rapid manufacturing processes.

I E 361: Statistical Quality Assurance
(Cross-listed with STAT). (2-2) Cr. 3. F.S.
Prereq: STAT 231, STAT 301, STAT 326 or STAT 401
Statistical methods for process improvement. Simple quality assurance principles and tools. Measurement system precision and accuracy assessment. Control charts. Process capability assessment. Experimental design and analysis for process improvement. Significant external project in process improvement.

I E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

I E 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

I E 403: Introduction to Sustainable Production Systems
(Dual-listed with I E 503). (3-0) Cr. 3.
Prereq: Credit or enrollment I E 341
Quantitative introduction of sustainability concepts in production planning and inventory control. Review of material recovery (recycling) and product/component recovery (remanufacturing) from productivity perspectives. Sustainability rubrics ranging from design and process to systems. Application to multi-echelon networks subject to forward/backward flow of material and information. Closed-loop supply chains. Comparative study of sustainable vs. traditional models for local and global production systems.

I E 405: Advanced Engineering Economy for Complex Engineering Projects
(Dual-listed with I E 505). (3-0) Cr. 3.
Prereq: MATH 265, MATH 267, STAT 231 and I E 305, or permission by instructor
Overview of engineering economic valuation and complex engineering projects. Stochastic dynamic programming for project valuation. Modeling and analysis of confounding factors of engineering projects. Integration and synthesis of valuation methodologies to complex projects. Applications to power plants, transmission networks, and satellites.

I E 413: Stochastic Modeling, Analysis and Simulation
(4-0) Cr. 4. F.
Prereq: MATH 267, STAT 231
Development and analysis of simulation models using a simulation language. Application to various areas of manufacturing and service systems such as assembly, material handling, and customer queues. Utilizing model output to make important business decisions. Fitting of data to statistical distributions. Introduction to Markov processes and other queuing models.

I E 432: Industrial Automation
(2-3) Cr. 3. S.
Prereq: Phys 222
Overview of electrical circuit theory and its relationship to industrial control systems. Theory and application of transducers in the form of sensors and actuators, with applications in manufacturing, distribution and mechanical systems. Programmable Logic Controllers (PLC), their programming and use for automation solutions. Introduction of automated identification systems such as Radio Frequency Identification (RFID) and Bar Coding technologies.

I E 441: Industrial Engineering Design
(1-6) Cr. 3. F.S.
Prereq: I E 248, I E 271, I E 361; credit or enrollment in I E 341, I E 413, and I E 448
A large, open-ended design project related to an enterprise. Application of engineering design principles including problem definition, analysis, synthesis, and evaluation.

I E 446: Geometric Variability in Manufacturing
(Dual-listed with I E 546). (3-0) Cr. 3.
Prereq: I E 348, or MAT E 216, or M E 324
Assessment, accommodation, and control of geometric variability in manufacturing processes, specifically composites, metalcasting, welding, machining, and powder metallurgy. Techniques include the design of the component, tooling and process plan. The use of contact and noncontact measurement methods to assess variation.

I E 447: Biomedical Design and Manufacturing
(Dual-listed with I E 547). (3-0) Cr. 3.
Prereq: Students with two semesters or less before graduation
Exploration of biology, materials, body mechanics, manufacturing, quality control, and ethics and the intersection of these subjects as they relate to biomedical manufacturing.

I E 448: Manufacturing Systems Engineering
(3-0) Cr. 3. S.
Prereq: I E 248, I E 305
Fixturing and tooling requirements for manufacturing process planning, geometric dimensioning and tolerancing, computer aided inspection, cellular and flexible manufacturing, and facility layout. Lean manufacturing principles and controlled flow production.

I E 449: Computer Aided Design and Manufacturing
(Dual-listed with I E 549). (3-0) Cr. 3.
Prereq: Prereq: I E 248 or similar manufacturing engineering course, MATH 265.
Representation and interpretation of curves, surfaces and solids. Parametric curves and surfaces and solid modeling. Use of CAD software and CAD/CAM integration. Computer numerical control, CNC programming languages, and process planning.

I E 450: Technical Sales for Engineers I
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in I E 305.
Sales process methodology, techniques for building professional relationships, sales automation software, prospecting and account development, market analysis and segmentation, responding to RFQ's and RFP's in written and verbal form. Developing technical value propositions and competitive positioning, evaluating organizational decision processes and people, technical marketing strategies, sales closing strategies.

I E 451: Technical Sales for Engineers II
(3-0) Cr. 3. S.
Prereq: I E 450
Case studies and experiential lessons on the development and application of technical sales strategies. Specific topics include developing pricing and distribution strategies, managing a sales staff and channel, developing sales teams and global sales plans, bid and negotiation strategies, time management skills, and implementing sales automation technologies.

I E 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, AER E, B M E, CPR E, E E, ENGR, M E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

I E 467: Multidisciplinary Engineering Design II
(Cross-listed with AER E, CPR E, E E, ENGR, M E, MAT E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: Student must be within two semesters of graduation or receive permission of instructor.
Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

I E 468: Large-Scale Complex Engineered Systems (LSCES)
(Dual-listed with I E 568). (Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: senior standing in College of Engineering or permission of AerE 468 instructor
Introduction to the theoretical foundation and methods associated with the design for large-scale complex engineered systems, including objective function formation, design reliability, value-driven design, product robustness, utility theory, economic factors for the formation of a value function and complexity science as a means of detecting unintended consequences in the product behavior.

I E 481: e-Commerce Systems Engineering
(Dual-listed with I E 581). (3-0) Cr. 3.
Prereq: I E 148
Design, analysis, and implementation of e-commerce systems. Information infrastructure, enterprise models, enterprise processes, enterprise views. Data structures and algorithms used in e-commerce systems, SQL, exchange protocols, client/server model, web-based views.

I E 483: Knowledge Discovery and Data Mining
(Dual-listed with I E 583). (3-0) Cr. 3.
Prereq: I E 148, I E 312, and STAT 231
Introduction to data warehouses and knowledge discovery. Techniques for data mining, including probabilistic and statistical methods, genetic algorithms and neural networks, visualization techniques, and mathematical programming. Advanced topics include web-mining and mining of multimedia data. Case studies from both manufacturing and service industries. A computing project is required.

I E 490: Independent Study
Cr. 1-5. Repeatable.
Prereq: Senior classification, permission of instructor
Independent study and work in the areas of industrial engineering design, practice, or research.

I E 490H: Independent Study: Honors
Cr. 1-5. Repeatable.
Prereq: Senior classification, permission of instructor
Independent study and work in the areas of industrial engineering design, practice, or research.

Courses primarily for graduate students, open to qualified undergraduates:

I E 501: M.S. Research Basics and Communications
Cr. R. Repeatable.
Prereq: Enrollment in M.S. or M.Eng. program in Industrial Engineering.
Principles and practices for research tasks at the M.S. level including proposal writing, presentations, paper preparation, and project management. Offered on a satisfactory-fail basis only.

I E 502: M.S. Research Conduct
Cr. R. Repeatable.
Prereq: Enrollment in M.S. program in Industrial Engineering.
Responsible conduct of research at the M.S. level, including ethical issues in peer review, conflicts of interest, mentoring, human subjects and live animals, data management, and collaboration. Offered on a satisfactory-fail basis only.

I E 503: Introduction to Sustainable Production Systems
(Dual-listed with I E 403). (3-0) Cr. 3.
Prereq: Credit or enrollment I E 341
Quantitative introduction of sustainability concepts in production planning and inventory control. Review of material recovery (recycling) and product/component recovery (remanufacturing) from productivity perspectives. Sustainability rubrics ranging from design and process to systems. Application to multi-echelon networks subject to forward/backward flow of material and information. Closed-loop supply chains. Comparative study of sustainable vs. traditional models for local and global production systems.

I E 505: Advanced Engineering Economy for Complex Engineering Projects
(Dual-listed with I E 405). (3-0) Cr. 3.
Prereq: MATH 265, MATH 267, STAT 231 and I E 305, or permission by instructor
Overview of engineering economic valuation and complex engineering projects. Stochastic dynamic programming for project valuation. Modeling and analysis of confounding factors of engineering projects. Integration and synthesis of valuation methodologies to complex projects. Applications to power plants, transmission networks, and satellites.

I E 508: Design and Analysis of Allocation Mechanisms
(3-0) Cr. 3.
Prereq: I E 312 or MATH 307
Market-based allocation mechanisms from quantitative economic systems perspective. Pricing and costing models designed and analyzed with respect to decentralized decision processes, information requirements, and coordination. Financial Engineering Techniques. Case studies and examples from industries such as regulated utilities, semiconductor manufacturers, and financial engineering services.

I E 510: Network Analysis
(3-0) Cr. 3.
Prereq: I E 312
Formulation and solution of deterministic network flow problems including shortest path, minimum cost flow, and maximum flow. Network and graph formulations of combinatorial problems including assignment, matching, and spanning trees. Introduction to deterministic and stochastic dynamic programming.

I E 513: Analysis of Stochastic Systems
(3-0) Cr. 3.
Prereq: STAT 231
Introduction to modeling and analysis of manufacturing and service systems subject to uncertainty. Topics include the Poisson process, renewal processes, Markov chains, and Brownian motion. Applications to inventory systems, production system design, production scheduling, reliability, and capacity planning.

I E 514: Production Scheduling
(3-0) Cr. 3.
Prereq: I E 312, I E 341
Introduction to the theory of machine shop systems. Complexity results for various systems such as job, flow and open shops. Applications of linear programming, integer programming, network analysis. Enumerative methods for machine sequencing. Introduction to stochastic scheduling.

I E 519: Simulation Modeling and Analysis
(3-0) Cr. 3.
Prereq: COM S 311, STAT 401
Event scheduling, process interaction, and continuous modeling techniques. Probability and statistics related to simulation parameters including run length, inference, design of experiments, variance reduction, and stopping rules. Aspects of simulation languages.

I E 531: Quality Control and Engineering Statistics
(Cross-listed with STAT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 401; STAT 342 or STAT 447
Statistical methods and theory applicable to problems of industrial process monitoring and improvement. Statistical issues in industrial measurement; Shewhart, CUSUM, and other control charts; feedback control; process characterization studies; estimation of product and process characteristics; acceptance sampling, continuous sampling and sequential sampling; economic and decision theoretic arguments in industrial statistics.

I E 533: Reliability
(Cross-listed with STAT). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 342 or STAT 432 or STAT 447
Probabilistic modeling and inference in engineering reliability; lifetime models, product limit estimator, probability plotting, maximum likelihood estimation for censored data, Bayesian methods in reliability, system reliability models, competing risk analysis, acceleration models and analysis of accelerated test data; analysis of recurrence data; planning studies to obtain reliability data.

I E 534: Linear Programming
(3-0) Cr. 3.
Prereq: I E 312
Formulation of optimization problems as mathematical models, including linear programming, integer programming concepts, multi-objective optimization, and bilevel optimization. Introduction to classic optimization algorithms, including Simplex, cutting plane, and branch-and-bound. Basic concepts of duality theory and sensitivity analysis. Using computer solvers (Matlab and Gusek) to obtain optimal solutions to optimization models.

I E 537: Reliability and Safety Engineering
(3-0) Cr. 3.
Prereq: STAT 231 or STAT 401
Mathematical basics for dealing with reliability data, theory, and analysis. Bayesian reliability analysis. Engineering ethics in safety evaluations. Case studies of accidents in large technological systems. Fault and event tree analysis.

I E 541: Inventory Control and Production Planning
(3-0) Cr. 3.
Prereq: I E 341
Economic Order Quantity, dynamic lot sizing, newsboy, base stock, and (Q,r) models. Material Requirements Planning, Just-In-Time (JIT), variability in production systems, push and pull production systems, aggregate and workforce planning, and capacity management. Supply Chain Contracts.

I E 543: Wind Energy Manufacturing
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Undergraduate engineering degree or permission of instructor.
Materials, processes and systems required to produce the major components (blades, towers, nacelles) of megawatt scale wind turbines. Transportation, manufacturing siting and procurement decisions as it relates to these large components in an expanding industry.

I E 545: Rapid Prototyping and Manufacturing
(3-0) Cr. 3.
Prereq: Prereq: I E 248 or similar manufacturing engineering course, MATH 265. Undergraduates at Senior Standing if given permission by instructor.
Introduction to rapid prototyping processes and other rapid manufacturing methodologies. Operating principles and characteristics of current and developing rapid prototyping processes. Use of rapid prototypes in product design, development, and service. Selection of rapid prototyping systems based on rapid methodologies used in manufacturing processes and rapid tooling approaches.

I E 546: Geometric Variability in Manufacturing
(Dual-listed with I E 446). (3-0) Cr. 3.
Prereq: I E 348, or MAT E 216, or M E 324
Assessment, accommodation, and control of geometric variability in manufacturing processes, specifically composites, metalcasting, welding, machining, and powder metallurgy. Techniques include the design of the component, tooling and process plan. The use of contact and noncontact measurement methods to assess variation.

I E 547: Biomedical Design and Manufacturing
(Dual-listed with I E 447). (3-0) Cr. 3.
Prereq: Students with two semesters or less before graduation
Exploration of biology, materials, body mechanics, manufacturing, quality control, and ethics and the intersection of these subjects as they relate to biomedical manufacturing.

I E 549: Computer Aided Design and Manufacturing
(Dual-listed with I E 449). (3-0) Cr. 3.
Prereq: Prereq: I E 248 or similar manufacturing engineering course, MATH 265.
Representation and interpretation of curves, surfaces and solids. Parametric curves and surfaces and solid modeling. Use of CAD software and CAD/CAM integration. Computer numerical control, CNC programming languages, and process planning.

I E 560: Engineering Risk Analysis
(3-0) Cr. 3.
Prereq: Coursework in basic probability and statistics
Overview of probabilistic risk analysis and modeling risks. Topics include probability, influence diagrams, subjective probability assessment, fault tree analysis, risk perception, risk communication, intelligent adversary, and financial risk analysis. Application of probabilistic risk analysis to business investments, engineering systems, critical infrastructure, defense and security, cybersecurity, and health systems.

I E 561: Continuous Quality Improvement of Process
(3-0) Cr. 3.
Prereq: I E 361
Methods for continuous quality improvement in process analysis. The systems analysis for process improvement model based on W. Edwards Deming. Quality function deployment methods. Case studies of applications to manufacturing and other heavy industries. Use of process analysis computerized programs and tools for design analysis.

I E 563: Engineering and Systems Management
(3-0) Cr. 3.
Prereq: Course in probability and statistics.
Introduction to engineering management concepts and examples relevant to the engineering manager today. Topics include decision trees and associated probabilities; personnel issues and challenges; working with management, client and the project team; personality types; and documents/forms that are useful for the engineering manager. Case studies, and a group project required.

I E 564: Decision Analysis in System Design
(3-0) Cr. 3.
Prereq: Course in probability and statistics.
Application of decision theory principles and tools to evaluate alternative complex engineering systems based on technical design requirements. Systems engineering methods are presented, with applications in aerospace, energy, and manufacturing domains. Methods for identifying and mitigating risk and uncertainty are presented.

I E 565: Systems Engineering and Analysis
(Cross-listed with AER E, E E). (3-0) Cr. 3.
Prereq: Coursework in basic statistics
Introduction to organized multidisciplinary approach to designing and developing systems. Concepts, principles, and practice of systems engineering as applied to large integrated systems. Life cycle costing, scheduling, risk management, functional analysis, conceptual and detail design, test and evaluation, and systems engineering planning and organization. Not available for degrees in industrial engineering.

I E 566: Applied Systems Engineering
(3-0) Cr. 3.
Prereq: I E 565
Design for reliability, maintainability, usability, supportability, producibility, disposability, and life cycle costs in the context of the systems engineering process. Students will be required to apply the principles of systems engineering to a project including proposal, program plan, systems engineering management plan, and test and evaluation plan. Not available for degrees in industrial engineering.

I E 568: Large-Scale Complex Engineered Systems (LSCES)
(Dual-listed with I E 468). (Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: senior standing in College of Engineering or permission of AerE 468 instructor
Introduction to the theoretical foundation and methods associated with the design for large-scale complex engineered systems, including objective function formation, design reliability, value-driven design, product robustness, utility theory, economic factors for the formation of a value function and complexity science as a means of detecting unintended consequences in the product behavior.

I E 570: Systems Engineering and Project Management
(3-0) Cr. 3.
Prereq: Coursework in basic statistics
Systems view of projects and the processes by which they are implemented. Focuses on qualitative and quantitative tools and techniques of project management. Topics will include organizational structure types; project selection methodologies; simulation and optimization; and earned value management. Case studies will be included, and a group project required.

I E 571: Occupational Biomechanics
(3-0) Cr. 3.
Prereq: E M 274, STAT 231
Anatomical, physiological, and biomechanical bases of physical ergonomics. Anthropometry, body mechanics, strength of biomaterials, human motor control. Use of bioinstrumentation, passive industrial surveillance techniques and active risk assessment techniques.
Acute injury and cumulative trauma disorders. Static and dynamic biomechanical modeling. Emphasis on low back, shoulder and hand/wrist biomechanics.

I E 572: Design and Evaluation of Human-Computer Interaction
(3-0) Cr. 3.
Prereq: I E 577 or instructor's permission
Human factors methods applied to interface requirements, design, prototyping, and evaluation. Concepts related to understanding user characteristics, design principles, usability analysis, methods and techniques for design and evaluation of the interface. The evaluation and design of the information presentation characteristics of a wide variety of interfaces: web sites (e-commerce), mobile applications, and information presentation systems (cockpits, instrumentation, etc.).

I E 576: Human Factors in Product Design
(3-0) Cr. 3.
Prereq: I E 572 or I E 577
Investigation of the human interface to consumer and industrial systems and products, providing a basis for their design and evaluation. Discussions of human factors in the product design process: modeling the human during product use; usability; human factors methods in product design evaluation; user-device interface; safety, warnings, and instructions for products; considerations for human factors in the design of products for international use.

I E 577: Human Factors
(3-0) Cr. 3.
Prereq: I E 271 or graduate classification
Physical and psychological factors affecting human performance in systems. Signal detection theory, human reliability modeling, information theory, and performance shaping applied to safety, reliability, productivity, stress reduction, training, and human/equipment interface design. Laboratory assignments related to system design and operation.

I E 581: e-Commerce Systems Engineering
(Dual-listed with I E 481). (3-0) Cr. 3.
Prereq: I E 148
Design, analysis, and implementation of e-commerce systems. Information infrastructure, enterprise models, enterprise processes, enterprise views. Data structures and algorithms used in e-commerce systems, SQL, exchange protocols, client/server model, web-based views.

I E 582: Enterprise Modeling and Integration
(3-0) Cr. 3.
Prereq: 3 credits in information technology or information systems
The design and analysis of enterprise models to support information engineering of enterprise-wide systems. Representation of system behavior and structure including process modeling, information modeling, and conceptual modeling. Applications in enterprise application integration, enterprise resource planning systems, product data management systems, and manufacturing execution systems.

I E 583: Knowledge Discovery and Data Mining
(Dual-listed with I E 483). (3-0) Cr. 3.
Prereq: I E 148, I E 312, and STAT 231
Introduction to data warehouses and knowledge discovery. Techniques for data mining, including probabilistic and statistical methods, genetic algorithms and neural networks, visualization techniques, and mathematical programming. Advanced topics include web-mining and mining of multimedia data. Case studies from both manufacturing and service industries. A computing project is required.

I E 585: Requirements and Architecture Engineering
(3-0) Cr. 3.
Prereq: 3 credits in information technology or information systems
Principles and practices for requirements engineering as part of the product development process with emphasis on software systems engineering. Problem definition, problem analysis, requirements analysis, requirements elicitation, validation, specifications. Case studies using requirements engineering methods and techniques.

I E 588: Information Systems for Manufacturing
(3-0) Cr. 3.
Prereq: I E 148, I E 448
Design and implementation of systems for the collection, maintenance, and usage of information needed for manufacturing operations, such as process control, quality, process definition, production definitions, inventory, and plant maintenance. Topics include interfacing with multiple data sources, methods to utilize the information to improve the process, system architectures, and maintaining adequate and accurate data for entities internal and external to the enterprise to achieve best manufacturing practices.

I E 590: Special Topics
Cr. 1-3. Repeatable.
Advanced study of a research topic in the field of industrial engineering.

Courses for graduate students:

I E 601: Ph.D. Research Basics and Communications
Cr. R. Repeatable.
Prereq: Enrollment in Ph.D. program in Industrial Engineering.
Principles and practices for conducting research at the Ph.D. level, including problem definition, proposal writing, presentations, conference proceedings, paper preparation, and project management. Offered on a satisfactory-fail basis only.

I E 602: Ph.D. Research Conduct
Cr. R. Repeatable.
Prereq: Enrollment in Ph.D. program in Industrial Engineering
Responsible conduct of research at the Ph.D. level, including ethical issues in peer review, conflicts of interest, mentoring, human subjects and live animals, data management, and collaboration. Offered on a satisfactory-fail basis only.

I E 613: Stochastic Production Systems
(3-0) Cr. 3.
Prereq: I E 513
Modeling techniques to evaluate performance and address issues in design, control, and operation of systems. Markov models of single-stage make-to-order and make-to-stock systems. Approximations for non-Markovian systems. Impact of variability on flow lines. Open and closed queuing networks.

I E 631: Nonlinear Programming
(3-0) Cr. 3.
Prereq: I E 534
Develop nonlinear models, convex sets and functions, optimality conditions, Lagrangian duality, unconstrained minimization techniques. Constrained minimization techniques covering penalty and barrier functions, sequential quadratic programming, the reduced gradient method, nonlinear control concepts.

I E 632: Integer Programming
(3-0) Cr. 3.
Prereq: I E 534
Integer programming including cutting planes, branch and bound, and Lagrangian relaxation. Introduction to complexity issues and search-based heuristics.

I E 633: Stochastic Programming
(3-0) Cr. 3.
Prereq: I E 513 or STAT 447, I E 534 or equivalent
Mathematical programming with uncertain parameters; modeling risk within optimization; multi-stage recourse and probabilistically constrained models; solution and approximation algorithms including Benders decomposition and progressive hedging; and applications to planning, allocation and design problems.

I E 634: Computational Optimization
(3-0) Cr. 3.
Prereq: I E 534 or equivalent.
Theory, algorithm, and computer implementation of optimization models. Simplex, Benders decomposition, computational complexity, mixed integer linear program, linear program with complementarity constraints, inverse optimization, bilevel discrete optimization. CPLEX, Matlab, and Tomlab will be used for computer implementation.

I E 642: Simultaneous Engineering in Manufacturing Systems
(3-0) Cr. 3.
Prereq: I E 549 or M E 415
Current engineering methods for the product life cycle process. Feature-based design, computer-aided process planning, and data-driven product engineering.

I E 671: Research Practicum in Human Factors and Ergonomics
(3-0) Cr. 3. Repeatable.
Prereq: I E 571 or I E 577 or IE 572
Research topic development, literature evaluation, experimental design, use of bioinstrumentation, data collection, basic data interpretation, statistical analysis, manuscript preparation.

I E 681: Cognitive Engineering
(Cross-listed with HCI). (3-0) Cr. 3.
Prereq: I E 572 or I E 577 or PSYCH 516 or HCI/PSYCH 521 or equivalent
Provides an overview of human cognitive capabilities and limitations in the design of products, work places, and large systems. Contexts vary broadly and could range from simple use of mobile devices to an air-traffic control or nuclear plant command center. Course focuses on what we can infer about users' thoughts and feelings based on what we can measure about their performance and physiological state. Covers the challenge of designing automated systems.

I E 690: Advanced Topics
Cr. 1-3. Repeatable.
Prereq: Permission of the instructor
Advanced topics related to Ph.D. research in industrial engineering under the direction of the instructor.

I E 697: Engineering Internship
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of department
One Fall OR Spring semester combined with one summer, maximum per academic year. Excludes Fall/Spring combination. Professional work period. Offered satisfactory/fail basis only. (With Instructor Permission). Offered on a satisfactory-fail basis only.

I E 699: Research
Cr. arr. Repeatable.

Materials Engineering

For the undergraduate curriculum in materials engineering leading to the degree bachelor of science. This curriculum is accredited under the General Criteria and the Materials Engineering Program Criteria by the Engineering Accreditation Commission of ABET, http://www.abet.org/. Materials engineering is a broadly-based discipline relating the composition, structure, and processing of materials to their properties, uses and performance. Materials engineering includes a variety of traditional and modern technologies involving metals, ceramics, polymers, composites, and electronic materials.

Because of its interdisciplinary nature, career opportunities for materials engineers bridge all industrial and government sectors including: materials based technologies (materials production), communication/information technologies (semiconducting materials, fiber optics), medical/environmental technologies (biomedical, energy production, waste containment), nanotechnologies, consumer products (building and construction, durable goods), and transportation industries (automotive, aerospace).

The objectives of the materials engineering program are to produce graduates who:

- practice materials engineering in a broad range of industries including materials production, semiconductors, medical/environmental, consumer products, and transportation products
- engage in advanced study in materials and related or complementary fields

Graduates in materials engineering are able to apply scientific and engineering principles to select or design the best materials to solve engineering problems. They are also able to control the microstructure of materials through processing to optimize properties and performance. They are skilled in creative, independent problem solving under time and resource constraints. Graduates will have gained experience in materials engineering practice through cooperative work experience or internships in industry, national laboratories, or other funded research work. They will have hands-on skills with a broad range of modern materials processing and characterization equipment and methods.

A degree in materials engineering relies on a strong foundation of math, chemistry and physics. The core materials courses include fundamentals of materials, kinetics and thermodynamics, mechanical properties, computational methods, design, and professional practice experience. Students tailor their programs to their goals and interests through the selection of a specialization from the three available: ceramic materials, metallic materials and polymeric materials. Additional technical electives can be taken in other areas of interest. The breadth and depth of the program provide excellent preparation for both immediate entry into industry or further study in graduate school.

The department also offers a cooperative education program that combines classroom learning with work experience.

Curriculum in Materials Engineering

Administered by the Department of Materials Science and Engineering.

Leading to the degree bachelor of science.

Total credits required: 128 cr. Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.
International Perspectives: 3 cr. [1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirement:

ENGL 150	Critical Thinking and Communication (grade of C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (grade of C or better in this course)	3
LIB 160	Information Literacy	1
One of the following (must have a grade of C or better in this course)		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	

ENGL 314	Technical Communication	
JL MC 347	Science Communication	

General Education Electives: 15 cr.

Complete 12 cr. from approved list with a maximum of 9 cr. of 100-level courses[2]. Also complete the one selected course (3 cr.) from the four choices shown above to complete your communication proficiency requirement (must have a grade of C or better in this course).

Basic Program: 27 cr. [3]

A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 177	General Chemistry I	4
or CHEM 167	General Chemistry for Engineering Students	
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGR 101	Engineering Orientation	R
ENGR 160	Engineering Problems with Computer Applications Laboratory [3]	3
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Math and Physical Science: 18 cr.

CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 178L	Laboratory in College Chemistry II	1
MATH 265	Calculus III	4
MATH 267	Elementary Differential Equations and Laplace Transforms	4
PHYS 222	Introduction to Classical Physics II	5
Total Credits		18

Materials/Specialties Engineering Core: 44 cr.

A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Core/Specialization GPA):

MAT E 214	Structural Characterization of Materials	3
MAT E 215	Introduction to Materials Science and Engineering I	3
MAT E 215L	Introduction to Materials Science and Engineering I - Lab	1
MAT E 216	Introduction to Materials Science and Engineering II	3
MAT E 216L	Introduction to Materials Science and Engineering II - Lab	1
MAT E 311	Thermodynamics in Materials Engineering	3
MAT E 314	Kinetics and Phase Equilibria in Materials	3
MAT E 316	Computational Methods in Materials	3
MAT E 317	Introduction to Electronic Properties of Ceramic, Metallic, and Polymeric Materials	3
MAT E 413	Materials Design and Professional Practice I	3
MAT E 414	Materials Design and Professional Practice II	3
MAT E 418	Mechanical Behavior of Materials	3
Students must choose one from the three areas of specialization (12 cr.): ceramic, metallic and polymeric materials.		12
Total Credits		44

The options below meet that expectation by using the following specialization courses:

Ceramic Materials:

MAT E 321	Introduction to Ceramic Science	3
MAT E 322	Introduction to Ceramic Processing	3
MAT E 425	Glass Science and Engineering	3
MAT E 433	Advanced Electronic Materials	3

Metallic Materials:

MAT E 341	Metals Processing	3
MAT E 342	Structure/Property Relations in Nonferrous Metals	3
MAT E 443	Physical Metallurgy of Ferrous Alloys	3
MAT E 444	Corrosion and Failure Analysis	3

Polymeric Materials:

CHEM 331	Organic Chemistry I	3
MAT E 351	Introduction to Polymeric Materials	3
MAT E 453	Physical and Mechanical Properties of Polymers	3
MAT E 454	Polymer Composites and Processing	3

Other Courses: 24 cr.

E M 274	Engineering Statics	3
E M 324	Mechanics of Materials	3
Technical electives from list of materials courses [2]		6
Technical electives from approved departments [2]		9
Non-remedial course [2]		3
Total Credits		24

Seminar/Co-op/Internships

MAT E 401	Materials Engineering Professional Planning	R

Co-op and internships are optional

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S. diversity and international perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list (http://www.mse.iastate.edu/files/2014/12/UG-HANDBK2014revised-12-5-14_web.pdf).
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

Note: A Mat E student may take up to 9 credit hours from General Education and free electives on a P/NP basis, except for courses used to meet the diversity and international perspectives requirement. S/F courses (different from P/NP) will be considered for these requirements on a course-by-course basis.

See also: A 4-year plan of study grid showing course template by semester.

Materials Engineering, B.S.

First Year

Fall	Credits	Spring	Credits
CHEM 177	4	CHEM 178	3
CHEM 177L	1	CHEM 178L	1
ENGL 150	3	MATH 166	4
ENGR 101	0	Gen Ed Elective	3
ENGR 160	3	Gen Ed Elective	3
MATH 165	4	US Diversity	3
LIB 160	1		
	16		17

Second Year

Fall	Credits	Spring	Credits
MATH 265	4	MATH 267	4
MAT E 215	3	MAT E 214	3
MAT E 215L	1	MAT E 216	3
PHYS 221	5	MAT E 216L	1
ENGL 250	3	PHYS 222	5
	16		16

Third Year

Fall	Credits	Spring	Credits
MAT E 311	3	MAT E 314	3
MAT E 317	3	MAT E 316	3
E M 274	3	E M 324	3
Materials Elective	3	Specialization	3
Specialization	3	Technical Elective	3
		International Perspective	3
	15		18

Fourth Year

Fall	Credits	Spring	Credits
MAT E 401	0	MAT E 414	3
MAT E 413	3	Specialization	3
MAT E 418	3	Technical Elective	3
Specialization	3	Technical Writing	3
Materials Elective	3	Free Elective	3
Technical Elective	3		
	15		15

Areas of specialization:

- Ceramic Materials: 321, 322, 425, 433
- Metallic Materials: 341, 342, 443, 444
- Polymeric Materials: Chem 331, 351, 453, 454

Well qualified juniors in materials engineering who are interested in graduate study may apply for concurrent enrollment during their senior year in the Graduate College to simultaneously pursue both bachelor of science and master of science degrees. See Materials Science and Engineering for more information.

Courses primarily for undergraduates:

MAT E 101: Materials Science & Engineering Learning Community Seminar
Cr. R. F.
Prereq: Enrollment in Materials Science Engineering Learning Community
Introduction to the Materials Science & Engineering Department and resources available to support student success. Offered on a satisfactory-fail basis only.

MAT E 214: Structural Characterization of Materials
(2-2) Cr. 3. F.S.
Prereq: MAT E 215, credit or enrollment in PHYS 221
Structural characterization of ceramic, electronic, polymeric and metallic materials. Techniques include optical and electron microscopy, x-ray diffraction, and thermal analysis. Identification of materials type, microstructure, and crystal structure.

MAT E 215: Introduction to Materials Science and Engineering I
(3-0) Cr. 3. F.S.
Prereq: Math 165 AND (CHEM 177 or CHEM 167)
Materials Engineering majors only. Structure and properties of ceramic, electronic, polymeric and metallic materials, emphasizing differences based on structure and bonding. Phase equilibria and phase transformations. Only one of Mat E 215, 273, or 392 may count toward graduation.

MAT E 215L: Introduction to Materials Science and Engineering I - Lab
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in MAT E 215 or MAT E 273 or MAT E 392
Materials Engineering majors only. Laboratory exercise in materials.

MAT E 216: Introduction to Materials Science and Engineering II
(3-0) Cr. 3. F.S.
Prereq: MAT E 215, Chem 178, Credit or enrollment in PHYS 222
Materials Engineering majors only. Fundamentals of ceramic, polymeric, and composite materials; degradation, electronic, thermal, magnetic, and optical properties of materials. Materials for energy, biomaterials, and nanomaterials.

MAT E 216L: Introduction to Materials Science and Engineering II - Lab
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in 216
Materials Engineering majors only. Laboratory exercise in materials.

MAT E 220: Globalization and Sustainability
(Cross-listed with ANTHR, ENV S, GLOBE, M E, SOC, T SC). (3-0) Cr. 3. F.S.
An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.
Meets International Perspectives Requirement.

MAT E 273: Principles of Materials Science and Engineering
(3-0) Cr. 3. F.S.SS.
Prereq: Sophomore classification; CHEM 167 or CHEM 177; MATH 165
Introduction to the structure and properties of engineering materials. Structure of crystalline solids and imperfections. Atomic diffusion. Mechanical properties and failure of ductile and brittle materials. Dislocations and strengthening mechanisms. Phase equilibria, phase transformations, microstructure development, and heat treatment principles of common metallurgical systems including steels and aluminum alloys. Structure and mechanical properties of ceramic, polymeric and composite materials. Thermal properties of materials. Corrosion and degradation. Basic electronic properties of materials. Engineering applications. Only one of Mat E 215, 272, 273. or 392 may count toward graduation

MAT E 311: Thermodynamics in Materials Engineering
(3-0) Cr. 3. F.
Prereq: CHEM 178, credit or enrollment in MAT E 216, PHYS 222, and MATH 267
Basic laws of thermodynamics applied to phase equilibria, transformations, and reactions in multicomponent multiphase materials systems; thermodynamic descriptions of heterogeneous systems; binary and ternary phase diagrams; interfaces, surfaces, and defects.

MAT E 314: Kinetics and Phase Equilibria in Materials
(3-0) Cr. 3. S.
Prereq: MAT E 216, MAT E 311
Kinetic phenomena and phase equilibria relevant to the origins and stability of microstructure in metallic, ceramic and polymeric systems. Application of thermodynamics to the understanding of stable and metastable phase equilibria, interfaces and their effects on stability: defects and diffusion, empirical rate equations for transformation kinetics, driving forces and kinetics of nucleation, diffusional and diffusionless phase transformations.

MAT E 316: Computational Methods in Materials
(3-0) Cr. 3. S.SS.
Prereq: MAT E 215
Use of mathematical and statistical computer tools for materials design and analysis. Applications of statistical principles to problems concerned with materials. Computer-assisted design of experiments.

MAT E 317: Introduction to Electronic Properties of Ceramic, Metallic, and Polymeric Materials
(3-0) Cr. 3. F.
Prereq: MAT E 216 and PHYS 222
Materials Engineering majors only. Introduction to electronic properties of materials and their practical applications. Classical conduction models and electronic properties of metallic and ceramic materials. Elementary quantum mechanics and band theory of electron states in solids. Quantum theory of metallic conduction. Elementary semiconductor theory and devices. Polarization and dielectric properties of materials. Electron conduction in polymeric systems. Magnetic properties and applications of metals and ceramics.

MAT E 321: Introduction to Ceramic Science
(3-0) Cr. 3. F.
Prereq: MAT E 216
Ceramic crystal structures, defects, diffusion and transport. Phase equilibria and microstructures. Thermal, electronic, optical and magnetic properties of ceramics.

MAT E 322: Introduction to Ceramic Processing
(2-3) Cr. 3. S.
Prereq: MAT E 216, MAT E 321
Synthesis and characterization of ceramic powders. Colloidal phenomena, rheology of suspensions, ceramic forming methods, and drying. High temperature ceramic reactions, liquid and solid-state sintering, grain growth, microstructure development. Processing/microstructure/property relationships.

MAT E 332: Semiconductor Materials and Devices
(Cross-listed with E E). (3-0) Cr. 3. S.
Prereq: PHYS 222; MAT E majors: MAT E 317; CPR E and E E majors: E E 230
Introduction to semiconductor material and device physics. Quantum mechanics and band theory of semiconductors. Charge carrier distributions, generation/recombination, transport properties. Physical and electrical properties and fabrication of semiconductor devices such as MOSFETs, bipolar transistors, laser diodes and LED's.

MAT E 334: Electronic & Magnetic Properties of Metallic Materials
(3-0) Cr. 3. S.
Prereq: MAT E 317
Electronic conduction in metals and the properties of conducting materials. Quantum mechanical behavior of free electrons and electrons in potentials wells, bonds and lattices. Development of the band theory of electron states in solids and the Free and Nearly Free Electron models. Density-of-states in energy bands and the Fermi-Dirac statistics of state occupancy. Quantum mechanical model of metallic conduction; Brillouin zones and Fermi surfaces. Additional topics include the thermal properties of metals, electron phase transitions in metallic alloys and the BCS theory of superconductivity. Classical and quantum mechanical treatment of the origins of magnetism in materials; orbital and spin angular momentum. Theory of magnetic behavior in dia-, para-magnetic, ferromagnetic materials.

MAT E 341: Metals Processing
(2-2) Cr. 3. F.
Prereq: 215 or 273 or 392, Mat E majors only
Theory and practice of metal processing, including casting; powder metallurgy; additive manufacturing; rolling; forging; extrusion; drawing; material removal; joining; surface modification; and heat treatment. Use of processing software.

MAT E 342: Structure/Property Relations in Nonferrous Metals
(3-0) Cr. 3. S.
Prereq: MAT E 215 or 273 or 392
Processing of metals and alloys to obtain desired mechanical properties by manipulation of their microstructure and composition of constituent phase(s). Relevance of defects to mechanical properties, plastic flow. Strengthening mechanisms in metals and alloys. Microstructure, heat treatment and mechanical properties of engineering alloys. Metal-matrix composites.

MAT E 348: Solidification Processes
(Cross-listed with I E). (2-2) Cr. 3. S.
Prereq: I E 248 and MAT E 273, or MAT E 215
Theory and applications related to metal casting, welding, polymer processing, powder metallurgy, and composites manufacturing, and related rapid manufacturing processes.

MAT E 351: Introduction to Polymeric Materials
(3-0) Cr. 3. S.
Prereq: MAT E 216, CHEM 331, credit or enrollment in Mat E 311
Introduction to polymeric materials, synthesis, structure and properties. Relationship between polymer composition, processing and properties.

MAT E 362: Principles of Nondestructive Testing
(Cross-listed with E M). (3-0) Cr. 3. S.
Prereq: PHYS 112 or PHYS 222
Radiography, ultrasonic testing, magnetic particle inspection, eddy current testing, dye penetrant inspection, and other techniques. Physical bases of tests, materials to which applicable, types of defects detectable, calibration standards, and reliability safety precautions.

MAT E 362L: Nondestructive Testing Laboratory
(Cross-listed with E M). (0-3) Cr. 1. S.
Prereq: Credit or enrollment in MAT E 362
Application of nondestructive testing techniques to the detection and sizing of flaws in materials and to the characterization of material's microstructure. Included are experiments in hardness, dye penetrant, magnetic particle, x-ray, ultrasonic and eddy current testing. Field trips to industrial laboratories.

MAT E 370: Toying with Technology
(Cross-listed with CPR E). (2-2) Cr. 3. F.S.
Prereq: C I 201 or C I 202
A project-based, hands-on learning course. Technology literacy, appreciation for technological innovations, principles behind many technological innovations, hands-on laboratory experiences based upon simple systems constructed out of LEGOs and controlled by small microcomputers. Future K-12 teachers will leave the course with complete lesson plans for use in their upcoming careers.

MAT E 391: Introduction to US Women's roles in Industry and Preparation for Summer Study
(3-0) Cr. 3. S.
Introduction to the historical role of women as related to US industry, family and community with emphasis on the years 1830 - 1945, but also related to the current climate. Topics completed in 392 with arranged lectures at Brunel University. Orientation for Brunel summer study program. Offered on a satisfactory-fail basis only. Credit for graduation allowable only upon completion of Mat E 392.
Meets U.S. Diversity Requirement

MAT E 392: Principles of Materials Science and Engineering
(3-0) Cr. 3. SS.
Prereq: MAT E 391, CHEM 167 or CHEM 177
Structure and properties of ceramic, electronic, polymeric and metallic materials, emphasizing differences based on structure and bonding. Phase equilibria and phase transformations. Taught on Brunel University campus. Only one of MAT E 215, 273, or 392 may count toward graduation.
Meets International Perspectives Requirement.

MAT E 394: Topics in Sustainable Engineering in Italy
(3-0) Cr. 3. S.
Prereq: Chem 167 or Chem 177
Fundamentals of sustainable engineering related to biofuels. Basics of food and biofuel chemistry and fluid dynamics. Preparation course for Italy as a case study for food and sustainable engineering. Orientation for summer study abroad program in Torino, Italy. Credit for graduation allowable only upon completion of the following summer's offering of Mat E 316 taught in Italy, along with additional sustainability lessons/tours.

MAT E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

MAT E 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

MAT E 401: Materials Engineering Professional Planning
Cr. R. F.
Prereq: Senior classification in materials engineering
Preparation for a career in materials engineering or graduate school; experiential learning, resumes, interviewing, Myers-Briggs Type Indicator, leadership, international opportunities, professional ethics, graduate school preparation and opportunities, and alternative career paths (med school, law school, etc.). Offered on a satisfactory-fail basis only.

MAT E 413: Materials Design and Professional Practice I
(2-2) Cr. 3. F.S.
Prereq: Senior status in Mat E
Fundamentals of materials engineering design, information sources, team behavior, professional preparation, quantitative design including finite-element analysis and computer aided design, materials selection, informatics and combinatorial methods. Analysis of design problems, development of solutions, selected case studies. Oral presentation skills. Preparations for spring project.

MAT E 414: Materials Design and Professional Practice II
(2-2) Cr. 3. F.S.
Prereq: Senior status in Mat E
Integration of materials processing, structure/composition, properties and performance principles in materials engineering problems. Multi-scale design of materials, materials processing, case studies including cost analysis, ethics, risk and safety. Team projects specified by either industry or academic partners. Written and oral final project reports.

MAT E 418: Mechanical Behavior of Materials
(3-0) Cr. 3. F.
Prereq: MAT E 216
Mechanical behavior of ceramics, metals, polymers, and composites. Relationships between materials processing and atomic aspects of elasticity, plasticity, fracture, and fatigue. Life prediction, stress-and failure analysis.

MAT E 425: Glass Science and Engineering
(2-3) Cr. 3. F.
Prereq: MAT E 216, MAT E 321
Composition, structure, properties manufacturing, and applications of inorganic glasses. Mechanical, structural, thermal, optical, ionic, electronic, and biological applications of inorganic glasses, especially silicate glasses. Contemporary topics in glass science and engineering such as glass optical fiber communication and flat panel display technologies. Laboratory exercises in the preparation and characterization of silicate glasses.

MAT E 432: Microelectronics Fabrication Techniques
(Dual-listed with M S E 532). (Cross-listed with E E). (2-4) Cr. 4.
Prereq: credit or enrollment in E E 332
Techniques used in modern integrated circuit fabrication, including diffusion, oxidation, ion implantation, lithography, evaporation, sputtering, chemical-vapor deposition, and etching. Process integration. Process evaluation and final device testing. Extensive laboratory exercises utilizing fabrication methods to build electronic devices. Use of computer simulation tools for predicting processing outcomes. Recent advances in processing CMOS ICs and micro-electro-mechanical systems (MEMS).

MAT E 433: Advanced Electronic Materials
(2-3) Cr. 3. S.
Prereq: MAT E 317
Charged point defects and formation equations. Non-stoichiometric conductors, dielectric, ferroelectric, and piezoelectric materials and applications. Optical properties, optical spectra of materials, optoelectronic devices. Magnetic and superconducting materials. Contemporary topics in advanced ceramics.

MAT E 443: Physical Metallurgy of Ferrous Alloys
(2-3) Cr. 3. S.
Prereq: 214, 216, 314
Production and processing of ferrous metals. Extraction of pig iron from ore. Steelmaking processes. Equilibrium and nonequilibrium phases in the Fe-C system. Properties and processing of cast irons, plain carbon and alloy steels, stainless and specialty steels. Transformation diagrams, hardenability, and surface treatments. Continuous casting, forging, hot rolling, quenching, and tempering as they apply to ferrous materials. Cost and mechanical performance considerations in cast iron and steel selection and heat treatment.

MAT E 444: Corrosion and Failure Analysis
(2-2) Cr. 3. S.
Prereq: MAT E 215 or 273 or 392 and credit or enrollment in MAT E 418
Corrosion and corrosion control of metallic systems. Corrosion fundamentals, classification of different types of metallic corrosion, corrosion properties of various engineering alloys, corrosion control. Failure analysis. Characteristics of common types of metallic failures, case studies of failures, designing to reduce failure risk.

MAT E 449: Structural Health Monitoring
(Dual-listed with M S E 549). (Cross-listed with C E). (3-0) Cr. 3.
Prereq: Senior classification in Engineering or permission of instructor
Introductory and advanced topics in structural health monitoring (SHM) of aeronautical, civil, and mechanical systems. Topics include sensors, signal processing in time and frequency domains, data acquisition and transmission systems, design of integrated SHM solutions, nodestructive evaluation techniques, feature extraction methods, and cutting edge research in the field of SHM. Graduate students will have a supervisory role to assist students in 449 and an additional design project or more in-depth analysis and design.

MAT E 453: Physical and Mechanical Properties of Polymers
(2-3) Cr. 3. F.
Prereq: MAT E 351
Overview of polymer chemical composition, microstructure, thermal and mechanical properties, rheology, and principles of polymer materials selection. Intensive laboratory experiments include chemical composition studies, microstructural characterization, thermal analysis, and mechanical testing.

MAT E 454: Polymer Composites and Processing
(Dual-listed with M S E 554). (3-0) Cr. 3. S.
Prereq: MAT E 351
Basic concepts in polymer composites, blends, and block copolymers. Phase separation and miscibility, microstructures and mechanical behavior. Fiber reinforced and laminated composites. Viscosity, rheology, viscoelasticity of polymers. Polymer melt processing methods such as injection molding and extrusion; selection of suitable processing methods and their applications.

MAT E 456: Biomaterials
(Dual-listed with M S E 556). (Cross-listed with B M E). (3-0) Cr. 3. F.
Prereq: MAT E 216 or MAT E 273 or MAT E 392
Presentation of the basic chemical and physical properties of biomaterials, including metals, ceramics, and polymers, as they are related to their manipulation by the engineer for incorporation into living systems. Role of microstructure properties in the choice of biomaterials and design of artificial organs, implants, and prostheses.

MAT E 457: Chemical and Physical Metallurgy of Rare Earth Metals
(Dual-listed with M S E 557). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MAT E 311 or CHEM 325 AND CHEM 324 or PHYS 322
Electronic configuration, valence states, minerals, ores, beneficiation, extraction, separation, metal preparation and purification. Crystal structures, phase transformations and polymorphism, and thermochemical properties of rare earth metals. Chemical properties: inorganic and organometallic compounds, alloy chemistry, nature of the chemical bonding. Physical properties: mechanical and elastic properties, magnetic properties, resistivity, and superconductivity.

MAT E 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, AER E, B M E, CPR E, E E, ENGR, I E, M E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

MAT E 467: Multidisciplinary Engineering Design II
(Cross-listed with AER E, CPR E, E E, ENGR, I E, M E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: Student must be within two semesters of graduation or receive permission of instructor.
Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

MAT E 481: Computational Modeling of Materials
(Dual-listed with M S E 581). (3-0) Cr. 3. F.
Prereq: Math 265 and (MatE 311 or ChE 381 or Chem 325 or Phys 304)
Introduction to the basic methods used in the computational modeling and simulation of materials, from atomistic simulations to methods at the mesoscale. Students will be expected to develop and run sample programs. Topics to be covered include, for example, electronic structure calculations, molecular dynamics, Monte Carlo, phase-field methods, etc.

MAT E 488: Eddy Current Nondestructive Evaluation
(Dual-listed with M S E 588). (Cross-listed with E E). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 265 and (MAT E 216 or MAT E 273 or E E 311 or PHYS 364)
Electromagnetic fields of various eddy current probes. Probe field interaction with conductors, cracks and other material defects. Ferromagnetic materials. Layered conductors. Elementary inversion of probe signals to characterize defects. Special techniques including remote-field, transient, potential drop nondestructive evaluation and the use of Hall sensors. Practical assignments using a 'virtual' eddy current instrument will demonstrate key concepts.

MAT E 490: Independent Study
Cr. arr. Repeatable.
Investigation of individual research or special topics.

MAT E 490C: Independent Study: Approved Student Submitted Proposal
Cr. arr. Repeatable. F.S.SS.
Prereq: permission of department
Independent study that is being proposed to be used toward graduation or minor requirements. This requires a proposal to the department's Curriculum Committee before the semester starts.

MAT E 490H: Independent Study: Senior Honors Project
Cr. arr. F.S.SS.
Prereq: permission of department
Independent study that is being proposed to be used for a Senior Honors Project (2 credits) and possibly for extra credits toward graduation or minor requirements. This requires a proposal to the department's Curriculum Committee before the semester starts.

MAT E 490R: Independent Study: Research
Cr. arr. F.S.SS.
Prereq: permission of department
Independent study that is being proposed strictly to gain research experience and the credits will not be used toward graduation or minor requirements. This requires a proposal to the department's Curriculum Committee before the semester starts.

Materials Science and Engineering

Graduate Study

Built on a foundation of thermodynamics, kinetics of phase transformations, mechanical behavior, physical properties, solid state science, and the structure and chemistry of materials, the graduate program offers advanced studies in many areas of materials science and engineering, including the design and control of materials for structural, electronic, photonic, magnetic, optical, and biological functionality. Graduates of the program have a fundamental understanding of the critical aspects of the field and how they are applied to real materials systems. The program is highly flexible and research-oriented, where students work carefully with their major professor in tailoring the various academic and research components to meet their interests.

With the ability to address complex problems in materials science while considering the various constraints inherent to both academic and industrial environments, our graduates are well prepared for a wide range of academic and research-related careers. They are skilled in carrying out independent and collaborative research, able to communicate effectively in formal and informal settings, and are proficient at writing persuasive technical articles and grant proposals.

The department boasts excellent facilities for academic materials research, maintaining a wide range of faculty laboratories across the ISU campus. In addition, departmental research is highly integrated with the operation of several Research Centers, such as the Ames Laboratory, the Center for Nondestructive Evaluation, the Microelectronics Research Center, and the Center for Advanced Technology Development. These laboratories offer excellent resources and opportunities for graduate student research.

Graduate Majors

The department offers work toward the following advanced degrees: Master of Engineering in Materials Science and Engineering, Master of Science in Materials Science and Engineering and Doctor of Philosophy in Materials Science and Engineering.

Prerequisite to major graduate work is completion of an undergraduate curriculum in physical science, biological science, or engineering discipline. Graduate students from disciplines other than materials science and engineering may expect that supplemental coursework will be needed, in addition to the required graduate coursework. Well qualified students (juniors) enrolled in the undergraduate materials engineering program at Iowa State University can apply to the Graduate College for admission to the concurrent enrollment program, where students may simultaneously pursue both master of science and bachelor of science degrees.

The requirements for the M. Eng., M.S. and Ph.D. degrees are established by the student's program of study committee within the established guidelines of the Graduate College. Minimum requirements include coursework, research (M.S. and Ph.D. only), proposal (M.S. and Ph.D. only), preliminary oral examination (Ph.D. only), dissertation (M.S. and Ph.D. only), and a final oral examination (M.S. and Ph.D. only). Academic coursework requirements include 31 credits for the M.Eng. degree, 21 credits for the M.S. degree and 32 credits for the Ph.D., with additional specific rules for choices available from the department.

There are no foreign language requirements for any of the graduate degrees administered by the Department of Materials Science and Engineering. Graduate students wishing to declare a formal minor in materials science and engineering will have at least one materials science and engineering faculty member serving on their program of study committee. For the M. Eng., M.S. and Ph.D. degrees, they will take a minimum of 8 materials science and engineering course credits for the M. Engr. or M.S. degrees and a minimum of 12 materials science and engineering course credits for the Ph.D. degree.

Courses primarily for graduate students, open to qualified undergraduates:

M S E 510: Fundamentals of Structure and Chemistry of Materials
(3-0) Cr. 3. F.
Prereq: MATH 165, PHYS 221, and CHEM 167
Geometric and algebraic representations of symmetry. Pair distribution function. Structure, chemistry, and basic properties of covalent, ionic, and metallic solids, glasses and liquids, and polymers. Interactions of materials with particles and waves. Relationships between direct and reciprocal spaces. The kinematical theory of diffraction, with an introduction to the dynamical theory.

M S E 519: Magnetism and Magnetic Materials
(Cross-listed with E E). (3-0) Cr. 3. F.
Prereq: E E 311 or MAT E 317 or PHYS 364
Magnetic fields, flux density and magnetization. Magnetic materials, magnetic measurements. Magnetic properties of materials. Domains, domain walls, domain processes, magnetization curves and hysteresis. Types of magnetic order, magnetic phases and critical phenomena. Magnetic moments of electrons, theory of electron magnetism. Technological application, soft magnetic materials for electromagnets, hard magnetic materials, permanent magnets, magnetic recording technology, magnetic measurements of properties for materials evaluation.

M S E 520: Thermodynamics and Kinetics in Multicomponent Materials
(3-0) Cr. 3. F.
Prereq: MAT E 311 or CHEM 321, MATH 266 or MATH 267
A review of the fundamental principles of heat, work, basic thermodynamic relations, and criteria for equilibrium. Analytical treatments for the thermodynamic description of multicomponent chemical solutions and reacting systems are developed and employed to predict phase equilibria in materials systems. Builds on the thermodynamic construction to treat the kinetics of chemical reactions and phase transformations. Topics include general first order and second order transitions, along with chemical diffusion. Detailed examples involving nucleation and diffusion limited growth, spinodal decomposition, martensitic transformations, magnetic and electric transitions, and glass formation will be considered.

M S E 521: Mechanical Behavior and Manufacturing of Polymers and Composites
(Cross-listed with M E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M E 324 or MAT E 272 and E M 324
Effect of chemical structure and morphology on properties. Linear viscoelasticity, damping and stress relaxation phenomena. Structure and mechanics of filler and fiber reinforced composites. Mechanical properties and failure mechanisms. Material selection and designing with polymers. Processing of polymer and composite parts.

M S E 530: Solid State Science
(3-0) Cr. 3. S.
Prereq: MAT E 334 or E E 332 or PHYS 322
Development of a quantitative description of the electronic structure of solids starting with fundamentals of atoms, atomic bonding, basic crystallography, and band theory of solids. Continuum properties of solids in response to electromagnetic fields and thermal gradients. Quantitative description of the atomistic properties of solids through electron-electron interactions, electron-phonon interactions, and dipole interactions.

M S E 532: Microelectronics Fabrication Techniques
(Dual-listed with MAT E 432). (Cross-listed with E E). (2-4) Cr. 4.
Prereq: credit or enrollment in E E 332
Techniques used in modern integrated circuit fabrication, including diffusion, oxidation, ion implantation, lithography, evaporation, sputtering, chemical-vapor deposition, and etching. Process integration. Process evaluation and final device testing. Extensive laboratory exercises utilizing fabrication methods to build electronic devices. Use of computer simulation tools for predicting processing outcomes. Recent advances in processing CMOS ICs and micro-electro-mechanical systems (MEMS).

M S E 540: Mechanical Behavior of Materials
(3-0) Cr. 3. F.
Prereq: MAT E 418, MATH 266 or MATH 267
Mechanical behavior of materials with emphasis on micromechanics of deformation in three generic regimes: elasticity, plasticity, and fracture. A materials science approach is followed to understand and model the mechanical behavior that combines continuum mechanics, thermodynamics, kinetics, and microstructure. Some topics include elastic properties of materials, permanent deformation mechanisms at different temperatures (e.g., via dislocation motion and creep), and fracture in ductile and brittle materials. Specific classes of materials that are studied: metals, ceramics, polymers, glasses and composites.

M S E 549: Structural Health Monitoring
(Dual-listed with MAT E 449). (Cross-listed with C E). (3-0) Cr. 3.
Prereq: Senior classification in Engineering or permission of instructor
Introductory and advanced topics in structural health monitoring (SHM) of aeronautical, civil, and mechanical systems. Topics include sensors, signal processing in time and frequency domains, data acquisition and transmission systems, design of integrated SHM solutions, nodestructive evaluation techniques, feature extraction methods, and cutting edge research in the field of SHM. Graduate students will have a supervisory role to assist students in 449 and an additional design project or more in-depth analysis and design.

M S E 550: Nondestructive Evaluation
(Cross-listed with E M). (3-2) Cr. 4. S.
Prereq: E M 324, MATH 385
Principles of five basic NDE methods and their application in engineering inspections. Materials behavior and simple failure analysis. NDE reliability, and damage-tolerant design. Advanced methods such as acoustic microscopy, laser ultrasonics, thermal waves, and computed tomography are analyzed. Computer-based experiments on a selection of methods: ultrasonics, eddy currents, x-rays are assigned for student completion.

M S E 551: Characterization Methods in Materials Science
(2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MAT E 214
Characterization of ceramic, metal, polymer and glassy materials using modern analytical techniques. Spectroscopic (IR, Raman, UV/VIS/NIR, and NMR), thermal (DSC, DTA/TGA, and DMA) methods, mechanical and rheological testing, magnetic and electrical characterization, and powder characterization.

M S E 552: Scanning and Auger Electron Microscopy
(2-3) Cr. 3. F.
Prereq: PHYS 222
Characterization of materials using scanning electron microscope (SEM), electron microprobe, and auger spectrometer. Compositional determination using energy and wavelength dispersive x-ray and Auger spectroscopies. Specimen preparation. Laboratory covers SEM operation.

M S E 554: Polymer Composites and Processing
(Dual-listed with MAT E 454). (3-0) Cr. 3. S.
Prereq: MAT E 351
Basic concepts in polymer composites, blends, and block copolymers. Phase separation and miscibility, microstructures and mechanical behavior. Fiber reinforced and laminated composites. Viscosity, rheology, viscoelasticity of polymers. Polymer melt processing methods such as injection molding and extrusion; selection of suitable processing methods and their applications.

M S E 556: Biomaterials
(Dual-listed with MAT E 456). (3-0) Cr. 3. F.
Prereq: MAT E 216 or MAT E 273 or MAT E 392
Presentation of the basic chemical and physical properties of biomaterials, including metals, ceramics, and polymers, as they are related to their manipulation by the engineer for incorporation into living systems. Role of microstructure properties in the choice of biomaterials and design of artificial organs, implants, and prostheses.

M S E 557: Chemical and Physical Metallurgy of Rare Earth Metals
(Dual-listed with MAT E 457). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MAT E 311 or CHEM 325 AND CHEM 324 or PHYS 322
Electronic configuration, valence states, minerals, ores, beneficiation, extraction, separation, metal preparation and purification. Crystal structures, phase transformations and polymorphism, and thermochemical properties of rare earth metals. Chemical properties: inorganic and organometallic compounds, alloy chemistry, nature of the chemical bonding. Physical properties: mechanical and elastic properties, magnetic properties, resistivity, and superconductivity.

M S E 564: Fracture and Fatigue
(Cross-listed with AER E, E M, M E). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324 and either MAT E 216 or MAT E 273 or MAT E 392.
Undergraduates: Permission of instructor
Materials and mechanics approach to fracture and fatigue.
Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue.

M S E 569: Mechanics of Composite and Combined Materials
(Cross-listed with AER E, E M). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E M 324
Mechanics of fiber-reinforced materials. Micromechanics of lamina. Macromechanical behavior of lamina and laminates. Strength and interlaminar stresses of laminates. Failure criteria. Stress analysis of laminates. Thermal moisture and residual stresses. Joints in composites.

M S E 581: Computational Modeling of Materials
(Dual-listed with MAT E 481). (3-0) Cr. 3. F.
Prereq: Math 265 and (MatE 311 or ChE 381 or Chem 325 or Phys 304)
Introduction to the basic methods used in the computational modeling and simulation of materials, from atomistic simulations to methods at the mesoscale. Students will be expected to develop and run sample programs. Topics to be covered include, for example, electronic structure calculations, molecular dynamics, Monte Carlo, phase-field methods, etc.

M S E 588: Eddy Current Nondestructive Evaluation
(Dual-listed with MAT E 488). (Cross-listed with E E). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 265 and (MAT E 216 or MAT E 273 or E E 311 or PHYS 364)
Electromagnetic fields of various eddy current probes. Probe field interaction with conductors, cracks and other material defects. Ferromagnetic materials. Layered conductors. Elementary inversion of probe signals to characterize defects. Special techniques including remote-field, transient, potential drop nondestructive evaluation and the use of Hall sensors. Practical assignments using a 'virtual' eddy current instrument will demonstrate key concepts.

M S E 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor

M S E 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

M S E 601: Materials Seminar
(1-0) Cr. 1. Repeatable. F.S.
Prereq: MSE Graduate Student Status
Seminar course - presentations given on a weekly basis by leading U.S. and International researchers that are experts in their respective fields closely related to Materials Science. Offered on a satisfactory-fail basis only.

M S E 620: Fundamentals of Phase Transformations
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: M S E 520
Explores various advanced theoretical treatments of the energetics and kinetics of multicomponent materials. Topics include analytical and computational descriptions of thermodynamic quantities, experimental measurement of essential physical properties, analytical and computational treatments of kinetic processes, and the use of theoretical predictions of phase equilibria and evolution in materials systems.

M S E 630: Physical Properties of Solids
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: M S E 530
Advanced course in the behavior of solids within the framework of solid state physics and chemistry. Includes magnetic, dielectric, transport, and optical phenomena in solids. Influence of phase transformations and crystal symmetry on the physical properties.

M S E 651: Powder Diffraction Methods
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M S E 510
Advanced structural characterization of materials using powder diffraction. Production of X-ray and neutron radiation. Review of symmetry, group and kinematical theories of diffraction. Mathematical and computational backgrounds of powder diffraction data. Introduction to single crystal diffraction methods, origin of powder diffraction pattern, history of the technique. Modern powder diffraction methods. Indexing of powder diffraction patterns, figures of merit, precise lattice parameters. Phase problem, determining crystal structures from symmetry and geometry, Patterson, direct and Fourier methods. Rietveled method, precise crystal structures: atomic parameters, qualitative and quantitative phase identification, preferred orientation, grain size, strain, residual stress, order-disorder. Powder diffraction at non-ambient conditions. Applications of powder diffraction: data bases, phase transformations, phase diagrams, local structures, magnetism.

M S E 652: Transmission Electron Microscopy
(2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M S E 510
Theory and application of transmission electron microscopy to inorganic materials. Specimen preparation, selected area and convergent beam electron diffraction, bright field/dark field/high resolution imaging. Compositional analysis using X-ray and electron energy loss spectroscopy.

M S E 690: Advanced Topics in Materials Science
Cr. arr. Repeatable.
Prereq: Permission of instructor

M S E 697: Engineering Internship
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of department, graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

M S E 699: Research
Cr. arr. Repeatable.

Mechanical Engineering

For the undergraduate curriculum in mechanical engineering leading to the degree bachelor of science. This curriculum is accredited under the General Criteria and Mechanical Engineering Program Criteria by the Engineering Accreditation Commission of ABET, http://www.abet.org/.

Mechanical engineers apply the principles of motion, energy, and force to create mechanical solutions to technological problems, thereby realizing devices and systems that make life better. About one-fifth of all engineers practicing today are mechanical engineers. Their skills are used in research, development, design, testing, production, technical sales, technical management, as well as medicine, law, and business. Mechanical engineers are characterized by personal creativity, breadth of knowledge, and versatility. For these reasons they are found to function and thrive as valuable members and leaders of multidisciplinary teams. Mechanical engineers are employed in a wide range of industries; examples include agricultural/heavy equipment, biomedical, consulting, energy and power, manufacturing, product design and transportation.

The mechanical engineering curriculum at Iowa State University is dedicated to preparing students for productive careers in the state, nation, and the world and has the following objectives:

1. Graduates will have utilized a foundation in engineering and science to improve lives and livelihoods through a successful career in mechanical engineering or other fields.

2. Graduates will have become effective collaborators and innovators, leading or participating in efforts to address social, technical and business challenges.
3. Graduates will have engaged in life-long learning and professional development through self-study, continuing education or graduate and professional studies in engineering, business, law or medicine.

The mechanical engineering curriculum is organized to provide students with a broad foundation in mathematics, science, engineering, social science and humanities. The mechanical engineering disciplinary areas emphasized are design and optimization, dynamic systems and control, materials processing and mechanics, and thermo-fluid sciences. Elective courses provide additional emphasis in terms of the student's unique educational goals, whether they include immediate entry into industry or further professional or graduate study.

A major focus throughout the mechanical engineering curriculum is a series of experiences that emphasize engineering design, culminating in a capstone design experience in the senior year. Students will develop engineering judgment through open-ended problems that require establishment of reasonable engineering assumptions and realistic constraints. Development of skills needed to be independent, creative thinkers, effective communicators, and contributing team members is emphasized throughout the curriculum. Students also develop an understanding of the societal context in which they will practice engineering, including environmental, legal, aesthetic, and human aspects.

Students are encouraged to participate in the cooperative education program or to obtain engineering internships, both domestically and abroad. Study abroad is encouraged, and the department has exchange programs with several universities around the world. These experiences help students to round out their education and to better prepare for careers in the increasingly global practice of engineering.

Curriculum in Mechanical Engineering

Administered by the Department of Mechanical Engineering. Leading to the degree bachelor of science.

Total credits required: 129 cr.
Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.
International Perspectives: 3 cr. [1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirement:

ENGL 150	Critical Thinking and Communication (minimum grade of C)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (minimum grade of C)	3
LIB 160	Information Literacy	1
Choose one of the following communication courses (minimum grade of C)		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
SP CM 212	Fundamentals of Public Speaking	

General Education Electives: 15 cr.

Choose one course from the following:		3
ECON 101	Principles of Microeconomics	
or ECON 102	Principles of Macroeconomics	
Social Science [2]		3
Humanities		6
Humanities or Social Science [2]		3
Total Credits		15

Basic Program: 27 cr.
A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 167	General Chemistry for Engineering Students	4
or CHEM 177	General Chemistry I	
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGR 101	Engineering Orientation	R
M E 160	Mechanical Engineering Problem Solving with Computer Applications [3]	3
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Mechanical Engineering Foundations: 25 cr.
A minimum GPA of 2.00 for the complete group of Foundations courses is required before students are permitted to enroll in the following Mechanical Engineering Core courses (please note that transfer course grades will not be calculated into the ME Foundations GPA): ME 324, ME 325, ME 332, ME 335, ME 370 and ME 421.

MATH 265	Calculus III	4
4 credits from the following:		4
MATH 267	Elementary Differential Equations and Laplace Transforms	

MATH 266 & MATH 268	Elementary Differential Equations and Laplace Transforms	
PHYS 222	Introduction to Classical Physics II	5
E M 274	Engineering Statics	3
E M 324	Mechanics of Materials	3
MAT E 273	Principles of Materials Science and Engineering	3
M E 231	Engineering Thermodynamics I	3
Total Credits		25

Mechanical Engineering Core: 38 cr.

A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Core GPA):

E M 345	Engineering Dynamics	3
E E 442	Introduction to Circuits and Instruments	2
E E 448	Introduction to AC Circuits and Motors	2
M E 270	Introduction to Mechanical Engineering Design	3
M E 324	Manufacturing Engineering	3
M E 324L	Manufacturing Engineering Laboratory	1
M E 325	Mechanical Component Design	3
M E 332	Engineering Thermodynamics II	3
M E 335	Fluid Flow	4
M E 370	Engineering Measurements	3
M E 421	System Dynamics and Control	4
M E 436	Heat Transfer	4
One Senior Capstone Design course from the following		3
M E 415	Mechanical Systems Design	
M E 442	Heating and Air Conditioning Design	
M E 466	Multidisciplinary Engineering Design	
M E 486	Appropriate Technology Design	
Total Credits		38

Other Remaining Courses: 24 cr.

Complete 15 cr. Technical Electives [2]		15
M E 170	Engineering Graphics and Introductory Design	3
STAT 305	Engineering Statistics	3
Complete one of the following communication courses with a minimum grade of C.		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
SP CM 212	Fundamentals of Public Speaking	
Total Credits		24

Seminar/Co-op/Internships:

M E 202	Mechanical Engineering - Professional Planning	R
Co-op/Internship optional		

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program.
   U.S. diversity and international perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved list of technical electives (http://www.me.iastate.edu/students/degrees-and-programs/bs-degree/degree-requirements/tech-electives) and general education electives (http://www.me.iastate.edu/students/degrees-and-programs/bs-degree/degree-requirements/general-education). Note: electives used to meet graduation requirements may not be taken Pass-Not Pass (P-NP).
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

Transfer Credit Requirements

The Mechanical Engineering Department requires a grade of a C or better for any transfer credit course that is applied to the degree program. The degree program must include a minimum of 15 credits taken from courses offered through the Mechanical Engineering Department at Iowa State University. Of these 15 credits, 3 must be from one of the senior capstone design courses. The remaining 12 credits may be from the core curriculum program (if a student is deficient in these courses) or from 400-level M E technical electives. No more than 3 credits of independent study shall be applied to meet the 12 credit requirement.

See also: A 4-year plan of study grid showing course template by semester.

Energy Systems Minor

http://www.me.iastate.edu/energy-systems-minor/

The Energy Systems minor is administered by the mechanical engineering department and is open to all undergraduates in the College of Engineering. The minor may be earned by completing 15 credits from the following courses. The complete list of approved elective courses can be found here (http://www.me.iastate.edu/energy-systems-minor).

Required courses		
ECON 380	Energy, Environmental and Resource Economics	3
E E 351	Analysis of Energy Systems	3
Electives: Choose from a list of approved courses		9
Total Credits		15

The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

Nuclear Engineering Minor

http://www.me.iastate.edu/students/degrees-and-programs/engineering-minors/

The nuclear engineering minor is administered by the mechanical engineering department and is open to all undergraduates. The minor may be earned by completing 15 credits from the following courses. A complete list of approved courses can be found here (http://www.me.iastate.edu/students/degrees-and-programs/engineering-minors).

Required courses		
NUC E 401	Nuclear Radiation Theory and Engineering	3
Electives: Choose from a list of approved courses.		12
Total Credits		15

The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

Mechanical Engineering, B.S.

First Year

Fall	Credits	Spring	Credits
CHEM 167	4	ENGL 150	3
M E 160	3	M E 170	3
MATH 165	4	MATH 166	4
ENGR 101	0	PHYS 221	5
General Education Elective	3	LIB 160	1
	14		16

Second Year

Fall	Credits	Spring	Credits
E M 274	3	E M 324	3
MAT E 273	3	MATH 267	4
MATH 265	4	M E 231	3
PHYS 222	5	M E 270	3
ENGL 250	3	General Education Elective	3
		M E 202	0
	18		16

Third Year

Fall	Credits	Spring	Credits
E E 442	2	M E 325	3
E E 448	2	M E 335	4
E M 345	3	M E 370	3
M E 332	3	M E 324	3
STAT 305	3	Communication Requirement	3
M E 324L	1		
General Education Elective	3		
	17		16

Fourth Year

Fall	Credits	Spring	Credits
Gen Ed Elective (Intl Perspective)	3	Gen Ed Elective (US Diversity)	3
M E 421	4	Technical Elective	3
M E 436	4	Technical Elective	3
Technical Elective	3	Technical Elective	3
Technical Elective	3	Capstone Design	3
	17		15

Graduate Study

The department offers programs for the degrees Master of Engineering (M. Eng.), Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) with a major in mechanical engineering. The M.Eng. degree is a coursework-only degree designed to improve professional expertise in mechanical engineering. The M.S. and Ph.D. degrees are designed to improve the student's capability to conduct research as well as their professional expertise. Although co-major and formal minor programs are not offered in mechanical engineering, courses may be used for minor work by students taking major work in other departments.

Well-qualified juniors and seniors in mechanical engineering who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both the Bachelor of Science and Master of Science, the Bachelor of Science and Master of Business Administration. Under concurrent enrollment, students are eligible for assistantships and simultaneously take undergraduate and graduate courses. Details are available in the Graduate Programs Office and on the department's website (http://www.me.iastate.edu/).

The graduate program offers advanced study in a variety of thrust areas, including biological and nanoscale sciences, clean energy technologies, complex fluid systems, design and manufacturing innovation, and simulation and visualization.

The department offers students the opportunity to broaden their education by participating in minor programs in established departments, interdepartmental programs, or other experiences as approved by their program of study committees.

The requirements for advanced degrees are established by the student's program of study committee within established guidelines of the Graduate College. Graduate students who have not completed an

undergraduate program of study substantially equivalent to that required of undergraduate students in the department can expect that additional supporting coursework will be required.

Program requirements can be found on the department webpage (http://www.me.iastate.edu/) and in the Mechanical Engineering Graduate Student Handbook.

Courses primarily for undergraduates:

M E 160: Mechanical Engineering Problem Solving with Computer Applications
(2-2) Cr. 3. F.S.
Prereq: M E majors only. MATH 142 or MATH 143 or MATH 145; credit or enrollment in MATH 165.
Introduction to the field of Mechanical Engineering through problem-solving in a range of topics including statics, mechanics of materials and thermo-fluids. Techniques to professionally present and communicate solutions. Use of MATLAB computer programming to aid problem solving, including curve fitting and graphing. Only one of M E 160, ENGR 160, Aer E 160, C E 160, CPR E 185, E E 185, S E 185 and I E 148 may count towards graduation.

M E 170: Engineering Graphics and Introductory Design
(2-2) Cr. 3. F.S.
Prereq: Satisfactory scores on mathematics placement assessments; credit or enrollment in MATH 142 or MATH 143 or MATH 145
Integration of fundamental graphics, computer modeling, and engineering design. Applications of multiview drawings and dimensioning. Techniques for visualizing, analyzing, and communicating 3-D geometries. Application of the design process including written and oral reports. Freehand and computer methods.

M E 190: Learning Communities
(1-0) Cr. 1. Repeatable. F.S.
Enrollment in M E learning communities.

M E 202: Mechanical Engineering - Professional Planning
(1-0) Cr. R. F.S.
Prereq: Sophomore classification
Preparation for a career in mechanical engineering; discussion of opportunities for leadership, undergraduate research, experiential learning.

M E 220: Globalization and Sustainability
(Cross-listed with ANTHR, ENV S, GLOBE, MAT E, SOC, T SC). (3-0) Cr. 3. F.S.
An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.
Meets International Perspectives Requirement.

M E 231: Engineering Thermodynamics I
(3-0) Cr. 3. F.S.SS.
Prereq: MATH 166, CHEM 167, PHYS 221
Fundamental concepts based on zeroth, first and second laws of thermodynamics. Properties and processes for ideal gases and solid-liquid-vapor phases of pure substances. Applications to vapor power cycles. Credit for either M E 231 or 330, but not both, may be applied toward graduation.

M E 270: Introduction to Mechanical Engineering Design
(1-6) Cr. 3. F.S.
Prereq: M E 160 or equivalent, M E 170 or equivalent, PHYS 221
Overview of mechanical engineering design with applications to thermal and mechanical systems. Introduction to current design practices used in industry. Semester-long team project focused on addressing societal needs. Past projects include designing human powered charging systems and products for developing nations.

M E 324: Manufacturing Engineering
(3-0) Cr. 3. F.S.SS.
Prereq: M E 270, E M 324, MAT E 273 and M E 324L
Fundamentals of manufacturing processes including forming, machining, casting and welding with emphasis on design considerations in manufacturing. Mechanical behavior of metallic materials. Modern manufacturing practices.

M E 324L: Manufacturing Engineering Laboratory
(0-2) Cr. 1. F.S.SS.
Prereq: M E 270, MAT E 273
Laboratory exercises in metrology, mechanical testing (tensile/compression and hardness tests), computer aided design (CAD), machining operations, metal welding, metal casting, and bulk/sheet metal forming.

M E 325: Mechanical Component Design
(3-0) Cr. 3. F.S.SS.
Prereq: M E 170, E M 324, and STAT 305
Philosophy of design and design methodology. Consideration of stresses and failure models useful for static and fatigue loading. Analysis, selection and synthesis of machine elements.

M E 332: Engineering Thermodynamics II
(3-0) Cr. 3. F.S.SS.
Prereq: M E 231
Gas power cycles. Fundamentals of gas mixtures, psychrometry, and thermochemistry. Applications to one-dimensional compressible flow, refrigeration, air conditioning and combustion processes.

M E 335: Fluid Flow
(3-2) Cr. 4. F.S.SS.
Prereq: E M 345, MATH 265, MATH 266 or MATH 267, credit or enrollment in M E 332.
Incompressible and compressible fluid flow fundamentals. Dimensional analysis and similitude. Internal and external flow applications. Lab experiments emphasizing concepts in thermodynamics and fluid flow. Written reports are required.

M E 370: Engineering Measurements
(2-3) Cr. 3. F.S.SS.
Prereq: E E 442, STAT 305
Fundamentals of design, selection, and operation of components of measuring systems. Measurement processes, data acquisition systems, analysis of data, and propagation of measurement uncertainty.

M E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

M E 398: Cooperative Education (Co-op).
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

M E 410: Mechanical Engineering Applications of Mechatronics
(2-2) Cr. 3. Alt. S., offered irregularly.
Prereq: E E 442, E E 448, credit or enrollment in M E 421
Fundamentals of sensor characterization, signal conditioning and motion control, coupled with concepts of embedded computer control. Digital and analog components used for interfacing with computer controlled systems. Mechanical system analysis combined with various control approaches. Focus on automation of hydraulic actuation processes. Laboratory experiences provide hands-on development of mechanical systems.

M E 411: Automatic Controls
(2-2) Cr. 3. F.
Prereq: M E 421
Methods and principles of automatic control. Pneumatic, hydraulic, and electrical systems. Representative applications of automatic control systems. Mathematical analysis of control systems.

M E 412: Ethical Responsibilities of a Practicing Engineer
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in M E 325
The study of ethics in engineering design and the engineering profession. A comprehensive look at when ethical decisions must be made and an approach to make them. The approach takes into account moral, legal, technical, experiential, and standards to aid in ethical decision making. Each area will be studied through lectures, debates, guest speakers, class discussion, and case studies.

M E 413: Fluid Power Engineering
(Cross-listed with A B E). (2-2) Cr. 3. F.
Prereq: Credit or enrollment in E M 378 or M E 335, A B E 216 or M E 270
Properties of hydraulic fluids. Performance parameters of fixed and variable displacement pumps and motors. Hydraulic circuits and systems. Hydrostatic transmissions. Characteristics of control valves. Analysis and design of hydraulic systems for power and control functions.

M E 415: Mechanical Systems Design
(0-6) Cr. 3. F.S.
Prereq: M E 324, M E 325
Mechanical Engineering Capstone Design course. Team approach to solving design problems involving mechanical systems. Teams will use current design practices they will encounter in industry. Document decisions concerning form and function, material specification, manufacturing methods, safety, cost, and conformance with codes and standards. Solution description includes oral and written reports. Projects often worked with industry sponsors.

M E 417: Advanced Machine Design

(Dual-listed with M E 517). (3-0) Cr. 3. S.

Prereq: M E 325, MAT E 273

Stress life, strain life, and fracture mechanics approaches to fatigue life and design with metals, polymers and ceramics. Introduction to material selection in design of machine components. Thermal and structural considerations in design of machine components and hybrid materials. Course project and relevant literature review required for graduate credit.

M E 418: Mechanical Considerations in Robotics

(Dual-listed with M E 518). (3-0) Cr. 3. S.

Prereq: Credit or enrollment in M E 421

Three dimensional kinematics, dynamics, and control of robot manipulators, hardware elements and sensors. Laboratory experiments using industrial robots.

M E 419: Computer-Aided Design

(3-0) Cr. 3. F.

Prereq: M E 325

Theory and applications of computer- aided design. Computer graphics programming, solid modeling, assembly modeling, and finite element modeling. Mechanical simulation, process engineering, rapid prototyping and manufacturing integration.

M E 421: System Dynamics and Control

(3-2) Cr. 4. F.S.SS.

Prereq: E E 442, E E 448, E M 345, MATH 267

Modeling and simulation of mechanical, electrical, fluid, and/or thermal systems. Development of equations of motion and dynamic response characteristics in time and frequency domains. Fundamentals of classical control applications, including mathematical analysis and design for closed loop control systems. Introduction to computer interfacing for simulation, data acquisition, and control. Laboratory exercises for hands-on system investigation and control implementation.

M E 423: Creativity and Imagination for Engineering and Design

(Dual-listed with M E 523). (3-0) Cr. 3.

Broad exposure to the study of creativity, both in scientific research and in engineering design practice. Exploration of the subject includes readings from a variety of fields; in-class discussion and activities; and individual and team projects that enable students to develop their creativity. Graduate students also will do independent research on creativity and develop a related teaching module.

M E 425: Optimization Methods for Complex Designs

(Dual-listed with M E 525). (3-0) Cr. 3. F.

Prereq: M E 160, MATH 265

Optimization involves finding the 'best' according to specified criteria. Review of a range of optimization methods from traditional nonlinear to modern evolutionary methods such as Genetic algorithms. Examination of how these methods can be used to solve a wide variety of design problems across disciplines, including mechanical systems design, biomedical device design, biomedical imaging, and interaction with digital medical data. Students will gain knowledge of numerical optimization algorithms and sufficient understanding of the strengths and weaknesses of these algorithms to apply them appropriately in engineering design. Experience includes code writing and off-the-shelf routines. Numerous case-studies of real-world situations in which problems were modeled and solved using advanced optimization techniques.

M E 433: Alternative Energy

(3-0) Cr. 3. F.

Prereq: PHYS 221/PHYS 222 and CHEM 167

Basic principles, performance, and cost analysis of alternative energy systems including biofuels, bioenergy, wind, solar, fuel cells, storage and other alternative energy systems. Performance analysis and operating principles of systems and components, and economic analysis for system design and operation will be taught. Emphasis is on alternative energy technologies needed to meet our future energy needs at various scales ranging from household to city to national levels.

M E 436: Heat Transfer

(3-2) Cr. 4. F.S.SS.

Prereq: M E 335

Heat transfer by conduction, convection, and radiation. Similarity concepts in heat, mass, and momentum transfer. Methods for determination of heat transfer coefficients. Combined modes of heat transfer. Heat exchangers. Lab experiments emphasizing concepts in thermodynamics and heat transfer. Written reports are required.

M E 437: Introduction to Combustion Engineering

(3-0) Cr. 3. S.

Prereq: Credit in M E 332 or equivalent and credit or enrollment in M E 335 or equivalent.

Introduction to the fundamentals of combustion and the analysis of combustion systems for gaseous, liquid, and solid fuels-including biomass fuels. Combustion fundamentals are applied to the analysis of engines; turbines, biomass cookstoves; suspension, fixed-bed, and fluidized-bed furnaces; and other combustion devices.

M E 441: Fundamentals of Heating, Ventilating, and Air Conditioning
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in M E 436
Space conditioning and moist air processes. Application of thermodynamics, heat transfer, and fluid flow principles to the analysis of heating, ventilating, and air conditioning components and systems. Performance and specification of components and systems.

M E 442: Heating and Air Conditioning Design
(1-5) Cr. 3. S.
Prereq: M E 441
Design criteria and assessment of building environment and energy requirements. Design of heating, ventilating, and air conditioning systems. System control and economic analysis. Oral and written reports required.

M E 444: Elements and Performance of Power Plants
(3-0) Cr. 3. S.
Prereq: M E 332, credit or enrollment in M E 335
Basic principles, thermodynamics, engineering analysis of power plant systems. Topics include existing power plant technologies, the advanced energyplex systems of the future, societal impacts of power production, and environmental and regulatory concerns.

M E 448: Fluid Dynamics of Turbomachinery
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: AER E 311 or M E 335
Applications of principles of fluid mechanics and thermodynamics in performance analysis and design of turbomachines. Conceptual and preliminary design of axial and radial flow compressors and turbines using velocity triangles and through-flow approaches.

M E 449: Internal Combustion Engines
(3-1) Cr. 3. F.
Prereq: M E 335
Basic principles, thermodynamics, combustion, and exhaust emissions of spark-ignition and compression-ignition engines. Laboratory determination of fuel properties and engine performance. Effects of engine components and operating conditions on performance. Written reports required.

M E 451: Engineering Acoustics
(Cross-listed with E E, E M). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: PHYS 221 and MATH 266 or MATH 267
Properties of sounds waves and noise metrics (pressure, power levels, etc). Sound sources and propagation. Principles of wave propagation in one-, two-, and three-dimensions. Wave reflection and transmission. Wave propagation in rectangular, cylindrical, and annular ducts. Acoustics fields for model noise sources. Introduction to aerodynamic noise sources in aircraft, aircraft engines, and wind turbines. Selected laboratory experiments.

M E 456: Machine Vision
(Dual-listed with M E 556). Cr. 3. Repeatable. Alt. S., offered irregularly.
Prereq: MATH 317, M E 421 or permission of instructor
Broad exposure to the study of creativity, both in scientific research and in engineering design practice. Exploration of the subject includes readings from a variety of fields; in-class discussion and activities; and individual and team projects that enable students to develop their creativity. Graduate students also will do independent research on creativity and develop a related teaching module.

M E 466: Multidisciplinary Engineering Design
(Cross-listed with A B E, AER E, B M E, CPR E, E E, ENGR, I E, MAT E). (1-4) Cr. 3. Repeatable. F.S.
Prereq: Student must be within two semesters of graduation; permission of instructor.
Application of team design concepts to projects of a multidisciplinary nature. Concurrent treatment of design, manufacturing, and life cycle considerations. Application of design tools such as CAD, CAM, and FEM. Design methodologies, project scheduling, cost estimating, quality control, manufacturing processes. Development of a prototype and appropriate documentation in the form of written reports, oral presentations and computer models and engineering drawings.

M E 467: Multidisciplinary Engineering Design II
(Cross-listed with AER E, CPR E, E E, ENGR, I E, MAT E). (1-4) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: Student must be within two semesters of graduation or receive permission of instructor.
Build and test of a conceptual design. Detail design, manufacturability, test criteria and procedures. Application of design tools such as CAD and CAM and manufacturing techniques such as rapid prototyping. Development and testing of a full-scale prototype with appropriate documentation in the form of design journals, written reports, oral presentations and computer models and engineering drawings.

M E 475: Modeling and Simulation
(3-0) Cr. 3. S.
Prereq: M E 421, credit or enrollment in M E 436
Introduction to computer solution techniques required to simulate flow, thermal, and mechanical systems. Methods of solving ordinary and partial differential equations and systems of algebraic equations; interpolation, numerical integration; finite difference and finite element methods.

M E 479: Sustainability Science for Engineering Design
(3-0) Cr. 3. Alt. S., offered irregularly.
Prereq: Any engineering design course
Scientific principles and quantitative methods concerning sustainability. Analysis of environmental issues associated with engineering design and product manufacturing in an economic and social context. Heuristic and analytical methods for assessing the sustainability of existing or potential product/service designs. Application to a design problem in teams.

M E 484: Technology, Globalization and Culture
(Dual-listed with M E 584). (Cross-listed with WLC). (3-0) Cr. 3. F.
Prereq: junior or senior classification for M E 484; graduate classification for M E 584
Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists.
Meets International Perspectives Requirement.

M E 486: Appropriate Technology Design
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: M E 231,M E 270, enrollment in M E 335; or permission of instructor.
Hands-on design experience utilizing knowledge acquired in core mechanical engineering courses. Emphasis with engineering problem formulation and solution, oral and written communication, team decision-making and ethical conduct. Design projects include engineering considerations in appropriate technology which have multidisciplinary components in economics and sociology.

M E 490: Independent Study
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of students and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490H: Independent Study: Honors
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of students and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490J: Independent Study: Thermodynamics and Energy Utilization
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of students and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490M: Independent Study: Nuclear Engineering
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of students and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490O: Independent Study: Design and Optimization
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of student and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490P: Independent Study: Dynamic Systems and Controls
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of student and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490Q: Independent Study: Materials Processing and Mechanics
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of student and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490R: Independent Study: Thermo-fluids
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of student and faculty. Election of course and topic must be approved in advance by supervising faculty.

M E 490S: Independent Study: Emerging Areas
Cr. 1-6. Repeatable.
Prereq: Senior classification
Investigation of topics holding special interest of student and faculty. Election of course and topic must be approved in advance by supervising faculty.

Courses primarily for graduate students, open to qualified undergraduates:

M E 510: Economics and Policy of Engineered Energy Systems
Cr. 3. S.
Prereq: Graduate standing.
Economics and policy for U.S. energy systems, with an emphasis on connections to engineering. Topics include: economic analysis of conventional energy commodity markets and technologies, deregulated electricity markets, and emerging energy technologies; demand forecasting; economic and environmental policy in energy; integrated assessment; and semester-specific contemporary issues. Economics majors may not apply this course towards graduation.

M E 511: Advanced Control Design
(3-0) Cr. 3. S.
Prereq: M E 411
Application of control design methods using continuous, discrete, and frequency-based models. Approaches include classical, pole assignment, model reference, internal model, and adaptive control methods. Mechanical design projects.

M E 517: Advanced Machine Design
(Dual-listed with M E 417). (3-0) Cr. 3. S.
Prereq: M E 325, MAT E 273
Stress life, strain life, and fracture mechanics approaches to fatigue life and design with metals, polymers and ceramics. Introduction to material selection in design of machine components. Thermal and structural considerations in design of machine components and hybrid materials. Course project and relevant literature review required for graduate credit.

M E 518: Mechanical Considerations in Robotics
(Dual-listed with M E 418). (3-0) Cr. 3. S.
Prereq: Credit or enrollment in M E 421
Three dimensional kinematics, dynamics, and control of robot manipulators, hardware elements and sensors. Laboratory experiments using industrial robots.

M E 520: Material and Manufacturing Considerations in Design
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: M E 324, M E 325
Integration of materials, design and manufacturing. Materials selection. Design for assembly and manufacturing (DFMA). Design and redesign to facilitate cost-effective manufacturing using material selection and DFMA software.

M E 521: Mechanical Behavior and Manufacturing of Polymers and Composites
(Cross-listed with M S E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M E 324 or MAT E 272 and E M 324
Effect of chemical structure and morphology on properties. Linear viscoelasticity, damping and stress relaxation phenomena. Structure and mechanics of filler and fiber reinforced composites. Mechanical properties and failure mechanisms. Material selection and designing with polymers. Processing of polymer and composite parts.

M E 523: Creativity and Imagination for Engineering and Design
(Dual-listed with M E 423). (3-0) Cr. 3.
Broad exposure to the study of creativity, both in scientific research and in engineering design practice. Exploration of the subject includes readings from a variety of fields; in-class discussion and activities; and individual and team projects that enable students to develop their creativity. Graduate students also will do independent research on creativity and develop a related teaching module.

M E 525: Optimization Methods for Complex Designs
(Dual-listed with M E 425). (3-0) Cr. 3. F.
Prereq: M E 160, MATH 265
Optimization involves finding the 'best' according to specified criteria. Review of a range of optimization methods from traditional nonlinear to modern evolutionary methods such as Genetic algorithms. Examination of how these methods can be used to solve a wide variety of design problems across disciplines, including mechanical systems design, biomedical device design, biomedical imaging, and interaction with digital medical data. Students will gain knowledge of numerical optimization algorithms and sufficient understanding of the strengths and weaknesses of these algorithms to apply them appropriately in engineering design. Experience includes code writing and off-the-shelf routines. Numerous case-studies of real-world situations in which problems were modeled and solved using advanced optimization techniques.

M E 527: Mechanics of Machining and Finishing Processes
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M E 324
Mechanics of material removal for ductile materials. Shear zone theory. Oblique cutting. Heat transfer in machining. Milling and grinding. Mechanics of material removal for brittle materials. Optimal selection and design of cutting parameters. Control of machining processes. Principles of precision finishing. Design considerations for machining and finishing processes.

M E 528: Micro/Nanomanufacturing
(3-0) Cr. 3. Alt. S., offered irregularly.
Prereq: M E 324
Concepts and applications of micro/nanotechnology appropriate to the manufacturing field. An overview of micro/nano-fabrication techniques including mechanical, EDM, laser and lithography. MEMS device fabrication. Scaling laws. Top down and bottom up approaches of nanomanufacturing. Experimental or theoretical project leading to potential submission of a manuscript for journal or conference.

M E 530: Advanced Thermodynamics
(3-0) Cr. 3. F.
Prereq: M E 332
Fundamentals of thermodynamics from the classical viewpoint with emphasis on the use of the first and second laws for analysis of thermal systems. Generalized thermodynamic relationships. Computer applications of thermodynamic properties and system analysis. Selected topics.

M E 531: Advanced Energy Systems and Analysis
Cr. 3. F.
Prereq: any undergraduate thermodynamics course; mathematics through differential equations
Introduction to energy systems including economic and thermodynamic principles. Various production systems will be analyzed. Application to transportation and building systems will be emphasized. Sustainability, climate change and other current energy system topics.

M E 532: Compressible Fluid Flow
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: AER E 310, 311 or equivalent
Thermodynamics of compressible flow. Viscous and inviscid compressible flow equations. One dimensional steady flow; isentropic flow, shocks, expansions. Multidimensional compressible flow aspects. Linear and nonlinear wave analysis and method of characteristics. Subsonic, transonic, supersonic and hypersonic flows.

M E 535: Thermochemical Processing of Biomass
(Cross-listed with BRT). (3-0) Cr. 3. S.
Prereq: Undergraduate course work in thermodynamics and transport phenomena
Introduction to thermal and catalytic processes for the conversion of biomass to biofuels and other biobased products. Topics include gasification, fast pyrolysis, hydrothermal processing, syngas to synfuels, and bio-oil upgrading. Application of thermodynamics, heat transfer, and fluid dynamics to bioenergy and biofuels.

M E 536: Advanced Heat Transfer
(3-0) Cr. 3. S.
Prereq: M E 436
Advanced treatment of heat transmission by conduction, convection, and radiation.

M E 538: Advanced Fluid Flow
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in M E 436
Detailed analysis of incompressible/compressible, viscous/inviscid, laminar/turbulent, and developing fluid flows on a particle/point control volume basis.

M E 539: Nanoscale Heat Transfer
Cr. 3. S.
Prereq: Any undergraduate course on thermodynamics or heat transfer or transport phenomena or solid state physics
Fundamentals of heat transfer in nanoscale systems, ballistic and diffusive transport, heat conduction due to photons and electrons. Wave and particle nature of energy transfer. Basics of nanoscale thermal radiation. Size effects and transport characteristics for solids, liquids and gases. Computational methodologies and measurement techniques for thermal properties.

M E 542: Advanced Combustion
(3-0) Cr. 3. S.
Prereq: M E 332 or CH E 381
Thermochemistry and transport theory applied to combustion. Gas phase equilibrium. Energy balances. Reaction kinetics. Flame temperatures, speed, ignition, and extinction. Premixed and diffusion flames. Combustion aerodynamics. Mechanisms of air pollution.

M E 543: Introduction to Random Vibrations and Nonlinear Dynamics
(Cross-listed with E M). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Vibrations of continuous systems. Nonlinear vibration phenomena, perturbation expansions; methods of multiple time scales and slowly-varying amplitude and phase. Characteristics of random vibrations; random processes, probability distributions, spectral density and its significance, the normal or Gaussian random process. Transmission of random vibration, response of simple single and two-degree-of-freedom systems to stationary random excitation. Fatigue failure due to random excitation.

M E 545: Thermal Systems Design
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: M E 436
Integrating thermodynamics, fluid mechanics, and heat transfer to model thermal equipment and to simulate thermal systems. Second law and parametric analysis; cost estimation, life cycle analysis and optimization. Some computer programming required.

M E 546: Computational Fluid Mechanics and Heat Transfer I
(Cross-listed with AER E). (3-0) Cr. 3. F.
Prereq: AER E 310 or M E 335, and programming experience
Basic concepts of discretization, consistency, and stability. Explicit and implicit methods for ordinary differential equations. Methods for each type of partial differential equation. Iterative solution methods; curvilinear grids. Students will program basic algorithms.

M E 547: Computational Fluid Mechanics and Heat Transfer II
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: AER E 546 or equivalent
Application of computational methods to current problems in fluid mechanics and heat transfer. Methods for solving the Navier-Stokes and reduced equation sets such as the Euler, boundary layer, and parabolized forms of the conservation equations. Introduction to relevant aspects of grid generation and turbulence modeling.

M E 552: Advanced Acoustics
(Cross-listed with E M). (3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: E M 451
Theoretical acoustics: wave propagation in fluids; acoustic radiation, diffraction and scattering; nonlinear acoustics; radiation force; cavitation; and ray acoustics.

M E 556: Machine Vision
(Dual-listed with M E 456). Cr. 3. Repeatable. Alt. S., offered irregularly.
Prereq: MATH 317, M E 421 or permission of instructor
Broad exposure to the study of creativity, both in scientific research and in engineering design practice. Exploration of the subject includes readings from a variety of fields; in-class discussion and activities; and individual and team projects that enable students to develop their creativity. Graduate students also will do independent research on creativity and develop a related teaching module.

M E 557: Computer Graphics and Geometric Modeling
(Cross-listed with COM S, CPR E). (3-0) Cr. 3. F.
Prereq: M E 421, programming experience in C
Fundamentals of computer graphics technology. Data structures. Parametric curve and surface modeling. Solid model representations. Applications in engineering design, analysis, and manufacturing.

M E 561: Scanning Probe Microscopy
(2-2) Cr. 3. Alt. F., offered irregularly.
Prereq: First year physics, chemistry
Introduction to the scanning probe microscope (SPM, also known as atomic force microscope or AFM) and associated measurement techniques. Overview or instrumentation system, basic principles of operation, probe-sample interaction and various operational modes to obtain micro/nanoscale structure and force spectroscopy of material surfaces. Examples of SPM significance and applications in science and engineering research, nanotechnology and other industries. Laboratory work involving use of a scanning probe microscope system is an integral part of the course.

M E 563: Micro and Nanoscale Mechanics
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: E M 324 and M E 325
Review of Fundamentals: (Elasticity, Electromagnetism, Mechanical response), Mechanics of thermally, electrostatically and magnetically actuated microsystems, Mechanics and design of nanostructured materials, mechanics of surface stress engineering and its implications to sensors and thin film structures.

M E 564: Fracture and Fatigue
(Cross-listed with AER E, E M, M S E). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: E M 324 and either MAT E 216 or MAT E 273 or MAT E 392. Undergraduates: Permission of instructor
Materials and mechanics approach to fracture and fatigue.
Fracture mechanics, brittle and ductile fracture, fracture and fatigue characteristics, fracture of thin films and layered structures. Fracture and fatigue tests, mechanics and materials designed to avoid fracture or fatigue.

M E 566: Phase Transformation in Elastic Materials
(Cross-listed with E M). (3-0) Cr. 3. S.
Prereq: EM 510 or EM 516 or EM 514
Continuum thermodynamics and kinetics approaches to phase transformations. Phase field approach to stress- and temperature-induced martensitic transformations and twinning at the nanoscale. Nucleation and growth. Nanostructural evaluation. Analytical and numerical solutions. Surface stresses and energy. Surface-induced phase transformations. Large Strain formulation.

M E 573: Random Signal Analysis and Kalman Filtering
(Cross-listed with AER E, E E). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or M E 370 or M E 411 or MATH 341
Elementary notions of probability. Random processes. Autocorrelation and spectral functions. Estimation of spectrum from finite data. Response of linear systems to random inputs. Discrete and continuous Kalman filter theory and applications. Smoothing and prediction. Linearization of nonlinear dynamics.

M E 574: Optimal Control
(Cross-listed with AER E, E E). (3-0) Cr. 3. S.
Prereq: E E 577
The optimal control problem. Variational approach. Pontryagin's principle, Hamilton-Jacobi equation. Dynamic programming. Time-optimal, minimum fuel, minimum energy control systems. The regulator problem. Structures and properties of optimal controls.

M E 575: Introduction to Robust Control
(Cross-listed with AER E, E E). (3-0) Cr. 3.
Prereq: E E 577
Introduction to modern robust control. Model and signal uncertainty in control systems. Uncertainty description. Stability and performance robustness to uncertainty. Solutions to the H2, Hoo, and l1 control problems. Tools for robustness analysis and synthesis.

M E 576: Digital Feedback Control Systems
(Cross-listed with AER E, E E). (3-0) Cr. 3. F.
Prereq: E E 475 or AER E 432 or M E 411 or MATH 415; and MATH 267
Sampled data, discrete data, and the z-transform. Design of digital control systems using transform methods: root locus, frequency response and direct design methods. Design using state-space methods. Controllability, observability, pole placement, state estimators. Digital filters in control systems. Microcomputer implementation of digital filters. Finite wordlength effects. Linear quadratic optimal control in digital control systems. Simulation of digital control systems.

M E 577: Linear Systems
(Cross-listed with AER E, E E, MATH). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or MATH 415; and MATH 207
Linear algebra review. Least square method and singular value decomposition. State space modeling of linear continuous-time systems. Solution of linear systems. Controllability and observability. Canonical description of linear equations. Stability of linear systems. State feedback and pole placements. Observer design for linear systems.

M E 578: Nonlinear Systems
(Cross-listed with AER E, E E, MATH). (3-0) Cr. 3. S.
Prereq: E E 577
Linear vs nonlinear systems. Phase plane analysis. Bifurcation and center manifold theory. Lyapunov stability. Absolute stability of feedback systems. Input-output stability. Passivity theory and feedback linearization. Nonlinear control design techniques.

M E 580: Virtual Environments, Virtual Worlds, and Application
(Cross-listed with HCI). (3-0) Cr. 3. F.
Prereq: Senior or Graduate status.
A systematic introduction to the underpinnings of Virtual Environments (VE), Virtual Worlds, advanced displays and immersive technologies; and an overview of some of the applications areas particularly virtual engineering.

M E 584: Technology, Globalization and Culture
(Dual-listed with M E 484). (Cross-listed with WLC). (3-0) Cr. 3. F.
Prereq: junior or senior classification for M E 484; graduate classification for M E 584
Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists.
Meets International Perspectives Requirement.

M E 590: Special Topics
Cr. 1-8. Repeatable.

M E 590Q: Special Topics: Independent Literature Investigation
Cr. 1-8. Repeatable.

M E 590T: Special Topics: Biological and Nanoscale Sciences
Cr. 1-8. Repeatable.

M E 590U: Special Topics: Complex Fluid Systems
Cr. 1-8. Repeatable.

M E 590V: Special Topics: Clean Energy Technologies
Cr. 1-8. Repeatable.

M E 590W: Special Topics: Design and Manufacturing Innovation
Cr. 1-8. Repeatable.

M E 590Z: Special Topics: Simulation and Visualization
Cr. 1-8. Repeatable.

M E 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

M E 600: Seminar
Cr. R. Repeatable.
(1-0).

M E 625: Surface Modeling
(3-0) Cr. 3. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: M E 557, programming experience in C
Theory and implementation of contemporary parametric sculptured surface modeling technology. Non-uniform rational B-spline (NURBS) curves and surfaces. Fundamental computational algorithms. Construction techniques. Advanced modeling topics. Computer projects.

M E 632: Multiphase Flow
(Cross-listed with CH E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: M E 538
Single particle, mutliparticle and two-phase fluid flow phenomena (gas-solid, liquid-solid and gas-liquid mixtures); particle interactions, transport phenomena, wall effects; bubbles, equations of multiphase flow. Dense phase (fluidized and packed beds) and ducted flows; momentum, heat and mass transfer. Computer solutions.

M E 637: Convection Heat Transfer
(3-0) Cr. 3. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: M E 436
Convection heat transfer to internal or external flows under laminar or turbulent conditions. Dimensionless parameters. Classical solutions of Newtonian viscous flows. Forced and free convection. Special topics.

M E 638: Radiation Heat Transfer
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: M E 436
Techniques for analysis of radiation in enclosures. Radiative properties of surfaces. Radiative transfer in participating media. Combined modes of transfer. Approximate methods of analysis.

M E 647: Advanced Computational Fluid Dynamics
(Cross-listed with AER E). (3-0) Cr. 3. S.
Prereq: AER E 547
An examination of current methods in computational fluid dynamics. Differencing strategies. Advanced solution algorithms for unstructured meshes. Grid generation. Construction of higher-order CFD algorithms. Parallel computing. Current applications. Use of state of the art CFD codes.

M E 690: Advanced Topics
Cr. arr. Repeatable.
Investigation of advanced topics of special interest to graduate students in mechanical engineering.

M E 690G: Advanced Topics: Advanced Machine Design
Cr. arr. Repeatable.
Investigation of advanced topics of special interest to graduate students in mechanical engineering.

M E 690O: Advanced Topics: Engineering Computation
Cr. arr. Repeatable.
Investigation of advanced topics of special interest to graduate students in mechanical engineering.

M E 690Q: Advanced Topics: Independent Literature Investigation
Cr. arr. Repeatable.
Investigation of advanced topics of special interest to graduate students in mechanical engineering.

M E 690T: Advanced Topics: Biological and Nanoscale Sciences
Cr. arr. Repeatable. F.S.SS.
Investigation of Special Topics: Biological and Nanoscale Sciences of special interest to graduate students in mechanical engineering.

M E 690U: Advanced Topics: Complex Fluid Systems
Cr. arr. Repeatable. F.S.SS.
Investigation of Special Topics: Complex Fluid Systems of special interest to graduate students in mechanical engineering.

M E 690V: Advanced Topics: Clean Energy Technologies
Cr. arr. F.S.SS.
Investigation of Special Topics: Clean Energy Technologies of special interest to graduate students in mechanical engineering.

M E 690W: Advanced Topics: Design and Manufacturing Innovation
Cr. arr. Repeatable.
Investigation of Design & Manufacturing Innovation of special interest to graduate students in mechanical engineering.

M E 690Z: Advanced Topics: Simulation and Visualization
Cr. arr. Repeatable. F.S.SS.
Investigation of Special Topics: Simulation and Visualization of special interest to graduate students in mechanical engineering.

M E 697: Engineering Internship
Cr. R. Repeatable.
Prereq: Permission of Director of Graduate Education, graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

M E 699: Research
Cr. arr. Repeatable.
Offered on a satisfactory-fail basis only.

Non-destructive Evaluation Engineering Minor

Minor supervised by an interdisciplinary faculty committee, administered by Aerospace Engineering. The NDE minor is a unique opportunity for engineering students to acquire a multidisciplinary engineering qualification in the rapidly evolving field of Nondestructive Evaluation.

Undergraduate Study

Students interested in completing the NDE engineering minor must be enrolled in the College of Engineering at Iowa State University. They must submit the "Request for Minor" form and complete the minimum prescribed 16 credit-hours of course work defined below. Acceptance is based on approval by the administering department, Aerospace Engineering.

The course requirements for the undergraduate minor in NDE are:

MAT E/E M 362	Principles of Nondestructive Testing	3
MAT E/E M 362L	Nondestructive Testing Laboratory	1
At least one of the following NDE specific courses		3-4
M S E/E M 550	Nondestructive Evaluation	
MAT E 488	Eddy Current Nondestructive Evaluation	
E M 480	Ultrasonic Nondestructive Evaluation	
AER E 429X	Penetrating Radiation Methods in Nondestructive Evaluation	
Independent study course		
Up to three of the following or additional NDE specific courses from the list above		9-12
AER E 321	Flight Structures Analysis	
AER E 421	Advanced Flight Structures	
AER E 423	Composite Flight Structures	
E E 418	High Speed System Engineering Measurement and Testing	
E E 224	Signals and Systems I	
CPR E 418	High Speed System Engineering Measurement and Testing	
I E 348	Solidification Processes	
I E 361	Statistical Quality Assurance	
STAT 231	Probability and Statistical Inference for Engineers	
STAT 305	Engineering Statistics	
STAT 322	Probabilistic Methods for Electrical Engineers	
AER E 422	Vibrations and Aeroelasticity	
AER E 426	Design of Aerospace Structures	
E M 424	Intermediate Mechanics of Materials	
E M 425	Introduction to the Finite Element Method	
M E 417	Advanced Machine Design	
M E 418	Mechanical Considerations in Robotics	
MAT E 316	Computational Methods in Materials	
MAT E 418	Mechanical Behavior of Materials	
MAT E 443	Physical Metallurgy of Ferrous Alloys	
MAT E 444	Corrosion and Failure Analysis	
Total Credits		16-20

A combined average grade of C or higher is required in courses applied to the minor and the minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

Nuclear Engineering Minor

http://www.me.iastate.edu/students/degrees-and-programs/engineering-minors/

Minor administered by Mechanical Engineering

The nuclear engineering undergraduate minor allows engineering students to acquire a formal background in nuclear engineering topics that will not only benefit them, but also fulfill a societal need for future hiring of engineers. Through this program, students can enroll in a formal minor that enables them to acquire a basic and fundamental knowledge of nuclear sciences and engineering, thus enabling them to pursue employment in any one of a number of fields associated with the construction, operation or regulation of nuclear power generation.

Students completing this minor acquire a body of knowledge in the fundamentals of nuclear science and engineering. The required courses selected ensures that all graduates of the nuclear engineering minor obtain a minimum body of knowledge in nuclear science and engineering that would allow them to apply their specialized field of engineering knowledge to nuclear-related applications, such as nuclear plant and site construction, nuclear power plant operations, nuclear safety and radiation protection.

The supporting courses that are listed in this program provide an opportunity for students to build upon the knowledge gained in the required courses by taking either more advanced courses or more specialized courses dealing with specific areas of nuclear engineering.

Undergraduate Study

Students interested in completing the nuclear engineering minor must be enrolled at Iowa State University and have the appropriate technical background. They should complete and submit the "Request for Minor" form for submission to the Nuclear Engineering program director. The selection process is based on approval by the administering department, Mechanical Engineering.

The course requirements for the undergraduate minor in nuclear engineering are:

Required course:		
NUC E 401	Nuclear Radiation Theory and Engineering	3
Four of the following:		12
NUC E 402	Nuclear Reactor Engineering *	
NUC E 405	Radiation Protection and Shielding *	
NUC E 410	Nuclear Reactor Theory *	
NUC E 421	Nuclear Criticality Safety	
NUC E 430	Nuclear Energy and Society	
NUC E 441	Probabilistic Risk Assessment	
NUC E 461	Radiation Detection, Measurement and Simulation	
NUC E 490	Independent Study	
Total Credits		15

*Students have the option of enrolling in these web-based distance courses offered at select universities. It is the responsibility of the student to arrange for enrollment and payment for these courses. Courses must be successfully completed with a "C" or higher in order to be considered for transfer credit. Contact the Nuclear Engineering program director for more information.

The minor must include at least nine credits which are beyond the total used to meet curriculum requirements for the bachelors degree in engineering.

Courses primarily for undergraduates:

NUC E 401: Nuclear Radiation Theory and Engineering
(3-0) Cr. 3. F.
Prereq: PHYS 222, MATH 266 or MATH 267
Atomic and nuclear physics. Radioactivity and reaction rates. Cross sections. Introduction to neutron diffusion theory. Engineering applications of radiation theory.

NUC E 402: Nuclear Reactor Engineering
(3-0) Cr. 3. S.
Prereq: NUC E 401, permission of Nuclear Engineering program director
WWW only. Fission and chain reactions. Neutron diffusion and moderation. Reactor equations. Fermi Age theory. Multigroup and multiregional analysis. Contact Nuclear Engineering program director for enrollment information.

NUC E 405: Radiation Protection and Shielding
(3-0) Cr. 3.
Prereq: NUC E 401, permission of Nuclear Engineering program director
WWW only. Basic principles and concepts of radiation protection and design: dosimetric units and response functions, hazards of radiation dose, radiation sources, basic methods for dose evaluation, and shielding design techniques for photons and neurons.

NUC E 410: Nuclear Reactor Theory
(3-0) Cr. 3. F.
Prereq: NUC E 401, permission of Nuclear Engineering program director
WWW only. An introduction to neutron diffusion theory, neutron moderation, conditions for criticality of nuclear reactors.

NUC E 421: Nuclear Criticality Safety
Cr. 3. F.
Prereq: NUC E 401
Nomenclature, theory, and practice of nuclear criticality safety. Review of nuclear criticality accidents, analytical methods used in criticality analysis, review of standards and regulations, and developing criticality safety evaluations.

NUC E 430: Nuclear Energy and Society
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: NUC E 401
The relationship between nuclear energy and society is examined from the perspective of significant events in the commercial nuclear power industry. Event analysis includes differences and similarities of technologies along with environmental impact. Political, social, media and regulatory responses for each event are discussed along with the impact on future plant design.

NUC E 441: Probabilistic Risk Assessment
(3-0) Cr. 3. S.
Prereq: STAT 305 or equivalent
Methods for analysis of nuclear power systems. Fault tree and event tree analysis methods. Mathematical basics for dealing with reliability data, theory, and analysis. Case studies of accidents in nuclear power systems.

NUC E 461: Radiation Detection, Measurement and Simulation
(3-0) Cr. 3. S.
Prereq: NUC E 401
Principles of nuclear radiation safety and detection. Radiation energy spectroscopy. Counting statistics and error analysis. Monte Carlo simulation of radiation transport. Detection system performance parameters. Design projects.

NUC E 490: Independent Study
Cr. 1-3. Repeatable, maximum of 3 credits.
Prereq: Junior Classification
Investigation of nuclear engineering topics. Election of course and topic must be approved in advance by supervising faculty.

Software Engineering

For the undergraduate curriculum in Software Engineering (http://www.se.iastate.edu) leading to the degree Bachelor of Science. This curriculum is accredited under the General Criteria and Software Engineering Program Criteria by the Engineering Accreditation Commission of ABET, http://www.abet.org.

The Bachelor of Science degree in software engineering is jointly administered by the College of Engineering and the College of Liberal Arts and Sciences. The Software Engineering program provides undergraduate students with the opportunity to learn software engineering fundamentals, to study applications of state-of-the art software technologies and to prepare for the practice of software engineering. The student-faculty interaction necessary to realize this opportunity occurs within an environment motivated by the principle that excellence in undergraduate education is enhanced by an integrated commitment to successful, long-term research and outreach programs.

The software engineering curriculum offers emphasis areas in software engineering principles, process and practice. Students may also take elective courses in computer engineering and computer science.

Program Educational Objectives

Within five years of graduation, the graduates should:

1. attain a **productive career** in Software Engineering or related fields;

2. attain **leadership** roles and become **effective collaborators** to advance professional and organizational goals;

3. engage in **continuous learning** and professional development.

We expect that these objectives will be manifested in our graduates through the following five key attributes: (a) *peer-recognized expertise*, (b) *engagement in professional practice*, (c) *sustained learning*, (d) *leadership* and (e) *teamwork*.

Demonstration of expertise involves applying state-of-the-art practices for solving problems in the design, development, validation, evolution and sustainment of (software) products. Demonstration of professional engagement involves contributing locally and globally to the use of ethical, competent, and creative practices in industry, academia or the public sector. Demonstration of sustained learning involves the ability to adapt to rapid technological, environmental, and organizational changes through self-study and group study and through opportunities of professional development or graduate study. Demonstration of leadership involves the ability to take initiative, and to facilitate the advancements of individuals and the community by influencing others and by having a widespread, positive impact on critical issues and projects. Finally, demonstration of teamwork involves the ability to work with collaborators who have varied expertise, and with diverse cultural and interdisciplinary backgrounds.

As a complement to the instructional activity, the Department of Computer Science and the Department of Electrical and Computer Engineering provide opportunities for each student to have experience with broadening activities. Students have the opportunity to gain practical industry experience in the cooperative education and internship program. Students have the opportunity to participate in advanced research activities. Through international exchange programs, students learn about engineering practices in other parts of the world.

Curriculum in Software Engineering

Administered by the Department of Electrical and Computer Engineering in the College of Engineering and the Department of Computer Science in the College of Liberal Arts and Sciences.

Leading to the degree bachelor of science.

Total credits required: 125 cr. Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs. Note: Pass/Not Pass credits cannot be used to meet graduation requirements.
International Perspectives: 3 cr. [1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirement:

ENGL 150	Critical Thinking and Communication (C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
LIB 160	Information Literacy	1
Choose one of the following:		3
ENGL 309	Proposal and Report Writing (C or better in this course)	

ENGL 314	Technical Communication (C or better in this course)	
Total Credits		10

General Education Electives: 15 cr. [2]

Choose 1 course from the following:		3
ECON 101	Principles of Microeconomics	
ECON 102	Principles of Macroeconomics	
I E 305	Engineering Economic Analysis	
Arts and Humanities		6
Social Sciences		3
Additional Arts and Humanities or Social Sciences course		3
Total Credits		15

Basic Program: 27 cr.

A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 167	General Chemistry for Engineering Students	4
or CHEM 177	General Chemistry I	
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
S E 101	Software Engineering Orientation [3]	R
S E 185	Problem Solving in Software Engineering [3]	3
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Math and Physical Science: 11 cr.

COM S 227	Introduction to Object-oriented Programming	4
COM S 228	Introduction to Data Structures	3
MATH 267	Elementary Differential Equations and Laplace Transforms	4
Total Credits		11

Software Engineering Core: 34 cr.

A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Core GPA):

CPR E 281	Digital Logic	4
Choose one of the following:		3
COM S 327	Advanced Programming Techniques	
CPR E 288	Embedded Systems I: Introduction	
Choose one of the following:		3
COM S 321	Introduction to Computer Architecture and Machine-Level Programming	
CPR E 381	Computer Organization and Assembly Level Programming	
Choose one of the following:		3
COM S 352	Introduction to Operating Systems	
CPR E 308	Operating Systems: Principles and Practice	
Choose one of the following:		3
COM S 230	Discrete Computational Structures	
CPR E 310	Theoretical Foundations of Computer Engineering	
COM S 311	Design and Analysis of Algorithms	3
COM S 363	Introduction to Database Management Systems	3
COM S 309	Software Development Practices	3
S E 319	Software Construction and User Interfaces	3
S E 329	Software Project Management	3
S E 339	Software Architecture and Design	3
Note: CPR E 288, CPR E 381 and CPR E 308 are 4-credit courses. The core credit requirement (34 credits) is given in terms of 3-credit courses. If the 4-credit courses are taken instead, then the extra credits will be used as credits for Supplementary Electives.		
Total Credits		34

Other Remaining Courses: 38 cr.

S E 491	Senior Design Project I and Professionalism	3
S E 492	Senior Design Project II	2
SP CM 212	Fundamentals of Public Speaking	3
One of the following STAT courses		3
STAT 330	Probability and Statistics for Computer Science	
STAT 305	Engineering Statistics	
One of the following ENGL courses (with a C or better in this course)		3
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
Math Elective: Choose one from the following list		3
MATH 207	Matrices and Linear Algebra	
MATH 265	Calculus III	
MATH 304	Combinatorics	
MATH 314	Graph Theory	
MATH 317	Theory of Linear Algebra	
Software Engineering Elective [2]		6
Technical Elective [2]		3
Supplementary Elective [2]		9

Open Elective [2]		3
Total Credits		38

Seminar/Co-op/Internships

S E 166	Careers in Software Engineering	R
S E 494	Software Engineering Portfolio Development	R

Co-op or internship (S E 396, S E 397, S E 398) is optional

Transfer Credit Requirements

The degree program must include a minimum of 30 credits at the 300-level or above in professional and technical courses earned at ISU in order to receive a B.S. in software engineering. These 30 credits must include S E 492 Senior Design Project II and credits in the core professional curriculum and/or in technical electives. The software engineering degree program requires a grade of C or better for any transfer credit course that is applied to the degree program.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S Diversity and International Perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved lists. (http://www.se.iastate.edu/academics)
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

See also: A 4-year plan of study grid showing course template by semester.

Note: International perspectives and U.S. diversity courses are used to meet the general education electives (http://www.se.iastate.edu/academics).

Plan of Study - 4 Year Plan *

Freshman

Fall	Credits	Spring	Credits
MATH 165	4	COM S 227	4
ENGL 150	3	MATH 166	4
S E 101	0	S E 166	0
LIB 160	1	PHYS 221	5
CHEM 167 or 177	4	Economics Elective	3
S E 185	3		
	15		16

Sophomore

Fall	Credits	Spring	Credits
CPR E 281[1]	4	S E 319[1]	3
ENGL 250	3	COM S 327 or CPR E 288[1, 2]	3
MATH 267	4	Math Elective	3
COM S 228	3	General Education Elective	3
SP CM 212	3		
	17		12

Junior

Fall	Credits	Spring	Credits
COM S 363[1]	3	S E 329[1]	3
COM S 230 or CPR E 310[1]	3	COM S 352 or CPR E 308[1, 2]	3
COM S 309[1]	3	ENGL 314 or 309	3
COM S 321 or CPR E 381[1, 2]	3	COM S 311[1]	3
General Education Elective	3	S E 339[1]	3
		Open Elective	3
	15		18

Senior

Fall	Credits	Spring	Credits
S E 494	0	S E 492	2
S E 491	3	Supplementary Electives	9
STAT 330 or 305	3	Software Engineering Electives	3
Technical Elective	3	General Education Elective	3
General Education Elective	3		
Software Engineering Elective	3		
	15		17

* Total credits required - 125 credits. Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU Cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.
Basic Program - A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA)
Must receive a C or better grade in required English classes.
General Educational Elective courses to be selected in consultation with SE advisers from a list of approved courses. They must include courses that satisfy university and college general education requirements. These courses include courses or categories of courses such as international perspectives and U.S. diversity, language, arts and humanities, and social sciences. Pass/Not Pass credit is not accepted.
Software Engineering Electives, Technical Electives, and Supplementary Electives must be selected from the program-approved list (http://www.se.iastate.edu/academics).

[1] Core Professional Curriculum (A minimum GPA of 2.00 is required for this set of courses, including any transfer courses but transfer course grades will not be calculated into the Core GPA)

[2] Students who take the 4-credit lab courses CPR E 288, CPR E 308, and CPR E 381 instead of the corresponding 3-credit alternatives can apply the additional credits toward Supplementary Electives. The total number of credits required in the Software Engineering Program remains the same for all students.

Courses primarily for undergraduates:

S E 101: Software Engineering Orientation
Cr. R.
Introduction to the procedures, policies, and resources of Iowa State University and the department of Computer Science and Electrical and Computer Engineering. Information on engineering and computer-based professions.

S E 166: Careers in Software Engineering
Cr. R.
Overview of the nature and scope of the software engineering profession. Relationship of coursework to careers. Departmental rules, student services operations, degree requirements, program of study planning, career options, and student organizations.

S E 185: Problem Solving in Software Engineering
(2-2) Cr. 3.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Introduction to software engineering and computer programming. Systematic thinking process for problem solving in the context of software engineering. Group problem solving. Solving software engineering problems and presenting solutions through computer programs, written documents and oral presentations. Introduction to principles of programming, software design, and extensive practice in design, writing, running, debugging, and reasoning about programs.

S E 319: Software Construction and User Interfaces
(Cross-listed with COM S). (3-0) Cr. 3. F.
Prereq: COM S 228
Basic theory of grammars, parsing. Language paradigms. State transition and table-based software design. Review of principles of object orientation, object oriented analysis using UML. Frameworks and APIs. User interface architecture, evaluation of user interface. Design of windows, menus, and commands. Introduction to formal specification and model-based software design. Introduction to domain-specific software engineering.

S E 329: Software Project Management
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: COM S 309
Process-based software development. Capability Maturity Model (CMM). Project planning, cost estimation, and scheduling. Project management tools. Factors influencing productivity and success. Productivity metrics. Analysis of options and risks. Version control and configuration management. Inspections and reviews. Managing the testing process. Software quality metrics. Modern software engineering techniques and practices.

S E 339: Software Architecture and Design
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: S E 319
Modeling and design of software at the architectural level. Architectural styles. Basics of model-driven architecture. Object-oriented design and analysis. Iterative development and unified process. Design patterns. Design by contract. Component based design. Product families. Measurement theory and appropriate use of metrics in design. Designing for qualities such as performance, safety, security, reliability, reusability, etc. Analysis and evaluation of software architectures. Introduction to architecture definition languages. Basics of software evolution, reengineering, and reverse engineering. Case studies. Introduction to distributed system software.

S E 342: Principles of Programming Languages
(Cross-listed with COM S). (3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165; COM S 230 or CPR E 310
Study of concepts in programming languages and major programming paradigms, especially functional programming. Special emphasis on design tradeoffs that enable students to make sound choices of programming languages for a given software development task. Programming projects.

S E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

S E 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

S E 409: Software Requirements Engineering
(3-0) Cr. 3. F.
Prereq: COM S 309; for graduate credit: graduate standing or permission of instructor
The requirements engineering process including identification of stakeholders requirements elicitation techniques such as interviews and prototyping, analysis fundamentals, requirements specification, and validation. Use of Models: State-oriented, Function-oriented, and Object-oriented. Documentation for Software Requirements. Informal, semi-formal, and formal representations. Structural, informational, and behavioral requirements. Non-functional requirements. Use of requirements repositories to manage and track requirements through the life cycle. Case studies, software projects, written reports, and oral presentations will be required.

S E 412: Formal Methods in Software Engineering
(Cross-listed with COM S, CPR E). (3-0) Cr. 3. S.
Prereq: COM S 230 or CPR E 310; COM S 311, STAT 330; for graduate credit: graduate standing or permission of instructor
A study of formal techniques for model-based specification and verification of software systems. Topics include logics, formalisms, graph theory, numerical computations, algorithms and tools for automatic analysis of systems. Graduate credit requires in-depth study of concepts.

S E 416: Software Evolution and Maintenance
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: COM S 309
Practical importance of software evolution and maintenance, systematic defect analysis and debugging techniques, tracing and understanding large software, impact analysis, program migration and transformation, refactoring, tools for software evolution and maintenance, experimental studies and quantitative measurements of software evolution. Written reports and oral presentation.

S E 417: Software Testing
(Cross-listed with COM S). (3-0) Cr. 3. S.
Prereq: COM S 309; COM S 230 or CPR E 310; ENGL 250, SP CM 212
Comprehensive study of software testing, principles, methodologies, management strategies and techniques. Test models, test design techniques (black box and white box testing techniques), test adequacy criteria,integration, regression, system testing methods, and software testing tools.

S E 419: Software Tools for Large Scale Data Analysis
(Cross-listed with CPR E). (3-3) Cr. 4.
Prereq: CPR E 308 or COM S 352, COM S 309
Software tools for managing and manipulating large volumes of data, external memory processing, large scale parallelism, and stream processing, data interchange formats. Weekly programming labs that involve the use of a parallel computing cluster.

S E 490: Independent Study
Cr. arr. Repeatable.
Prereq: Senior classification in software engineering
Investigation of an approved topic.

S E 491: Senior Design Project I and Professionalism
(2-3) Cr. 3.
Prereq: S E 329, completion of 29 credits in the S E core professional program, ENGL 314
Preparing for entry to the workplace. Selected professional topics. Use of technical writing skills in developing project plan and design report; project poster. First of two-semester team-oriented, project design and implementation experience.

S E 492: Senior Design Project II
(1-3) Cr. 2.
Prereq: S E 491
Second semester of a team design project experience. Emphasis on the successful implementation and demonstration of the design completed in S E 491 and the evaluation of project results. Technical writing of final project report; oral presentation of project achievements.

S E 494: Software Engineering Portfolio Development
Cr. R. F.S.
Prereq: Credit or enrollment in S E 491
Portfolio assessment for Software Engineers. Guidelines and Advice to improve software engineering portfolios and to better use portfolios as a tool to enhance career opportunities.

Systems Engineering

Systems Engineering Master's Degree

Administered by the Department of Industrial and Manufacturing Systems Engineering

The Systems Engineering Program focuses on developing an individual's analytical skills to design, evaluate, and build modern complex engineered systems. Engineers who can conceptualize, model, and integrate hardware, software, data, and humans are critical in technology driven multi-disciplinary design teams. The Iowa State University Master of Engineering in Systems Engineering Program is designed to train engineers to excel in the technology driven design environment commonly found in developing modern complex engineered systems. The program can be completed on line or in residence, part-time or full-time.

Admission Requirements

Unrestricted admission requires (1) a 3.0 grade point average from an ABET accredited undergraduate engineering program, (2) minimum of two years of engineering experience or current full-time employment

as an engineer, (3) calculus, engineering statistics, and engineering economy. A GRE is not required for this program.

Applicants for admission to the Systems Engineering Program apply through the Graduate College at Iowa State University. Each applicant must submit:

- Application and application fee
- Official academic transcripts
- Three letters of recommendation
- Resume

Applications should be submitted as early as possible before the beginning of the semester for which admission is sought. Individuals may also take up to 9 credits at Iowa State as a non-degree seeking student and then transfer them to the program when they are admitted. (http://www.elo.iastate.edu/how-elo-works/admission-and-enrollment)

The Master of Engineering in Systems Engineering Program at Iowa State University is focused on supporting working professionals so teaching or research assistantships typically are not available.

Degree Requirements (10 courses total = 30 credits)

Intro Core (required first year)

I E 563	Engineering and Systems Management	3
I E 565	Systems Engineering and Analysis	3
Additional Core		
I E 564	Decision Analysis in System Design	3
I E 570	Systems Engineering and Project Management	3
I E 585	Requirements and Architecture Engineering	3
Electives (select 5 courses from any categories)		
Manufacturing Courses		
I E 448	Manufacturing Systems Engineering	
I E 541	Inventory Control and Production Planning	
I E 549	Computer Aided Design and Manufacturing	
I E 561	Continuous Quality Improvement of Process	
I E 572	Design and Evaluation of Human-Computer Interaction	
I E 577	Human Factors	
Engineering Courses		
I E 582	Enterprise Modeling and Integration	
AER E 568	Large-Scale Complex Engineered Systems (LSCES)	
I E 503	Introduction to Sustainable Production Systems	
Software Courses		
I E 581	e-Commerce Systems Engineering	
I E 588	Information Systems for Manufacturing	
1 Other from any graduate program (optional)		

Students working in research and development who are interested in furthering their research skills may select a creative component option as part of their supporting courses.

Systems Engineering Certificate 2016 (4 courses total = 12 credits)

Intro Core (required first year)

I E 563	Engineering and Systems Management
I E 565	Systems Engineering and Analysis
Core (required to pick 2)	
I E 564	Decision Analysis in System Design
I E 570	Systems Engineering and Project Management
I E 585	Requirements and Architecture Engineering

Other focus areas in related disciplines, such as systems engineering, human factors, supply chain management, or manufacturing, may be substituted for supporting courses. A program of study is developed by the student and academic adviser to fit individual needs.

Students working in research and development who are interested in furthering their research skills may select a creative component option as part of their supporting courses.

College of Human Sciences

Laura Jolly, Dean
Carla Peterson, Associate Dean Research and Graduate Education
Linda Serra Hagedorn, Associate Dean Undergraduate Programs, International Affairs, Diversity, Equity, and Community, Students Services
Debra Sellers, Associate Dean and Director of Human Sciences Extension and Outreach

www.hs.iastate.edu/ (http://www.hs.iastate.edu)

The College of Human Sciences provides an integrative approach to improving the quality of life for individuals, families, schools and communities by linking discovery, science, creativity, and practice; applying the knowledge of learning in all endeavors; and developing leaders for roles in research, education, business and industry, and health and human services.

The College of Human Sciences (CHS), founded in 2005, fosters innovative synergies in teaching and learning in addition to the discovery of new knowledge, and in many ways is reinventing how human potential can be enhanced. Members of the college strive to improve the quality of people's lives - helping them learn better, live longer, and lead lives that are more productive and fulfilling.

Recommended High School Preparation

Recommended preparation for students entering most departments in the College of Human Sciences should include 4 years of English (including speech) with emphasis in composition and communication skills; 3 years each of mathematics and natural sciences, and at least 2 years of social sciences and/or humanities. In addition, students interested in Elementary Education are advised to complete three or more years of high school study in one foreign language.

Information for Prospective Students

Each student in the College of Human Sciences works closely with an academic advisor who is associated with the program in which the student is majoring. Advisors assist students in developing academic programs and in adjusting to university life. They also provide information and guidance about career choices. Advisors attempt to assist students as they develop their schedule of classes to meet their goals, interests, and capabilities.

The college offers a number of orientation sessions during the summer for students planning to enter in the fall. Students who enter in spring or summer terms are also offered orientation sessions which are held prior to the beginning of the student's first term. Incoming students are encouraged to attend an orientation session so that academic assessments can be made and appropriate classes may be scheduled for the following term.

Undecided Students

The College of Human Sciences offers an academic support program for students who are considering several majors at Iowa State University. This program is administered to undecided Human Sciences students through the MINDS Learning Community. Students in the MINDS Learning Community take coursework together, including an orientation and career exploration course which is taught by college advisers. This course provides opportunities for students to evaluate their interests, skills, and strengths while also receiving additional support through a peer mentor program. All undecided majors in the College of Human Sciences are required to participate in MINDS Learning Community and will sign up for the program during orientation. For more information, visit the MINDS webpage: http://www.hs.iastate.edu/prospective/learning-communities/minds/

Planned Transfer Programs

By planning carefully, students may begin their education at another college and then transfer their courses to a curriculum within the College of Human Sciences with maximum efficiency in meeting the degree requirements. The college works closely with community colleges in Iowa and surrounding states to facilitate a transfer to Iowa State University. For more information, call 1-800-522-0683 or visit the College of Human Sciences Recruitment Office.

Divisions of the College

- Apparel, Events, and Hospitality Management (http://www.aeshm.hs.iastate.edu)
- Food Science and Human Nutrition (http://www.fshn.hs.iastate.edu)
- Human Development and Family Studies (http://www.hdfs.hs.iastate.edu)
- Kinesiology (http://www.kin.hs.iastate.edu)
- School of Education (http://www.education.iastate.edu)

Accreditation and Licensure

The following program-specific accreditation/ licensure/registrations have been attained by departments or School of Education within the college:

Department of Apparel, Events, and Hospitality Management:

Apparel, Merchandising, and Design major is endorsed by the American Apparel and Footwear Association's Education Foundation. The design primary option is accredited by the National Association of Schools in Art and Design.

Hospitality Management is accredited by the Accreditation Commission for Programs in Hospitality Administration.

Department of Food Science and Human Nutrition:

- The Food Science degree, including Industry and Technology options are approved by the Institute of Food Technologists.
- The Didactic Program in Dietetics and Dietetics Internship are accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics.

Department of Human Development and Family Studies:

- The Child Development Laboratory School is accredited by the National Association for the Education of Young Children (NAEYC), Academy for Early Childhood Programs, is licensed by the Iowa Department of Human Services, and maintains a 5 Star Rating from the Iowa Quality Rating System.
- The Early Childhood Education Program (administered in collaboration with the School of Education) and the Family and Consumer Sciences Education Teacher Licensure Program are accredited by the Iowa Department of Education and students may be recommended for licensure to the Iowa Board of Educational Examiners.

Department of Kinesiology:

- Athletic Training program is accredited by the Commission on Accreditation of Athletic Training Education.

- Physical Education Teacher Licensure Program is licensed by the Iowa Department of Education and Iowa Board of Educational Examiners.

School of Education - Educator Preparation and Licensure:

- All Iowa State University Educator Preparation Programs are accredited by the Iowa Department of Education and the Iowa Board of Educational Examiners.
- All students who are recommended by Iowa State University for teacher licensure must meet the requirements of the University Educator Preparation Program.
- Each student will be enrolled in the School or Department in which he or she plans to major and must meet the graduation requirements of that department and the college in which it is located.
- For details concerning the professional educator requirements and the areas of specialization requirements, see Teacher Education.

Undergraduate Core Curriculum

Purpose

The College of Human Sciences has established core learning outcomes to provide the unifying foundation critical to personal and professional success for all College of Human Sciences undergraduate students. Assessment of College of Human Sciences' core learning outcomes will measure student competence in four (4) areas. Assessment results will be used by CHS faculty and staff to enhance student learning experiences.

Four components

The core identifies the expected minimum outcomes that each undergraduate in the college must meet:

Communication - Communicate with clear purpose, workable organization and effective style in written, oral, visual and electronic (WOVE) formats without distracting errors in usage or convention.

Self-Assessment/Self Reflection - Consistently and realistically analyze and evaluate one's own knowledge, abilities and actions in comparison to professional standards and create action plans to enhance personal and professional efficacy.

Critical Thinking - Generate, acquire and evaluate information based on scientific evidence, creative processes, and logical and ethical reasoning to make decisions and solve problems in one's personal, professional and community endeavors.

Social Justice - Articulate and demonstrate a clear concept of a just society in which individuals and groups equitably share in societal benefits within a global community.

Expectations for Departments/School of Education/ Programs

Departments/schools/programs formally participate in outcomes assessment. Programs identify courses at three levels (introductory, intermediate, and advanced) where at least one significant educational activity is identified and assessed. Increased achievement and level of mastery at advanced levels is discussed and incorporated through continuous improvement efforts.

General Education

Students in the College of Human Sciences are required to complete a program in general education which is integrated in their professional training and extends through the undergraduate curriculum.

The general education program emphasizes intellectual growth and personal development as contrasted with specific career preparation.

The program aims to stimulate a desire for learning and intellectual endeavor, develop understanding and appreciation for the physical and cultural world, encourage independent thinking and analysis, increase competence in all aspects of communication, and create an understanding of individuals as social, psychological, and physical beings.

The student is expected to complete studies in three groups in general education. Areas represented below are not departmental titles. In some cases, courses relating to a given area may be found in several different departments. Credits listed are minimum requirements.

Minimum Group Requirements in the College of Human Sciences

I. Communication Skills (10 cr.): ENGL 150, ENGL 250; LIB 160; and 3 credits in oral communication

II. Biological and physical sciences and mathematical disciplines (9 cr.): at least 3 credits in mathematical disciplines

III. Social sciences and humanities (15 cr.): at least 6 credits in social sciences and at least 6 credits in humanities

Double Majors

Undergraduate students may elect a second major from the departments or school and program areas listed above, or from a major field offered for the bachelor's degree in another college of the university. Double majors may be prohibited between majors as determined by the appropriate curriculum committees.

The major departments must approve the degree program, and if those majors involve two colleges, both deans must approve. Such programs must fulfill the general education requirements of the college of the primary major. If one major leads to the B.A. degree and the other to the B.S. degree, the degree awarded will be the one offered by the department

of the primary major. If the primary major may lead to either a B.A. or a B.S., a student may choose to receive either degree. In this case, the student must satisfy the requirements of each major and of the degree that is chosen for the primary major.

Students with a primary major in another college who wish to take a second major in the College of Human Sciences are required to meet all requirements for the major, prerequisites and supporting courses.

Two Bachelor's Degrees

Any degree offered by the College of Human Sciences may be earned together with a degree in this or any other college of the university. For the requirements for two degrees, see Index, Bachelor's Degree, Two.

International and Cross Cultural Programs

The College of Human Sciences encourages students to participate in international and cross-cultural programs that will help them become life-long learners of other cultures and perspectives, enhance their global citizenship, and expand their opportunities for employment after graduation. The College offers short-term faculty-led study abroad programs, semester-long exchange programs, international student teaching sites, and dietetic internship rotations.

International opportunities change each year, and students should visit http://intl.hs.iastate.edu to review the list of available programs and to explore which offerings are designed for specific majors. The College offers several study abroad scholarships and last year over $55,000 was awarded to support student participation in our international programs.

Faculty members also bring diversity and global perspectives to instruction through research and collaborations with scholars and institutions abroad, and the College employs faculty members from many different countries.

Honors Program

High achieving students, with a grade point average of above 3.50, are invited to apply to the Honors Program. Honors students are encouraged to develop a creative program of study expanding their interests while meeting individual educational objectives. Students in the Honors Program also participate in University Honors Seminars, Honors Courses and complete an honors project. For further information, contact the College Honors Committee or academic adviser. See www.hs.iastate.edu/academics/honors/ (http://www.hs.iastate.edu/academics/honors/%20%20) or look in the Index, under Honors Program.

Human Sciences Extension and Outreach

Students may prepare for a career in the Cooperative Extension System by enrolling in a curriculum in the College of Human Sciences that provides them with a subject matter base for conducting educational programs for families. Advice on choice of courses should be sought from the Family and Consumer Sciences Education and Studies program, the Associate Dean and Director of Iowa State University Human Sciences Extension and Outreach, and/or the Iowa State University Extension and Outreach 4-H Youth Development Program Leader.

Undergraduate Majors

For more information about a major, see:

1. The curriculum descriptions in this section of the catalog
2. The department catalog section under Courses and Programs
3. Department websites.

Apparel, Events, and Hospitality Management

Apparel, Merchandising, and Design

Options: Merchandising; Creative and Technical Design; and Product Development See Curriculum in Apparel, Merchandising, and Design

Event Management

See Curriculum in Event Management

Hospitality Management

See Curriculum in Hospitality Management

Food Science and Human Nutrition

Culinary Food Science

See Curriculum in Culinary Food Science

Diet and Exercise B.S./M.S.

Jointly administered with the Department of Kinesiology. See Curriculum in Diet and Exercise

Dietetics

See Curriculum in Dietetics

Food Science

Options: Food Science and Industry; Food Science and Technology. See Curriculum in Food Science

Nutritional Science

Options: Pre-Health Professional and Research; Family Health; Food Service; Global Health and Policy; Health Coach; and Nutrition and Wellness. See Curriculum in Nutritional Science.

Human Development and Family Studies

Child, Adult, and Family Services

Options: Child Programs; Youth Programs; and Adult/Family Programs. See Curriculum Child, Adult, and Family Services

Early Childhood Education - Unified

Administered jointly by the School of Education and the Department of Human Development and Family Studies. See Curriculum in Early Childhood Education

Family and Consumer Sciences Education and Studies

Options: Communications; Professional Studies; Teacher Licensure. See Curriculum in Family and Consumer Sciences Education and Studies

Financial Counseling and Planning

See Curriculum in Financial Counseling and Planning

Affiliated Program: Early Childcare Education and Programming.

Offered by the Great Plains Interactive Distance Education Alliance (GPIDEA). See Curriculum in Early Childcare Education and Programming

Kinesiology

Athletic Training

See Curriculum in Athletic Training

Diet and Exercise B.S./M.S.

Jointly administered with the Department of Food Science and Human Nutrition. See Curriculum in Diet and Exercise

Kinesiology & Health

Options: Community and Public Health; Exercise Science; Physical Activity and Health Promotion; Physical Education Teacher Education; and Pre-Health Professions. See Curriculum in Kinesiology & Health

School of Education

Early Childhood Education - Unified

Administered jointly by the School of Education and the Department of Human Development and Family Studies. See Curriculum in Early Childhood Education

Elementary Education

Administered by the School of Education. See Curriculum in Elementary Education

Secondary Education

Offered in conjunction with subject matter areas, or majors, offered by various departments across the university campus. These subject matter areas include agriculture, biology, chemistry, earth sciences, English, family and consumer sciences, health, history-social sciences, mathematics, music, physics, physical education, and world languages. See Index, Teacher Education

International Studies (secondary major only)

The International Studies Program is an interdisciplinary program which may be taken only as a second major. Students pursuing a second major in international studies must complete the International Studies Program as described in this catalog (see Index, International Studies).

Undergraduate Minors

Minors are available to all Iowa State students. Minors consist of at least 15 credits including 6 credits taken at Iowa State University in courses numbered 300 or above. A student may not apply the same course to two different minors. The minor must include 9 credits that are not used to meet any other department, college or university requirement. Minors are available in the following areas:

Apparel, Merchandising, and Design - (select "Program Information") See http://www.aeshm.hs.iastate.edu/majors/amd/#minor

Child, Adult, and Family Services - See http://www.hdfs.hs.iastate.edu/undergraduate-majors/minors/#child-adult-and-family-services

Culinary Food Science - See http://www.fshn.hs.iastate.edu/undergraduate-programs/minors/

Dance - See http://www.kin.hs.iastate.edu/programs/dance/minor/

Educational Services in Family and Consumer Sciences - See http://www.hdfs.hs.iastate.edu/undergraduate-majors/minors/#educational-services-in-family-and-consumer-sciences

Event Management - (select "Program Information") See http://www.aeshm.hs.iastate.edu/majors/event-management/#minor

Exercise Science - See http://www.kin.hs.iastate.edu/programs/minors/exercise-science/

Financial Counseling and Planning - See http://www.hdfs.hs.iastate.edu/undergraduate-majors/minors/#financial-counseling-and-planning

Food and Society – See http://www.fshn.hs.iastate.edu/undergraduate-programs/minors/

Food Safety (interdepartmental minor) - See http://www.fshn.hs.iastate.edu/undergraduate-programs/minors/

Food Science - See http://www.fshn.hs.iastate.edu/undergraduate-programs/minors/

Gerontology (interdisciplinary minor) - See http://www.gerontology.iastate.edu/programs/ugrad-minor/

Health Promotion - See http://www.kin.hs.iastate.edu/programs/minors/health-promotion/

Hospitality Management - (select "Program Information") See http://www.aeshm.hs.iastate.edu/majors/hospitality-management/#minor

Learning and Leadership Sciences

Learning Technologies - See http://www.education.iastate.edu/undergraduate-studies/learning-technologies-minor/

Kinesiology - See http://www.kin.hs.iastate.edu/programs/minors/kinesiology/

Nutrition - See http://www.fshn.hs.iastate.edu/undergraduate-programs/minors/

Graduate Programs

The College of Human Sciences offers a variety of programs leading to a Masters degree, a Ph.D., or a graduate certificate. Each unit offers a variety of program options, as well as opportunities for interdisciplinary study in the areas of gerontology, toxicology, nutritional studies, and genetics. Multiple opportunities for on-campus and distance education programs are available.

Preparation for Graduate Study

Students considering graduate studies should gain background knowledge in basic subjects related to their area of interest. Undergraduate mathematics, statistics, and research methods courses are useful as preparation for advanced study in graduate school. Upon completion of graduate programs, students are qualified for leadership positions in business, government agencies, and public and private agencies and institutions, as well as for teaching, research, and extension positions in colleges and universities.

Information for Prospective Students

Graduate study in the College of Human Sciences is conducted through collaboration with the Graduate College, and application is completed through the Graduate College. Details regarding the application process and general information about graduate studies at ISU are found in the Graduate College section of this catalog, (http://www.grad-college.iastate.edu/). Details regarding the curricula and specific expectations for each program are found on department websites.

Each graduate student in the College of Human Sciences works closely with an academic advisor and a Program of Study (POS) committee. The POS assists students in developing academic programs tailored to meet individual needs, guide research and/or internship activities, and provide information and guidance about career choices. Graduate assistantship support is available for many students and involves them in research, teaching, and administrative experiences. Incoming students are encouraged to work with departmental advisors to develop appropriate class and assistantship activities.

Graduate Curricula

Information about curricula and degree options for each College of Human Sciences unit is available on the unit websites below.

•Apparel, Events, and Hospitality Management – http://www.aeshm.hs.iastate.edu/graduate-programs/

•Food Science & Human Nutrition – http://www.fshn.hs.iastate.edu/graduate-program/

•Human Development & Family Studies – http://www.hdfs.hs.iastate.edu/graduate/

•Kinesiology – http://www.kin.hs.iastate.edu/graduate/

•School of Education - http://www.education.iastate.edu/graduate-studies/

Distance Education Opportunities

Several courses and degree programs are available online. Additionally, some degree programs are provided with a combination of online and condensed schedules that require limited time on campus. Details about these offerings are found on unit websites.

Some degree programs and graduate certificates are offered through collaboration with the Great Plains Interactive Distance Education Alliance (GP-IDEA; http://www.gpidea.org/). These online programs allow students to earn a graduate degree from ISU while taking courses and interacting with students from a number of participating universities. As well, the CHS offers a Masters of Family and Consumer Sciences-Comprehensive degree (http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-comprehensive/) online.

Undergraduate Certificates

An undergraduate certificate provides a way to give formal recognition of focused study in a specialized area that is less comprehensive than required for an undergraduate major. At Iowa State University, an undergraduate certificate is awarded concurrently or after baccalaureate requirements are finished. The following undergraduate certificate is available in the College of Human Sciences:

Health Coach Certificate - see http://www.fshn.hs.iastate.edu/undergraduate-programs/health-coach-certificate

Graduate Certificates

Graduate certificates provide formal recognition of focused graduate study in an area of specialization that is less comprehensive than required for a master's degree. At Iowa State University, a graduate certificate may be earned either before, after, or concurrently with the master's or doctoral degree. The following graduate certificates are available in the College of Human Sciences:

Applied Research Methods in Human Sciences Certificate - see http://www.education.iastate.edu/graduate-studies/gradprograms/appliedresearch/

Community College Teaching Certificate - see http://www.education.iastate.edu/graduate-studies/gradprograms/ccteaching/

Development and Family Sciences Advanced Research Design and Methods - see www.hdfs.hs.iastate.edu/graduate/curriculum/certificates/

* Dietetics Internship Certificate - see www.dietetics.iastate.edu/ (http://www.dietetics.iastate.edu)

* Family Financial Planning Certificate - see www.online.hs.iastate.edu/graduate-programs/masters/mfcs-ffp/ (http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-ffp)

Family Well Being in Diverse Society - see www.hdfs.hs.iastate.edu/graduate/curriculum/certificates/#family-well-being-in-diverse-society

* Gerontology Certificate - see www.hdfs.hs.iastate.edu/graduate/curriculum/ms-fcs/ (http://www.hdfs.hs.iastate.edu/graduate/curriculum/ms-fcs)

* Infant and Early Childhood Mental Health - see www.hdfs.hs.iastate.edu/graduate/curriculum/certificates/#infant-and-early-childhood-mental-health

* Instructional Design Certificate - see http://www.education.iastate.edu/graduate-studies/gradprograms/itms/instructional-design/

Life Span Development - see www.hdfs.hs.iastate.edu/graduate/curriculum/certificates/

* Literacy Coaching Certificate - see www.education.iastate.edu/te/graduate/literacy/literacy-coaching/

Principal Endorsement (Pre-LEAD) - see http://www.education.iastate.edu/graduate-studies/gradprograms/elop/prelead.html

Education for Social Justice Certificate - see www.education.iastate.edu/graduate/social-justice/certificate/

Special Education Certificate - see http://www.education.iastate.edu/graduate-studies/gradprograms/l3/special-education-certificate.html

Superintendent Licensure - see www.education.iastate.edu/graduate/ed-admin/superintendent/

* Youth Development Specialist - see http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-youth-development/

* Youth Program Management & Evaluation - see http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-youth-development/

*** online certificate**

Apparel, Events, and Hospitality Management Department

The Apparel, Events, and Hospitality Management department offers courses that provide opportunities for students to learn about interdisciplinary areas including aesthetics, leadership, entrepreneurship, and multi-channel retailing at both undergraduate and graduate levels. AESHM courses serve to complement the student's major area of study whether it be Apparel, Merchandising, and Design; Event Management; Hospitality Management; agriculture, business, design education, engineering, liberal arts and sciences or minor areas of study including entrepreneurial studies, design studies, or international studies.

Apparel, Events, and Hospitality Management, otherwise known as AESHM, is composed of three majors:

- Apparel, Merchandising, and Design
- Event Management
- Hospitality Management

Through each of these three programs, students gain skills and knowledge to help them succeed in the real world. In addition to coursework, they complete an internship that closely relates to their career aspirations.

Graduates of these programs are the managers of your favorite resorts, the designers of your best jeans, and the coordinators of lavish events. From fine dining to fine apparel, our students, alumni, faculty, and staff have an eye for the original and a taste for quality.

Courses primarily for undergraduates:

AESHM 112: Orientation for AESHM
(1-0) Cr. 1. F.S.
Prereq: Concurrent enrollment with AESHM 113
Orientation policies and procedures of university and college. Guest speakers representing the university. Some online lectures.

AESHM 113: Professional Development for AESHM
(1-0) Cr. 1. F.S.
Career exploration, presentation and professional skills, teamwork and leadership, creativity, critical thinking, technology, and service learning components. Orientation to policies and procedures of college, department, and program.

AESHM 113E: Professional Development for AESHM: Event Management and Hospitality Management
(1-0) Cr. 1. F.S.
EVENT and HSP M career exploration, presentation and professional skills, teamwork and leadership, creativity, critical thinking, technology, and service learning components. Orientation to policies and procedures of CHS college; AESHM department; and Event Management and Hospitality Management programs.

AESHM 113N: Professional Development for AESHM: Apparel, Merchandising, and Design
(1-0) Cr. 1. F.S.
AMD career exploration, presentation and professional skills, teamwork and leadership, creativity, critical thinking, technology, and service learning components. Orientation to policies and procedures of CHS college, AESHM department, and AMD program.

AESHM 170: Supervised Work Experience I
Cr. 1. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Adviser permission required; freshman classification or permission
Supervised work experience with a cooperating firm or organization. Offered on a satisfactory-fail basis only. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 170D: Supervised Work Experience I: Hospitality
Cr. 1. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Adviser permission required
Supervised work experience with a cooperating firm or organization. Offered on a satisfactory-fail basis only. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 170F: Supervised Work Experience I: Event Management
Cr. 1. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Adviser permission required
Supervised work experience with a cooperating firm or organization. Offered on a satisfactory-fail basis only. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 170N: Supervised Work Experience I: Apparel
Cr. 1. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Adviser permission required; freshman classification
Supervised work experience with a cooperating firm or organization. Offered on a satisfactory-fail basis only. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 170P: Supervised Work Experience I: ISU Dining
Cr. 1. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Adviser permission required; freshman classification or permission
Supervised work experience with a cooperating firm or organization. Offered on a satisfactory-fail basis only. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 175: Financial Applications for Retail and Hospitality Industries
(2-0) Cr. 2. S.
Using an online delivery method, students will learn basic mathematical concepts, calculations and formulas commonly used in the apparel and hospitality industries. Emphasis on problem solving, critical/creative thinking, and mathematical interpretation of calculations and formulas used within the apparel and hospitality industries.

AESHM 175D: Financial Applications for Retail and Hospitality Industries: Hospitality Management
(2-0) Cr. 2. S.
Using an online delivery method, students will learn basic mathematical concepts, calculations and formulas commonly used in the apparel and hospitality industries. Emphasis on problem solving, critical/creative thinking, and mathematical interpretation of calculations and formulas used within the hospitality industries.

AESHM 175N: Financial Applications for Retail and Hospitality Industries: Retail Merchandising
(2-0) Cr. 2. S.
Using an online delivery method, students will learn basic mathematical concepts, calculations and formulas commonly used in the apparel and hospitality industries. Emphasis on problem solving, critical/creative thinking, and mathematical interpretation of calculations and formulas used within the apparel industries.

AESHM 211: Leadership Experiences and Development (LEAD)
(3-0) Cr. 3. S.
Introduction to leadership behaviors. Development and utilization of leadership behaviors to positively impact school life, community life, and work life.

AESHM 222: Creativity on Demand
(3-0) Cr. 3. S.
Learn to use creativity strategies to solve everyday problems related to personal and professional lives. Application of creative thinking techniques to view things from different perspectives; identify unique opportunities; and generate and evaluate original ideas. Field trips might be required.

AESHM 270: Supervised Work Experience II
Cr. 1-2. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Minimum 2.0 GPA; Adviser permission required; sophomore classification
Supervised work experience with a cooperating firm or organization. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 270D: Supervised Work Experience II: Hospitality
Cr. 1-2. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Minimum 2.0 GPA; Adviser permission required; sophomore classification; 6 cr in AESHM or HSP M, credits in AESHM 170
Supervised work experience with a cooperating firm or organization. No more than 12 credits total from AESHM 170, AESHM 270, and 470 may be applied toward graduation.

AESHM 270F: Supervised Work Experience II: Event Management
Cr. 1-2. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Minimum 2.0 GPA; Adviser permission required; 6 cr in AESHM, HSP M, or EVENT; employer location should be different than employer location used for AESHM 170 and 470.
Supervised work experience with a cooperating firm or organization. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 270N: Supervised Work Experience II: Apparel
Cr. 1-2. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Minimum 2.0 GPA; Adviser permission required. Sophomore AMD classification
Supervised work experience with a cooperating firm or organization. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 270P: Supervised Work Experience II: ISU Dining
Cr. 1-2. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Minimum 2.0 GPA; Adviser permission required; sophomore classification; 6 cr in AESHM or HSP M, credit in AESHM 170.
Supervised work experience with a cooperating firm or organization. No more than 12 credits total from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 272: Fashion Show Production and Promotion
(2-2) Cr. 1-3. Repeatable, maximum of 4 credits. F.S.
Prereq: Application and instructor permission, application form available from the AESHM Department office
Planning and production of fashion show including developing budgets, public relations, advertising, fund-raising, choreography, staging, lighting, and food. Promotion of fashion show and similar events. Maximum of 4 credits can be applied to graduation

AESHM 280: Orientation to U.S. Field Study
Cr. R. Repeatable, maximum of 2 times. F.S.
Orientation to the field study location during the semester preceding the trip.

AESHM 281: Orientation to International Field Study
Cr. 1. Repeatable, maximum of 2 times. F.S.
Orientation to the field study location during the semester preceding the trip.

AESHM 287: Principles of Management in Human Sciences
(3-0) Cr. 3. F.S.
Introduction to management concepts and principles with application to human sciences-related businesses and organizations. Includes service quality management, professionalism, and social responsibility.

AESHM 311: Seminar on Careers and Internships
(1-0) Cr. 1. F.S.
Prereq: AESHM 113; Sophomore classification. Good academic standing
Internship and career planning, professional expectations and responsibilities. Résumé development, cover letters, interviewing techniques, and business etiquette.

AESHM 311E: Seminar on Careers and Internships: Event Management and Hospitality Management
(1-0) Cr. 1. F.S.
Prereq: AESHM 113; Sophomore classification. Good academic standing.
Internship and career planning, professional expectations and responsibilities. Résumé development, cover letters, interviewing techniques, and business etiquette.

AESHM 311N: Seminar on Careers and Internships: Apparel, Merchandising, and Design
(1-0) Cr. 1. F.S.
Prereq: AESHM 113; Sophomore classification. Good academic standing
Internship and career planning, professional expectations and responsibilities. Résumé development, cover letters, interviewing techniques, and business etiquette.

AESHM 340: Hospitality and Apparel Marketing Strategies
(3-0) Cr. 3. F.S.
Prereq: ECON 101
Application of marketing principles to the hospitality-, events-, and apparel-related industries. Emphasis on the role of marketing in an organization's overall strategic planning. Development and evaluation techniques available to hospitality, events, apparel, and related businesses, including advertising, sales promotion, packaging, and public relations.

AESHM 342: Aesthetics of Consumer Experience
(3-0) Cr. 3. F.S.
Prereq: Sophomore classification
Design principles, aesthetic concepts, and research applied to consumer experiences, with an emphasis on hospitality and retail environments and events. Influence of individual differences and cultural patterns on aesthetic preferences.
Meets U.S. Diversity Requirement

AESHM 380: U.S. Field Study
(Dual-listed with AESHM 580). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in A M D, AESHM, EVENT, and/or HSP M; sophomore classification; minimum 2.0 GPA. Permission by application
Study and tours of areas of interest to majors in the AESHM Department. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 380D: U.S. Field Study: Hospitality Management
(Dual-listed with AESHM 580D). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in AESHM or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 280 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 380F: U.S. Field Study: Event Management
(Dual-listed with AESHM 580F). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in EVENT, AESHM, or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 280 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the majors in the Event Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 380N: U.S. Field Study: Apparel, Merchandising, and Design
(Dual-listed with AESHM 580N). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in A M D or AESHM; sophomore classification; minimum 2.0 GPA; AESHM 280 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 381: International Field Study
(Dual-listed with AESHM 581). Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in A M D, AESHM, EVENT, and/or HSP M; sophomore classification; minimum 2.0 GPA. Permission by application
Study and tours of areas of interest to majors in the AESHM Department. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 381D: International Field Study: Hospitality Management
(Dual-listed with AESHM 581D). Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in AESHM and/or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 281 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 381F: International Field Study: Event Management
(Dual-listed with AESHM 581F). Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in AESHM, EVENT, and/or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 281 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Event Management major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 381N: International Field Study: Apparel, Merchandising, and Design
(Dual-listed with AESHM 581N). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in A M D and/or AESHM; sophomore classification; minimum 2.0 GPA; AESHM 281 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 398: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of adviser; junior classification
Required of all cooperative education students seeking full-time status. Students register for this course prior to commencing each work period.

AESHM 411: Seminar on Current Issues
Cr. 1. F.S.
Prereq: Permission of instructor.
Trends, issues, research, and scholarship in apparel, events, and hospitality management.

AESHM 411E: Seminar on Current Issues: Events and Hospitality
Cr. 1. F.S.
Prereq: senior classification in AESHM.
Trends, issues, research, and scholarship in events and hospitality management.

AESHM 411N: Seminar on Current Issues: Apparel
(1-0) Cr. 1. Repeatable, maximum of 2 times. F.S.
Prereq: AESHM 470N
Trends, issues, research, and scholarship in apparel.

AESHM 421: Developing Global Leadership: Maximizing Human Potential
(3-0) Cr. 3. S.
Development of leadership in a global environment. Focus on global concerns that impact on the well-being of individuals, families, and communities. Strategies for working with individuals, families and communities in other countries and cultures. Taking local action on global issues. Participation in a service activity.
Meets International Perspectives Requirement.

AESHM 438: Human Resource Management
(3-0) Cr. 3. F.S.
Prereq: AESHM 270, AESHM 275 or AESHM 287; junior classification
Principles and practices of human resource management relevant to human science-related organizations. Emphasis on the entry-level manager's role.

AESHM 470: Supervised Professional Internship
Cr. 3-6. Repeatable. F.S.SS.
Supervised work experience with a cooperating firm or organization.

AESHM 470D: Supervised Professional Internship: Hospitality
Cr. 3-6. Repeatable. F.S.SS.
Prereq: AESHM 270, 311, 9 credits in HSP M, and minimum 2.0 GPA; permission by application; junior or senior classification; employer location should be different than employer/location used for AESHM 170 and 270
Supervised work experience with a cooperating firm or organization. No more than 12 credits from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 470F: Supervised Professional Internship: Event Management
Cr. 3-6. Repeatable. F.S.SS.
Prereq: AESHM 311, EVENT 271; employer/location should be different than employer/location used for AESHM 170 and 270
Supervised work experience with a cooperating firm or organization. No more than 12 credits from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 470N: Supervised Professional Internship: Apparel
Cr. 3-6. Repeatable. F.S.SS.
Prereq: AESHM 311, 9 credits in A M D, and minimum 2.0 GPA; permission by application; junior or senior classification; employer/location should be different than employer/location for AESHM 170 and 270
Supervised work experience with a cooperating firm or organization. No more than 12 credits from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 470P: Supervised Professional Internship: ISU Dining
Cr. 3-6. Repeatable. F.S.SS.
Prereq: AESHM 170, 311, 9 credits in AESHM or HSP M, and minimum 2.0 GPA; permission by application; junior or senior classification; employer/location should be different than employer/location used for AESHM 170 and 270
Supervised work experience with a cooperating firm or organization. No more than 12 credits from AESHM 170, 270, and 470 may be applied toward graduation.

AESHM 472: Fashion Show Management
(2-2) Cr. 1-3. Repeatable, maximum of 5 credits. S.
Prereq: Permission of instructor
Provide leadership and communicate direction for planning and production of fashion show, including developing budgets, publicity, advertising, fundraising, choreography, staging, lighting, and food. Maximum of 5 credits can be applied to graduation

AESHM 474: Entrepreneurship in Human Sciences
(Dual-listed with AESHM 574). (3-0) Cr. 3. F.S.
Prereq: A M D 275 or AESHM 287 or ACCT 284 or 3 cr in MKT or permission of instructor
Comprehensive approach to entrepreneurship including concepts of innovation, creativity, opportunity assessment, and business planning. Focus on human sciences-related businesses: retail, service, hospitality, event, food-related, family-owned, rural, and community businesses. Interaction with entrepreneurs, market research, feasibility analysis, business proposals, and business/community outreach and consulting.

AESHM 497: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of adviser; senior or graduate classification
Required of cooperative education students. Students must register for this course prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

AESHM 510: Research Methods in Apparel and Hospitality
Cr. 3. SS.
Prereq: Graduate standing in the Department
Overview of research methods. Methods for collecting and analyzing quantitative and qualitative data. Development of research plan.

AESHM 511: Seminar
Cr. 1-3. Repeatable, maximum of 6 times.
Prereq: 6 graduate credits in A M D, AESHM, or HSP M. Permission of instructor
Discussion of scholarship and current issues. Topics vary.

AESHM 570: Practicum
Cr. 1-3. Repeatable, maximum of 2 times. F.S.SS.
Prereq: 6 graduate credits in program area; permission of instructor
Supervised experience related to career objective. Proposal must be approved semester before placement.

AESHM 570A: Apparel Merchandising and Design
Cr. 1-3. Repeatable, maximum of 2 times. F.S.SS.
Prereq: 6 graduate credits in program area; permission of instructor
Supervised experience related to career objective. Proposal must be approved semester before placement.

AESHM 570B: Hospitality Management
Cr. 1-3. Repeatable, maximum of 2 times. F.S.SS.
Prereq: 6 graduate credits in program area; permission of instructor
Supervised experience related to career objective. Proposal must be approved semester before placement.

AESHM 574: Entrepreneurship in Human Sciences
(Dual-listed with AESHM 474). (3-0) Cr. 3. F.S.
Prereq: A M D 275 or AESHM 287 or ACCT 284 or 3 cr in MKT or permission of instructor
Comprehensive approach to entrepreneurship including concepts of innovation, creativity, opportunity assessment, and business planning. Focus on human sciences-related businesses: retail, service, hospitality, event, food-related, family-owned, rural, and community businesses. Interaction with entrepreneurs, market research, feasibility analysis, business proposals, and business/community outreach and consulting.

AESHM 580: U.S. Field Study
(Dual-listed with AESHM 380). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in A M D, AESHM, EVENT, and/or HSP M; sophomore classification; minimum 2.0 GPA. Permission by application
Study and tours of areas of interest to majors in the AESHM Department. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 580D: U.S. Field Study: Hospitality Management
(Dual-listed with AESHM 380D). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in AESHM or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 280 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 580F: U.S. Field Study: Event Management
(Dual-listed with AESHM 380F). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in EVENT, AESHM, or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 280 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the majors in the Event Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 580N: U.S. Field Study: Apparel, Merchandising, and Design
(Dual-listed with AESHM 380N). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in A M D or AESHM; sophomore classification; minimum 2.0 GPA; AESHM 280 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 280.

AESHM 581: International Field Study
(Dual-listed with AESHM 381). Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in A M D, AESHM, EVENT, and/or HSP M; sophomore classification; minimum 2.0 GPA. Permission by application
Study and tours of areas of interest to majors in the AESHM Department. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 581D: International Field Study: Hospitality Management
(Dual-listed with AESHM 381D). Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in AESHM and/or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 281 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Hospitality Management program. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 581F: International Field Study: Event Management
(Dual-listed with AESHM 381F). Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in AESHM, EVENT, and/or HSP M; sophomore classification; minimum 2.0 GPA; AESHM 281 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Event Management major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

AESHM 581N: International Field Study: Apparel, Merchandising, and Design
(Dual-listed with AESHM 381N). Cr. 1-3. Repeatable, maximum of 3 times. F.S.SS.
Prereq: 9 credits in A M D and/or AESHM; sophomore classification; minimum 2.0 GPA; AESHM 281 or concurrent enrollment; permission by application
Study and tours of areas of interest to majors in the Apparel, Merchandising, and Design major. Trip to location under supervision of faculty member. Locations and lengths of trip vary. Final projects, reports, journal entries, and analysis are required. May be combined with AESHM 281.
Meets International Perspectives Requirement.

Courses for graduate students:

AESHM 611: Seminar
Cr. 1-3. Repeatable.
Prereq: 6 graduate credits in AESHM, A M D, or HSP M. Permission of instructor
Scholarship and current issues. Topics vary.

AESHM 670: Teaching Practicum
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 graduate credits in program area; permission of instructor
Supervised experience in the university classroom. Proposal must be approved semester before placement.

AESHM 670A: Teaching Practicum: Apparel Merchandising and Design
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 graduate credits in program area; permission of instructor
Supervised experience in the university classroom. Proposal must be approved semester before placement.

AESHM 670B: Teaching Practicum: Hospitality Management
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 graduate credits in program area; permission of instructor
Supervised experience in the university classroom. Proposal must be approved semester before placement.

Apparel, Merchandising, and Design

Administered by the Department of Apparel, Events, and Hospitality Management. Leading to the degree bachelor of science.

Total credits required: 123 including a minimum of 18 credits in A M D at Iowa State University for the degree (12 of the 18 credits must be at the 300-400 level). The major in apparel, merchandising, and design provides a broad-based program of study with flexibility in creating program options. Courses are required in general education, and apparel industry professional core. To complete the program, a student selects a primary option from design, product development/sourcing and merchandising.

Merchandising and product development require selection of an additional secondary option.

A minor in apparel, merchandising, and design is available.

Undergraduate Study

The program offers study for the degree of Bachelor of Science with a major in apparel, merchandising, and design (A M D). The program offers students a broad understanding of textile and apparel products, merchandising and marketing strategies, technical and creative design, product development, production processes, and business practices leading to a wide range of careers at state, national, and international levels in business and industry. Courses in the program provide scientific, technical, and humanistic knowledge about textiles, apparel, and related products basic to career preparation. Courses also provide knowledge applicable to the development and use of apparel and textile products by individuals, families, and institutions. The program provides a foundation for graduate study. Graduates understand the production, distribution, and use of textiles and apparel, aesthetic expression, and communication. They are prepared to plan, develop, source and present textile and apparel products to meet the needs of consumers. They understand the issues involved in textile and apparel production and marketing, both nationally and internationally. Graduates appreciate the interdependence of nations and cultures as producers and consumers of textile products.

The A M D major provides a broad-based program of study with flexibility in creating an individualized program. To complete the program, a student combines general education, A M D core classes, and structured clusters of courses to form an option in merchandising, product development/sourcing, or design. The combinations of primary options, secondary areas of concentration, and electives allow students to individualize their programs.

An option in merchandising prepares students for the planning, development, and presentation of market-oriented product lines and events. Career opportunities are in product development, sourcing, buying, promotion, and management in both manufacturing and retailing sectors with a focus on the textile and apparel industry. An option in creative and technical design is appropriate for those interested in the aesthetic and creative aspects of design, product or line development, promotion of textiles and apparel, technical design, apparel engineering, product development, sourcing, and quality assurance. An option in product development/sourcing is appropriate for those interested in both designing and merchandising products or lines for consumer groups, sourcing and manufacturing. Students in design have a review of their design skills (A M D 206 Design Selective Advancement) after A M D 121 Apparel Assembly, A M D 131 Overview of the Fashion Industry, A M D 178 Introduction to Fashion Design Studio, and A M D 204 Textile Science.

For additional courses of interest, see Apparel, Events, and Hospitality Management.

Grade Point Requirement

All students majoring in apparel, merchandising, and design are required to earn a C- or better in all AESHM and A M D courses applied toward the degree, including transfer credits.

Communication Proficiency Requirement

Undergraduate English proficiency is certified when the student has received a grade of C or better in ENGL 150 Critical Thinking and Communication, and ENGL 250 Written, Oral, Visual, and Electronic Composition.

Students who receive a C-, D+, D, or D- in ENGL 150 Critical Thinking and Communication or ENGL 250 Written, Oral, Visual, and Electronic Composition may take one of the following, with permission from the English Department, instead of repeating the lower-level course:

ENGL 302	Business Communication	3
ENGL 309	Proposal and Report Writing	3
ENGL 314	Technical Communication	3

Minor

A minor in apparel, merchandising, and design requires (15-17 cr) of the following:

One of the following:		3
A M D 121	Apparel Assembly Processes	
A M D 131	Fashion Products and Markets	
A M D 165	Dress and Diversity in Society	
A M D 178	Introduction to Apparel Design Studio	
A Textile Science Class		3-4
One of the following:		3-4
A M D 231	Product Development and Manufacturing	
A M D 245	Aesthetics and Brand Image	
A M D 257	Museum Studies	
A M D 275	Retail Merchandising	
2 courses of the 300-400 level at Iowa State University in A M D or approved AESHM		6
Total Credits		15-17

Curriculum in Apparel, Merchandising, and Design

Administered by the Department of Apparel, Events, and Hospitality Management. Leading to the degree bachelor of science.

Total credits required: 123 including a minimum of 18 credits in AMD at Iowa State University for the degree (12 of the 18 credits must be at the 300-400 level).

Cr.	Degree Requirements	
Communications Skills		
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
Select one of the following:		3
COMST 214	Professional Communication	
COMST 218	Conflict Management	
SP CM 212	Fundamentals of Public Speaking	
Total Credits		10
Biological and Physical Sciences and Mathematical Disciplines		
Mathematics (MATH 150 recommended for merchandising)		3
Select from natural sciences, including FS HN 167. Creative and Technical Design and Product Development Options must take CHEM 163 and CHEM 163L.		3-5
Statistics		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
STAT 226	Introduction to Business Statistics I	
Total Credits		9-12
Social Sciences		
ECON 101	Principles of Microeconomics	3
A M D 165	Dress and Diversity in Society	3
Select from approved list, including A M D 362		3
Total Credits		9
Humanities		
Select from:		3
A M D 354	History of European and North American Dress	
A M D 356	History of Twentieth Century Fashion	
Select from approved list (world language and cultures course recommended)		3
History/Art History (Creative and Technical Design: ART H required)		3
Total Credits		9
Professional A M D core courses		
AESHM 112	Orientation for AESHM	1
AESHM 113N	Professional Development for AESHM: Apparel, Merchandising, and Design	1
AESHM 311	Seminar on Careers and Internships	1
AESHM 411	Seminar on Current Issues	1
AESHM 470N	Supervised Professional Internship: Apparel	3-6
Field Study (if AESHM 470 is not out-of-home-state)		2-3
AESHM 380	U.S. Field Study	
or AESHM 381	International Field Study	
A M D 131	Fashion Products and Markets	3
A M D 204	Textile Science	4
A M D 210	Computer Applications in Digital Design and Data Management	3
COM S 113	Introduction to Spreadsheets and Databases	3
A M D 231	Product Development and Manufacturing	4
A M D 245	Aesthetics and Brand Image	3
A M D 275	Retail Merchandising	3
A M D 372	Sourcing and Global Issues	3
Total Credits		35-39

Primary Options

Select one professional primary option from the following three choices:

Creative and Technical Design Courses		
A M D 121	Apparel Assembly Processes	3
A M D 178	Introduction to Apparel Design Studio	3
A M D 206	Design Selective Advancement	R
A M D 225	Patternmaking I: Drafting and Flat Pattern	3
A M D 278	Fashion Illustration	3
A M D 310	Computer Aided Apparel Patternnmaking	3
A M D 321	Computer Integrated Textile and Fashion Design	3
A M D 325	Patternmaking II: Draping	3
A M D 329	Digital Textile Printing for Apparel Design	3
A M D 415	Technical Design Processes	3
A M D 495	Senior Design Studio	3
Select from:		3
A M D 305	Quality Assurance of Textiles and Apparel	
A M D 404	Advanced Textile Science	
A M D 431	Apparel Production Management	
Select from:		9
ACCT 284	Financial Accounting	
AESHM 222	Creativity on Demand	
AESHM 272	Fashion Show Production and Promotion	
AESHM 340	Hospitality and Apparel Marketing Strategies	
or MKT 340	Principles of Marketing	
AESHM 470N	Supervised Professional Internship: Apparel	
AESHM 472	Fashion Show Management	
AESHM 474	Entrepreneurship in Human Sciences	
A M D 257	Museum Studies	

A M D 305	Quality Assurance of Textiles and Apparel	
A M D 328	Design Seminar	
A M D 362	Cultural Perspectives of Dress	
A M D 377	Visual Presentation and Promotions	
A M D 404	Advanced Textile Science	
A M D 426	Creative Design Processes	
A M D 431	Apparel Production Management	
A M D 467	Consumer Studies in Apparel and Fashion Products	
A M D 490	Independent Study	
A M D 496	Fashion Product Development and Prototyping	
A M D 499	Undergraduate Research	
THTRE 255	Introduction to Theatrical Production	
THTRE 357	Stage Make-up	
Any art history, art integrated studio, or design studies		
Select from:		3
A M D 354	History of European and North American Dress	
A M D 356	History of Twentieth Century Fashion	
A M D 362	Cultural Perspectives of Dress	
Total Credits		45

Product Development Primary Option

A M D 121	Apparel Assembly Processes	3
A M D 178	Introduction to Apparel Design Studio	3
A M D 206	Design Selective Advancement	R
A M D 305	Quality Assurance of Textiles and Apparel	3
A M D 321	Computer Integrated Textile and Fashion Design	3
A M D 415	Technical Design Processes	3
A M D 431	Apparel Production Management	3
A M D 496	Fashion Product Development and Prototyping	3
Total Credits		21

Secondary Areas for Product Development (Select one)
Option 1: Merchandising: Line Development and Sourcing

AESHM 340	Hospitality and Apparel Marketing Strategies	3
or MKT 340	Principles of Marketing	
A M D 225	Patternmaking I: Drafting and Flat Pattern	3
A M D 376	Merchandise Planning and Control	4
A M D 467	Consumer Studies in Apparel and Fashion Products	3
ACCT 284	Financial Accounting	3
SCM 301	Supply Chain Management	3
Select from:		3
AESHM 222	Creativity on Demand	
AESHM 381	International Field Study	
AESHM 470N	Supervised Professional Internship: Apparel	
AESHM 474	Entrepreneurship in Human Sciences	
A M D 377	Visual Presentation and Promotions	
A M D 475	Retail Information Analysis	
A M D 477	Omni-channel Retailing	
A M D 490	Independent Study	
A M D 499	Undergraduate Research	
Study Abroad		
One semester of one foreiign language		
Total Credits		22

Option 2: Product Innovation

A M D 278	Fashion Illustration	3
A M D 310	Computer Aided Apparel Patternnmaking	3
A M D 328	Design Seminar	arr †
A M D 329	Digital Textile Printing for Apparel Design	3
A M D 404	Advanced Textile Science	3
Select from:		6
A M D 225	Patternmaking I: Drafting and Flat Pattern	
A M D 328	Design Seminar	
A M D 490	Independent Study	
A M D 499	Undergraduate Research	
A M D 521	Digital Technologies in Textile and Apparel Design	
A M D 565	Sustainability: Theory and Practical Application	
AESHM 381	International Field Study	
ENV S 334	Environmental Ethics	
IND D 334	Materials and Processes for Industrial Design	
T SC 220	Globalization and Sustainability	
T SC 342	World Food Issues: Past and Present	
Study Abroad		
Total Credits		18 †

† Arranged with instructor.

Merchandising Primary Option

ACCT 284	Financial Accounting	3
AESHM 340	Hospitality and Apparel Marketing Strategies	3
or MKT 340	Principles of Marketing	
AESHM 474	Entrepreneurship in Human Sciences	3
A M D 356	History of Twentieth Century Fashion	3
A M D 376	Merchandise Planning and Control	4
A M D 377	Visual Presentation and Promotions	3

A M D 467	Consumer Studies in Apparel and Fashion Products	3
A M D 475	Retail Information Analysis	3
A M D 477	Omni-channel Retailing	3
Total Credits		28

Merchandising Areas of Concentration (select one):
Option 1: Apparel, Merchandising, and Design/AESHM

Select 5-6 additional courses from A M D or AESHM courses for 15 credits, including study abroad or community college work in A M D or AESHM — 15

AESHM 175N	Financial Applications for Retail and Hospitality Industries: Retail Merchandising
AESHM 211	Leadership Experiences and Development (LEAD)
AESHM 222	Creativity on Demand
AESHM 270N	Supervised Work Experience II: Apparel
AESHM 272	Fashion Show Production and Promotion
AESHM 287	Principles of Management in Human Sciences
AESHM 342	Aesthetics of Consumer Experience
AESHM 380	U.S. Field Study
AESHM 381	International Field Study
AESHM 438	Human Resource Management
AESHM 470N	Supervised Professional Internship: Apparel
AESHM 472	Fashion Show Management
A M D 121	Apparel Assembly Processes
A M D 178	Introduction to Apparel Design Studio
A M D 225	Patternmaking I: Drafting and Flat Pattern Important prerequisites need to be met
A M D 257	Museum Studies
A M D 278	Fashion Illustration Important prerequisites need to be met
A M D 305	Quality Assurance of Textiles and Apparel
A M D 321	Computer Integrated Textile and Fashion Design Important prerequisites need to be met
A M D 354	History of European and North American Dress
A M D 362	Cultural Perspectives of Dress
A M D 404	Advanced Textile Science Important prerequisites need to be met
A M D 431	Apparel Production Management
A M D 490	Independent Study
A M D 496	Fashion Product Development and Prototyping
A M D 499	Undergraduate Research
Total Credits	15

Option 2: Two Areas of Concentration

Select two approved classes from first discipline and three approved classes from second discipline from the recommended academic areas to create an area of concentration leading to career paths in AMD Merchandising. One of the areas may either be AMD or AESHM. Selections must be approved by adviser. — 15

Approved Academic Coursework options include: ACCT, ADVRT, AESHM or A M D, ANTHR, ART H, ARTIS, DSN, BUSAD, COMST, CRP, ECON, EVENT, ENGL, FIN, HIST, INST, JLMC, MGMT, MIS, MKT, POL S, PR, PSYCH, SCM, SOC, T SC, WLC, W S

Total Credits 15

Apparel Merchandising, Design B.S. - creative technical design primary option

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	A M D 165	3
LIB 160	1	A M D 204	4
A M D 131 Fall only	3	A M D 206	0
AESHM 112	1	CHEM 163	4
AESHM 113	1	CHEM 163L	1
A M D 121	3	ENGL 250	3
A M D 178	3		
	15		15

Sophomore

Fall	Credits	Spring	Credits
A M D 210	3	A M D 275	3
A M D 225	3	A M D 278	3
A M D 245	3	COM S 113	3
AESHM 311	1	ECON 101	3
Humanities	3	Social Science elective	3
MATH	3		
	16		15

Junior

Fall	Credits	Spring	Credits	Summer	Credits
A M D 231	4	A M D 372	3	AESHM 470N	4
A M D 310	3	AMD Design: Choose from:	3		
A M D 321	3	A M D 354			

A M D 325	3	A M D 356	
Humanities	3	A M D 362	
Fashion History			
A M D 354 or 356		AESHM 380	1-3
		ART H	3
		STAT 101	4
	16		14-16

Senior

Fall	Credits	Spring	Credits
A M D 329	3	Select from:	3
A M D 415	3	A M D 305	
A M D 495	3	A M D 404	
AESHM 411N	1	A M D 431	
Creative & Technical Design Option Elective (1)	3	Creative & Technical Design Option Elective (2)	3
		Creative & Technical Design Option Elective (3)	3
		Elective	3
		Speech	3
	13		15

Total Credits: 123-125

Apparel Merchandising, Design B.S. - merchandising primary option

Freshman

Fall	Credits	Spring	Credits
A M D 131[Fall only]	3	A M D 204	4
A M D 165	3	A M D 245	3
AESHM 112	1	COM S 113	3
AESHM 113	1	ENGL 250	3
ENGL 150	3	MATH	3
LIB 160	1		
Social Science Elective	3		
	15		16

Sophomore

Fall	Credits	Spring	Credits
A M D 210	3	A M D 231	4
A M D 275	3	A M D 376	4
AESHM 311	1	AESHM 380	1-3
ACCT 284	3	Choose one:	3
ECON 101	3	AESHM 340	
Science	3	MKT 340	
		Humanities Elective	3
	16		15-17

Junior

Fall	Credits	Spring	Credits	Summer	Credits
A M D 372	3	A M D 356	3	AESHM 470N	5
A M D 377	3	A M D 477	3		
Merchandising Option Elective (1)	3	Choose one:	4		
Merchandising Option Elective (2)	3	STAT 101			
Speech	3	STAT 226			
		Merchandising Option Elective (3)	3		
		Merchandising Option Elective (4)	3		
	15		16		5

Senior

Fall	Credits	Spring	Credits
A M D 475	3	AESHM 474	3
A M D 467	3	Merchandising Option Elective (5)	3
AESHM 411N	1	History	3
Humanities Apparel	3	Elective	3

Elective	3		
	13		12

Total Credits: 123-125

Apparel Merchandising, Design B.S. - product development sourcing primary option

Freshman

Fall	Credits	Spring	Credits
A M D 121	3	A M D 165	3
A M D 131	3	A M D 204	4
A M D 178	3	A M D 206	R
AESHM 112	1	CHEM 163	4
AESHM 113	1	CHEM 163L	1
ENGL 150	3	ENGL 250	3
LIB 160	1		
	15		15

Sophomore

Fall	Credits	Spring	Credits
A M D 210	3	A M D 231	4
A M D 225	3	A M D 275	3
A M D 245	3	AESHM 380	1-3
AESHM 311	1	ACCT 284	3
Math	3	COM S 113	3
Social Science Elective	3	ECON 101	3
	16		17-19

Junior

Fall	Credits	Spring	Credits	Summer	Credits
A M D 376	4	A M D 321	3	AESHM 470N	6
AESHM 340 or MKT 340	3	Select one:	3		
Humanities Elective	3	A M D 354			
Statistics	4	A M D 356			
		A M D 372	3		
		HISTORY	3		
		SPEECH	3		
	14		15		6

Senior

Fall	Credits	Spring	Credits
A M D 305	3	A M D 431	3
A M D 415	3	A M D 496	3
A M D 467	3	Product Development Secondary Option Elective	3
AESHM 411N	1	Elective	3
SCM 301	3		
	13		12

Total Credits: 123-125

Apparel, Merchandising, and Design, B.S. -- product development sourcing product innovation primary option

Freshman

Fall	Credits	Spring	Credits
A M D 131[Fall only]	3	A M D 121	3
A M D 165	3	A M D 204	4
A M D 178	3	A M D 206	0
AESHM 112	1	CHEM 163	4
AESHM 113	1	CHEM 163L	1
ENGL 150	3	ENGL 250	3
LIB 160	1		
	15		15

Sophomore

Fall	Credits	Spring	Credits
A M D 210	3	A M D 231	4
A M D 245	3	A M D 275	3
AESHM 311	1	A M D 278	3
ECON 101	3	A M D 328	3
MATH	3	COM S 113	3
Social Science Elective	3		
	16		16

Junior

Fall	Credits	Spring	Credits	Summer	Credits
A M D 310	3	A M D 372	3	AESHM 470N	6
A M D 321	3	A M D 404	3		
Humanities Elective	3	AESHM 380	1-3		

SPEECH	3	Humanities	3	
		Fashion History, select from:		
STATISTICS	4	A M D 354		
		A M D 356		
		HISTORY	3	
	16		13-15	6

Senior

Fall	Credits	Spring	Credits
A M D 305	3	A M D 431	3
A M D 329	3	A M D 496	3
A M D 415	3	Product Innovation Elective	3
AESHM 411N	1	Elective	3
Product Innovation Elective	3	Elective	1
	13		13

Total Credits: 123-125

Graduate Study

The program offers work for the Master of Science (thesis and non-thesis options) and Doctor of Philosophy (on-campus and distance hybrid) with a major in apparel, merchandising, and design. For all programs the field of study is highly interdisciplinary; programs of study are tailored to students' background and interests. The program offers a concurrent B.S. and M.S. degree that allows students to obtain both the B.S. and M.S. degrees in apparel, merchandising, and design in 5 years. Application for admission to the Graduate College should be made in the junior year.

Graduates understand how textiles and apparel are essential in meeting individual and societal needs and understand the interdependence of nations and cultures as producers and consumers. Graduates understand diverse philosophies of scholarship and apply multiple methods to creative activity, research, and teaching. Strong writing and oral communication skills help graduates disseminate scholarship and compete successfully for awards and grants.

Graduates accept positions relevant to their academic experience. All doctoral graduates have teaching experience. Master's and doctoral graduates have experience working in team-oriented and interactive environments. Graduates are prepared to adapt to future changes in their professions and to provide leadership in professional and public practice. They bring a strong sense of ethics to research, teaching, and business endeavors.

Program emphases for graduate study include creative design and product development; consumer behavior; entrepreneurship; merchandising and marketing aspects of textiles and clothing; acquisition and use of textiles and apparel within cultures; U.S. dress and textiles from the 19th into the 21st centuries; textiles; textile conservation; and computer-aided design. The program participates in the interdepartmental gerontology minor.

Courses primarily for undergraduates:

A M D 120: Apparel Construction Techniques
(3-0) Cr. 3. SS.
Assemble components and completed garments with the use of basic sewing equipment. Learn basic construction techniques, applications and vocabulary. Students will need access to a home sewing machine, iron, computer and the internet. Not available for credit for A M D majors.

A M D 121: Apparel Assembly Processes
(1-4) Cr. 3. F.S.
Prereq: A M D 204 concurrent recommended
Principles of garment assembly. Use of mass production equipment and methods to analyze, develop and assemble garments.

A M D 131: Fashion Products and Markets
(3-0) Cr. 3. F.
Fashion industry structure from concept to consumer. Focus on fashion-driven consumer goods. Development and prototyping of fashion products for a target market.

A M D 165: Dress and Diversity in Society
(3-0) Cr. 3. F.S.
Examination of diversity among consumers and introduction to forecasting trends in dress. Introduction to social justice issues. Meets U.S. Diversity Requirement

A M D 178: Introduction to Apparel Design Studio
(1-4) Cr. 3. F.S.
Introduction to the elements and principles of design in fashion and apparel including skill development in fashion illustration, technical drawing, and fabric rendering using traditional media. Application of written and verbal presentations to communicate fashion and apparel design concepts and terminology. Fashion presentation and introduction to portfolio development.

A M D 204: Textile Science
(3-2) Cr. 4. F.S.
Prereq: A M D 131
Textile fibers, yarns, fabrication, coloration, and finishes. Quality and performance application to textile products. Lab work included.

A M D 206: Design Selective Advancement
Cr. R. Repeatable, maximum of 2 times. F.S.
Prereq: Completion or enrollment in A M D 121, A M D 131, A M D 178, and A M D 204 and enrollment in major
Project review and skill assessment related to 2-dimensional and 3-dimensional visualization, apparel assembly, basic product knowledge, design problem solving, illustration, textiles. Offered on a satisfactory-fail basis only.

A M D 210: Computer Applications in Digital Design and Data Management
(2-2) Cr. 3. F.S.
Prereq: A M D 131, A M D 245 or concurrent; AESHM 113N
Applications of basic skills in Photoshop, Illustrator, PLM-type software, Excel, and databases. Introduction to digital product design and line development. Focus on elements and principles of design. Introduction to digital portfolio development for design and merchandising. Online lectures.

A M D 225: Patternmaking I: Drafting and Flat Pattern
(1-4) Cr. 3. F.S.
Prereq: A M D 121, A M D 204, AMD 206.
Application of patternmaking tools and their functions, measurement techniques, pattern labeling, and patternmaking communication documents. Sloper drafting and flat pattern manipulation methods for women's apparel. Design and construction of original garments using drafted slopers and flat pattern manipulation methods to enable the analysis of fit.

A M D 231: Product Development and Manufacturing
(3-2) Cr. 4. F.S.
Prereq: A M D 204
Analysis of apparel product development, sourcing, and manufacturing processes. Focus on materials and specifications relative to quality, performance, cost, and price. Applications of software for PLM.

A M D 245: Aesthetics and Brand Image
(3-0) Cr. 3. F.S.
Prereq: A M D 131, A M D 165, A M D 204 or concurrent
Elements and principles of design. Analysis of sensory, expressive, and symbolic aspects that build brand image, with a focus on fashion products and promotional settings.

A M D 257: Museum Studies
(3-0) Cr. 3. F.
Prereq: Sophomore standing
Overview of museums including history, functions, and philosophy. Collection and curatorial practices. Funding and governance issues. Hands-on object research and exhibit development. Required field trip.

A M D 275: Retail Merchandising
(3-0) Cr. 3. F.S.
Prereq: 3 credits in Math
Principles of merchandising as applied to retail-, service-, events-, and hospitality-related businesses. Study of the planning, development, and presentation of apparel- and hospitality-related products, services, and experiences. Industry and market research, planning of new offerings, and development of promotional and competitive strategies for various retail formats.

A M D 278: Fashion Illustration
(0-6) Cr. 3. F.S.
Prereq: A M D 178, A M D 210 or concurrent enrollment, A M D 245 or concurrent enrollment. Permission of instructor.
Development of fashion plates and focused apparel lines/collections. Proficiency in drawing the fashion figure, technical drawings/flats, and apparel using a variety of media. Continuation of fashion presentation and portfolio development.

A M D 290: Independent Study
Cr. 1-2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Freshmen or Sophomore Classification; Permission of instructor, adviser, and department chair.
Independent study on topics of special interest to the student, facilitated by approved faculty member. Total number of A M D 290 and A M D 490 credits applied to graduation cannot exceed 9 credits.

A M D 305: Quality Assurance of Textiles and Apparel
(Dual-listed with A M D 505). (2-2) Cr. 3. F.
Prereq: A M D 231, one course in natural science (chemistry with lab preferred); STAT 101, STAT 226, or STAT 401
Principles of product and materials evaluation and quality assurance. Developing specifications and using standard practices for evaluating materials, product characteristics, performance, and quality.

A M D 310: Computer Aided Apparel Patternnmaking
(0-6) Cr. 3. F.S.
Prereq: A M D 210, 225; Permission of instructor.
Computer-aided patternmaking technology used in pattern drafting, grading, marker making, and 3-D virtual prototyping.

A M D 321: Computer Integrated Textile and Fashion Design
(0-6) Cr. 3. F.S.
Prereq: A M D 210, A M D 278 or concurrent enrollment. Permission of instructor
Analysis and advanced use of computer-aided design software for textile and fashion design for various target markets. Digital presentation and portfolio development.

A M D 325: Patternmaking II: Draping
(0-6) Cr. 3. F.S.
Prereq: A M D 206, A M D 225; permission of instructor.
Principles of patternmaking through basic draping techniques on industry standard body forms. Apparel design through analysis of fit and design; problem solving and interaction of fabric characteristics with style features.

A M D 328: Design Seminar
(Dual-listed with A M D 528). Cr. arr. Repeatable. F.S.SS.
Prereq: Vary with topic.
Focus on artisanal textile, apparel, or surface and structural design techniques. Design processes for specialty fabrics and markets. Topics vary by term.

A M D 329: Digital Textile Printing for Apparel Design
(2-2) Cr. 3. F.S.
Prereq: A M D 321; A M D 325 or concurrent
Overview of the use of digital printing in the textile and apparel industry, color matching, repeat print patterns, engineered prints, and creation of apparel prototypes.

A M D 354: History of European and North American Dress
(3-0) Cr. 3. F.
Prereq: 3 credits from Hist or Art H
Survey of history of dress from ancient times up to the American Civil War; focus on European and North American dress. Emphasis on connection of dress to the social, cultural, environmental, and technological contexts of the Western world.
Meets International Perspectives Requirement.

A M D 356: History of Twentieth Century Fashion
(3-0) Cr. 3. S.
Prereq: 3 credits HIST or ART H; A M D 204 recommended.
Survey of major design and technological developments from the American Civil War through the 20th Century. Emphasis on fashion as a system of design and production, culture of consumption, fashion change, and trends in art, society, and culture.

A M D 362: Cultural Perspectives of Dress
(3-0) Cr. 3. S.
Prereq: A M D 165 or 3 credits in anthropology, psychology, or sociology.
Analysis of multiple factors related to dress in selected societies, including technology, cultural identity, aesthetics, social organization, ritual, stability and change. Applications to fair trade and social responsibility.
Meets International Perspectives Requirement.

A M D 372: Sourcing and Global Issues
(3-0) Cr. 3. F.S.
Prereq: A M D 231, A M D 275; ECON 101 or ECON 102 recommended
Evaluation of key issues facing textile and apparel industries in global markets considering ethical, economic, political, social, and professional implications. Sourcing strategies in a global environment. Corporate and consumer social responsibility and sustainability.
Meets International Perspectives Requirement.

A M D 376: Merchandise Planning and Control
(3-2) Cr. 4. F.S.
Prereq: A M D 275; A M D 210 or COM S 113; 3 credits from ACCT 284, MATH 104, MATH 105, MATH 140, MATH 150, or equivalent.
Calculations and computer application in the planning and control of merchandise. Emphasis on retail math as it pertains to assortment planning, the six-month buying plan process, and other buying concepts and strategies. Online modules.

A M D 377: Visual Presentation and Promotions
(3-0) Cr. 3. F.S.
Prereq: A M D 245 or AESHM 342; AESHM 340 or MKT 340
Principles of visual aspects of brand development and management; emphasis on branding, visual merchandising, design/layout of retail spaces. Includes applications such as visual communication and documentation using Adobe Creative Suite(R), hands-on display projects, and brand case studies.

A M D 393: Apparel, Merchandising, and Design Workshop
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: A M D Junior or Senior Classification and Permission of Instructor.
Intensive 2 to 8 week workshop exploration. Topics vary each time offered. Maximum of 6 credits applied to graduation.

A M D 404: Advanced Textile Science
(Dual-listed with A M D 504). (2-2) Cr. 3. S.
Prereq: A M D 204, CHEM 163 and CHEM 163L or equivalent
Theories and principles of textile science. Textile product serviceability. Effect of fiber structure on properties and performance. New developments in textiles.

A M D 415: Technical Design Processes
(2-2) Cr. 3. F.
Prereq: A M D 225; A M D 231
Garment development and analysis of fit, performance, quality, cost. Exploration of alternative materials, construction methods, grading; specifications and portfolio development.

A M D 426: Creative Design Processes
(1-4) Cr. 3. Alt. F., offered irregularly.S.
Prereq: A M D 206, A M D 321, A M D 325 or concurrent
Exploration of the creative process and sources of inspiration with emphasis on wearable art; experimentation of advanced design problem solving, alternative materials, fabric manipulation, and pattern-making techniques.

A M D 431: Apparel Production Management
(3-0) Cr. 3. S.
Prereq: A M D 231; A M D 121 recommended; A M D 372 or concurrent.
Procedures and experiences related to application and use of process controls: method analysis, work measurement, costing, pricing, and production planning. Resource management, technology applications, and quality assurance.

A M D 457: Textile Conservation and Collection Management
(Dual-listed with A M D 557). (3-0) Cr. 3.
Prereq: A M D 204
Condition assessment, repair, and stabilization of textiles and apparel in museum collections. Dry and aqueous cleaning. Examination of storage and exhibition techniques, materials, and conditions. Experience with cataloging and management practices.

A M D 467: Consumer Studies in Apparel and Fashion Products
(2-2) Cr. 3. F.
Prereq: A M D 165; AESHM 340 or MKT 340; STAT 101 or STAT 104 or STAT 226;
Application of concepts and theories from the social sciences to the study of consumer behavior related to dress, textile and apparel products, and retail experiences. Experience in conducting consumer research.

A M D 475: Retail Information Analysis
(2-2) Cr. 3. S.
Prereq: A M D 376
Evaluation of information needed to make effective retail decisions. Use of technology in analyzing and interpreting retail systems data. Application of concepts related to forecasting, consumer demand, assortment planning, market research, data mining, database interface, pattern recognition, supply-chain/logistics management, retail technology applications such as Visual Retailing, PLM, and Sourcing Simulator.

A M D 477: Omni-channel Retailing
(3-0) Cr. 3. S.
Prereq: 3 credits in marketing or A M D 275 or AESHM 287
A customer-centric view of marketing with a focus on the retailer-customer relationship and omni-channel strategies. Analysis and evaluation of integrated retail applications and strategies using digital media, including store formats, e-commerce, catalog, mobile, crowdsourcing, and social media.

A M D 490: Independent Study
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair
Independent Study. Maximum of 9 credits of both A M D 290 and A M D 490 can be applied toward graduation.

A M D 490A: Independent Study: Textile Science
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair

A M D 490B: Independent Study: Historical, Cultural, and Museum Studies of Dress and Textiles
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair

A M D 490C: Independent Study: Textile and Apparel Design
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair

A M D 490E: Independent Study: Merchandising, Aesthetics, and Entrepreneurship
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair

A M D 490F: Independent Study: Sociological, Psychological, and Consumer Behavioral Aspects of Dress
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair

A M D 490H: Independent Study: Honors
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in A M D. Permission of the instructor, adviser, and department chair

A M D 490J: Independent Study: Product Development, Innovation, and Sourcing
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in textiles and clothing. Permission of the instructor, adviser, and department chair

A M D 490S: Independent Study: Production and Quality Assurance
Cr. arr. Repeatable. F.S.SS.
Prereq: 6 credits in textiles and clothing. Permission of the instructor, adviser, and department chair

A M D 490W: Independent Study: Fashion Show, Fashion Public Relations and Marketing
Cr. arr. Repeatable. F.S.SS.
Prereq: Prereq: 6 credits in textiles and clothing. Permission of the instructor, adviser, and department chair

A M D 495: Senior Design Studio
(Dual-listed with A M D 595). (0-6) Cr. 3. F.
Prereq: A M D 310, A M D 325. Permission of instructor.
Creation of an apparel line from target market research to prototypes through the use of manual techniques and CAD technologies. The line is to be included in a professional portfolio and pieces submitted to a juried exhibition.

A M D 496: Fashion Product Development and Prototyping
(3-0) Cr. 3. S.
Prereq: A M D 231, A M D 245, A M D 275
Applying consumer, aesthetic, and quantitative trend information to develop value-added fashion products and product lines with merchandising/promotion campaigns for diverse target markets. Multi-function team projects. Development of a prototype and presentation to industry representatives.

A M D 499: Undergraduate Research
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Senior classification, 15 credits in A M D. Permission of instructor, adviser, and department chair
Research experience in textiles and clothing with application to a selected problem.

Courses primarily for graduate students, open to qualified undergraduates:

A M D 504: Advanced Textile Science
(Dual-listed with A M D 404). (2-2) Cr. 3. S.
Prereq: A M D 204, CHEM 163 and CHEM 163L or equivalent
Theories and principles of textile science. Textile product serviceability. Effect of fiber structure on properties and performance. New developments in textiles.

A M D 505: Quality Assurance of Textiles and Apparel
(Dual-listed with A M D 305). (2-2) Cr. 3. F.
Prereq: A M D 231, one course in natural science (chemistry with lab preferred); STAT 101, STAT 226, or STAT 401
Principles of product and materials evaluation and quality assurance. Developing specifications and using standard practices for evaluating materials, product characteristics, performance, and quality.

A M D 510: Foundation of Scholarship in Textiles and Clothing
(3-0) Cr. 3. F.Alt. SS., offered irregularly.
Prereq: Graduate classification or permission of instructor
Overview of scholarship in textiles and clothing with emphasis on current and future directions. Fundamentals of writing literature reviews. Examination of ethical issues in scholarship and academic life. Introduction to creativity, sustainability, and entrepreneurship. Development of teaching units.

A M D 521: Digital Technologies in Textile and Apparel Design
(3-0) Cr. 3.
Prereq: Research Methods course. Permission of instructor.
Digital technologies in textile and apparel design. Theories and practices of mass customization and personalization, digital textile printing, 3D body scanning, creating avatars from body scans, and fitting digital apparel designs.

A M D 528: Design Seminar
(Dual-listed with A M D 328). Cr. arr. Repeatable. F.S.SS.
Prereq: Vary with topic.
Focus on artisanal textile, apparel, or surface and structural design techniques. Design processes for specialty fabrics and markets. Topics vary by term.

A M D 545: Consumer Aesthetics and Retail Branding
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: One course in design elements and principles, psychology, consumer behavior, or marketing
Examination of hedonic nature of consumer experience and its application to experiential design and branding of retail/hospitality establishments. Emphasis on consumer behavior, environmental psychology, and marketing literature.

A M D 557: Textile Conservation and Collection Management
(Dual-listed with A M D 457). (3-0) Cr. 3.
Prereq: A M D 204
Condition assessment, repair, and stabilization of textiles and apparel in museum collections. Dry and aqueous cleaning. Examination of storage and exhibition techniques, materials, and conditions. Experience with cataloging and management practices.

A M D 565: Sustainability: Theory and Practical Application
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 3 credits in research methods; basic knowledge of apparel industry and product development; permission of instructor.
Overview of current sustainability theory, research, and methodology. Emphasis on the evaluation and discussion of current sustainability literature and sustainable practice of apparel, textiles, and related products and services through people, processes, and the environment. Development and presentation of original scholarly and creative design work under various sustainability frameworks.

A M D 567: Consumer Behavior and Apparel
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A M D 467 or MKT 447; STAT 401
Application of concepts and theories from the social sciences to the study of consumer behavior. Experience in conducting research; manuscript writing.

A M D 572: Sourcing and Global Issues
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: A course in merchandising or marketing
Evaluation of textile and apparel industries in global markets considering ethical, economic, political, social, and professional implications. Sourcing strategies in a global environment. Corporate and consumer social responsibility and sustainability. Experience in conducting research using secondary data.
Meets International Perspectives Requirement.

A M D 576: Industry Applications in Merchandising and Management
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A M D 376 or equivalent; A M D 275 or equivalent. Permission of instructor
Using the case study method, students apply merchandising theory, principles, and practices to industry scenarios. Emphasis on problem solving, creative thinking, data analysis, and data interpretation involved in business operations. Focus on the development of leadership skills while functioning in small and large groups.

A M D 577: E-Commerce for Apparel and Hospitality Companies
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Course in marketing or permission of instructor
Analysis of technology and consumer trends, industry practices, and marketing strategies for e-commerce including big data, data mining, and social media. Evaluation and development of apparel or hospitality company websites. Theory application to the development of multi-channel business strategies.

A M D 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed A M D-related projects that reflect the special interests of the student.

A M D 590A: Special Topics: Textile Science
Cr. arr. Repeatable.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed A M D-related projects that reflect the special interests of the student.

A M D 590B: Special Topics: Historical, Cultural, and Museum Studies of Dress and Textiles
Cr. arr. Repeatable.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed A M D-related projects that reflect the special interests of the student.

A M D 590C: Special Topics: Textile and Apparel Design
Cr. arr. Repeatable.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed A M D-related projects that reflect the special interests of the student.

A M D 590E: Special Topics: Merchandising, Aesthetics, and Entrepreneurship
Cr. arr. Repeatable.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed A M D-related projects that reflect the special interests of the student.

A M D 590F: Special Topics: Sociological, Psychological, and Consumer Behavioral Aspects of Dress
Cr. arr. Repeatable.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed A M D-related projects that reflect the special interests of the student.

A M D 590J: Special Topics: Product Development, Innovation, and Sourcing
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed textile and clothing-related projects that reflect the special interests of the student.

A M D 590S: Special Topics: Production and Quality Assurance
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed textile and clothing-related projects that reflect the special interests of the student.

A M D 590W: Special Topics: Fashion Show, Fashion Public Relations and Marketing
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of director of graduate education, adviser, and instructor(s)
Individually designed textile and clothing-related projects that reflect the special interests of the student.

A M D 595: Senior Design Studio
(Dual-listed with A M D 495). (0-6) Cr. 3. F.
Prereq: A M D 310, A M D 325. Permission of instructor.
Creation of an apparel line from target market research to prototypes through the use of manual techniques and CAD technologies. The line is to be included in a professional portfolio and pieces submitted to a juried exhibition.

A M D 599: Creative Component
Cr. arr. Repeatable.
Prereq: 9 graduate credits in A M D

Courses for graduate students:

A M D 611: Seminar
Cr. 1-3. Repeatable.
Prereq: 6 graduate credits in A M D. Permission of instructor
Discussion of scholarship and current issues. Topics vary.

A M D 625: Design Theory and Process
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor.
Analysis and application of design theory and creative processes, including strategies for solving aesthetic, functional, and/or technology-focused design problems. Creation and dissemination of design scholarship.

A M D 665: Social Science Theories of Appearance
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 6 credits in sociology or psychology
Analysis of social science theories and concepts applicable to appearance research. Emphasis on qualitative research and philosophy of knowledge, including postmodern, symbolic interaction, semiotic, and feminist theories. Collection and analysis of qualitative data.

A M D 676: Merchandising Theory and Research Applications
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A M D 275 or equivalent; statistics course recommended.
Review of current merchandising theory, research, and methodology. Emphasis on the evaluation and discussion of current and seminal merchandising literature, understanding research processes, interpretation of findings, assessing implications of research for future directions in merchandising, and the development and presentation of original scholarly work.

A M D 690: Advanced Topics
Cr. arr. Repeatable.
Prereq: Enrollment in doctoral program, permission of instructor; and approval of D.O.G.E

A M D 699: Research
Cr. arr. Repeatable.

Athletics

Administered by the Department of Kinesiology.

Courses primarily for undergraduates:

ATH 101: Intercollegiate Athletics
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101B: Intercollegiate Athletics: Basketball (men)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101C: Intercollegiate Athletics: Basketball (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101D: Intercollegiate Athletics: Cross Country (men)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101E: Intercollegiate Athletics: Cross Country (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101F: Intercollegiate Athletics: Football (men)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101G: Intercollegiate Athletics: Golf (men)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101J: Intercollegiate Athletics: Gymnastics (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101K: Intercollegiate Athletics: Softball (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101M: Intercollegiate Athletics: Swimming/Diving (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101O: Intercollegiate Athletics: Tennis (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101P: Intercollegiate Athletics: Track and Field (men)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101Q: Intercollegiate Athletics: Track and Field (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101R: Intercollegiate Athletics: Volleyball (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101S: Intercollegiate Athletics: Wrestling (men)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101T: Intercollegiate Athletics: Golf (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

ATH 101U: Intercollegiate Athletics: Soccer (women)
Cr. 1. Repeatable, maximum of 4 credits. F.S.
Prereq: Permission of head coach
Limited to 1 credit per year to a maximum of 4. Offered on a satisfactory-fail basis only. Credit for a sport section of Ath 101 may not be applied toward graduation if credit is also received for KIN 166 or any skill technique course in the same sport.

Athletic Training

This major prepares students for a career as an athletic trainer in high school, college or professional settings or for work in other settings (such as sports medicine clinics, the military, industry, and fitness centers). The program is CAATE accredited and students are prepared for the Board of Certification exam upon graduation. Admission to the athletic training program is competitive and based on available departmental resources. Admission procedures and technical standards can be found at *http://www.kin.hs.iastate.edu/programs/athletic-training/#program-information-and-requirements*.

Mission

We promote health and well-being by creating and disseminating knowledge about physical activity and active living. Through discovery, learning and engagement we improve the lives of citizens of Iowa, the United States and the world.

Goals

The department has identified the following goals to support this mission:

1. We seek to improve the lives of citizens of Iowa, the United States, and the world by the creation and dissemination of knowledge about physical activity and its relationship to health and well-being.
2. We prepare scholars and professionals in the study of physical activity at the undergraduate and graduate levels.
3. We educate the public and the University community in the scientific aspects of physical activity especially exercise, sport, and the role of movement throughout the lifespan.

Undergraduate Study

The Department of Kinesiology offers two Bachelor of Science degrees: Athletic Training and Kinesiology & Health. The undergraduate curriculum major/option is comprised of three components: general education, required departmental courses and the component courses. The intent of the general education component is to promote intellectual and personal growth and to prepare students for success in the basic, advanced and major/option components. Required courses provide an introduction to the field and fundamental principles of physical activity, fitness, health and disease.

B.S. degree in Athletic Training

Certified Athletic Trainers are allied medical health professionals who specialize in the prevention, assessment, treatment and rehabilitation of injuries to athletes and physically active individuals who are engaged in physical and athletic activities. To gain certification, candidates must graduate from a CAATE accredited athletic training education program and successfully pass the Board of Certification (BOC) examination. Many states also have licensure requirements to practice athletic training. The Athletic Training education program at Iowa State University, accredited since 2001, includes various athletic training clinical rotations including high school, physical therapy clinics, surgical observation experiences, and emergency room observation. The Athletic Training Program utilizes a competitive admission process for undergraduate students.

Curriculum in Athletic Training

This major prepares students for a career as an athletic trainer in high school, college or professional settings or for work in other settings (such as sports medicine clinics, the military, industry, and fitness centers). The program is CAATE accredited and students are prepared for the Board of Certification exam upon graduation. Admission to the athletic training program is competitive and based on available departmental resources. Admission procedures and technical standards can be found http://www.istatesportsmed.com/

Communication Proficiency

In order to meet graduation requirements, all students must earn an average of C (2.0) or better in ENGL 150 and ENGL 250, with neither grade being lower than a C-. Students not meeting this condition must earn a C or better in an advanced writing course:

or ENGL 314	Technical Communication	
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3

U.S. Diversity and International Perspectives

In order to meet graduation requirements, all students must complete 3 cr. of course work in U.S. Diversity and 3 cr. in International Perspectives. See university approved list.

General Education
Physical and Life Sciences:

BIOL 255	Fundamentals of Human Anatomy	3
BIOL 255L	Fundamentals of Human Anatomy Laboratory	1
BIOL 256	Fundamentals of Human Physiology	3
BIOL 256L	Fundamentals of Human Physiology Laboratory	1

Additional major-specific requirements are:

CHEM 163	College Chemistry	4
CHEM 163L	Laboratory in College Chemistry	1
FS HN 167	Introduction to Human Nutrition	3
PHYS 111	General Physics	4-5
or PHYS 115	Physics for the Life Sciences	

Mathematics and Statistics:

From the following:		3-4
MATH 140	College Algebra	
or MATH 143	Preparation for Calculus	
or MATH 145	Applied Trigonometry	
or MATH 165	Calculus I	
or MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
From the following:		3-4
STAT 101	Principles of Statistics	
or STAT 104	Introduction to Statistics	

Social Sciences: 9 cr. min required

PSYCH 101	Introduction to Psychology	3
or PSYCH 230	Developmental Psychology	
SOC 134	Introduction to Sociology	3

Humanities: 6 cr. min required

Choose from department approved list.

Communications:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
One of the following		3
ENGL 302	Business Communication	
or ENGL 314	Technical Communication	
or SP CM 31	Business and Professional Speaking	

Program requirements:

The following courses are required in all majors and options:

H S 110	Personal and Consumer Health	3
H S 350	Human Diseases (*)	3
KIN 252	Disciplines and Professions in Kinesiology and Health	1
KIN 253	Orientation and Learning Community in Kinesiology and Health	1
KIN 258	Physical Fitness and Conditioning	2
KIN 358	Physiology of Exercise (*)	3

* A grade of C- or better is required.

Courses for Athletic Training Major

Option Requirements:

A TR 219	Clinical Practicum in Athletic Training	1
A TR 221	Pre-Athletic Training Clinical Practicum	1
A TR 222	Basic Athletic Training for Athletic Trainers	3
A TR 223	Clinical Practicum in Athletic Training	1
A TR 224	Evaluation of Athletic Injuries I	3
A TR 225	Athletic Injuries I Clinical Practicum	1
A TR 226	Evaluation of Athletic Injuries II	3
A TR 227	Athletic Injuries II Clinical Practicum	1
A TR 240	Introduction to Taping, Equipment, and Bracing Techniques	1
A TR 323	Therapeutic Modalities for Athletic Trainers	3
A TR 324	Therapeutic Modalities Clinical Practicum	1
A TR 326	Rehabilitation of Athletic Injuries	3
A TR 327	Rehabilitation of Athletic Injuries Clinical Practicum	1
A TR 425	Organization and Administration of Athletic Training	3
A TR 450	Medical Concerns for the Athletic Trainer	3
A TR 488	Evidence Based Practice in Athletic Training	2
A TR 489	Review of Athletic Training Competencies and Clinical Proficiencies	1
H S 215	Drug Education	3
H S 305	Instructor's First Aid and Cardio-pulmonary Resuscitation	2
KIN 266	Advanced Strength Training and Conditioning	2
KIN 355	Biomechanics (*)	3

KIN 360	Sociology of Sport and Exercise (*)	3
KIN 365	Sport Psychology (*)	3
KIN 445	Legal Aspects of Sport	3
KIN 480	Functional Anatomy	3
Electives		3
Total Credits		57

* A grade of C- or better is required.

Athletic Training

Freshman

Fall	Credits	Spring	Credits
BIOL 255	3	A TR 221	1
BIOL 255L	1	A TR 222	3
ENGL 150	3	BIOL 256	3
H S 110	3	BIOL 256L	1
KIN 252	1	FS HN 167	3
KIN 253	1	SOC 134	3
LIB 160	1	STAT 101 or 104	3-4
PSYCH 101 or 230	3		
	16		17-18

Sophomore

Fall	Credits	Spring	Credits
A TR 219	1	A TR 224	3
A TR 223	1	A TR 225	1
A TR 226	3	A TR 240	1
A TR 227	1	H S 215	3
ENGL 250	3	KIN 266	2
KIN 258	2	PHYS 111 or 115	4-5
MATH 140, 143, 145, 165 or 181	3-4	Humanities Choice	3
	14-15		17-18

Junior

Fall	Credits	Spring	Credits
A TR 323	3	A TR 326	3
A TR 324	1	A TR 327	1
CHEM 163	4	H S 350	3
CHEM 163L	1	KIN 358	3
KIN 355	3	KIN 365	3
Social Science Choice	3	SP CM 212	3
	15		16

Senior

Fall	Credits	Spring	Credits
A TR 425	3	A TR 488	2
A TR 450	3	A TR 489	1
KIN 360	3	ENGL 302, 314, or SP CM 312	3
Electives	3	H S 305	2
Humanities Choice	3	KIN 445	3
		KIN 480	3
	15		14

Students must complete a 3-credit course in US Diversity and a 3-credit course in International Perspectives. Check ISU homepage for list of approved courses. You must complete a minimum of 46 credits in 300/400 level courses and a total of 124 credits for graduation. Foru year plans are arranged with courses in prerequisite sequence and within the term a course is usually offered. This is a SAMPLE plan - use the degree audit as "official" documentation of progress towards your degree.

Courses primarily for undergraduates:

A TR 218: Orientation to Athletic Training Clinical Experience
(0-2) Cr. 0.5. F.
Pre-athletic training clinical experience designed to orientate students to the athletic training profession prior to enrolling in athletic training course sequence. Students will observe athletic trainers in various athletic training clinical sites. Open to pre-athletic training students only. Offered on a satisfactory-fail basis only.

A TR 219: Clinical Practicum in Athletic Training
(0-2) Cr. 1. F.
Athletic training clinical experiences designed to review human anatomical structures including origin, insertion, action, innervations of muscles. Students will gain experience with palpation of these structures to help identify location of anatomical landmarks. Students will also gain experience identifying bones, ligaments, and tendons. Open to athletic training students only.

A TR 220: Basic Athletic Training
(1-2) Cr. 2.
Prereq: BIOL 155 or BIOL 255 and BIOL 256
Introduction to methods of prevention and immediate care of athletic injuries. Basic information concerning health supervision of athletes, and some basic wrapping and strapping techniques for common injuries. Non A TR majors only.

A TR 221: Pre-Athletic Training Clinical Practicum
(0-3) Cr. 1. S.
Prereq: Credit or enrollment in A TR 222
Athletic training clinical observation experiences to accompany A TR 222. Utilize knowledge to evaluate, analyze and demonstrate appropriate taping, wrapping and basic skill techniques. Open to students interested in the athletic training option. Offered on a satisfactory-fail basis only.

A TR 222: Basic Athletic Training for Athletic Trainers
(2-2) Cr. 3. S.
Prereq: BIOL 255, BIOL 255L
Provides pre-athletic training students with the knowledge of the profession of a certified athletic trainer, factors associated with injury prevention, treatment, emergency care of athletic injuries, protective equipment, basic organization, administrative, and legal concepts in the athletic training setting. To be taken concurrently with A TR 221.

A TR 223: Clinical Practicum in Athletic Training
(0-3) Cr. 1. F.
Prereq: Permission of Athletic Training Program Director
Athletic training clinical experiences for athletic training students during pre-season intercollegiate football. Clinical experiences include: Professional Rescuer CPR, AED certification, emergency splinting and spineboarding, medical record keeping and HIPPA regulations, environmental conditions, prevention of injury screening strategies, athletic training room and education program policies and procedures, review of athletic taping techniques, acute injury management, mouthpiece formation, and anatomy review. Offered on a satisfactory-fail basis only.

A TR 224: Evaluation of Athletic Injuries I
(2-3) Cr. 3. F.
Prereq: Permission of athletic training program director
Sport injury assessment procedures and evaluation techniques for lower body injuries. Includes an overview of mechanisms of injury, general musculoskeletal disorders, and spine or neurological dysfunction. Designed for students in the athletic training major.

A TR 225: Athletic Injuries I Clinical Practicum
(0-3) Cr. 1. F.
Prereq: Permission of athletic training program director
Athletic training clinical experience to accompany A TR 224. Open to students in the athletic training major. Offered on a satisfactory-fail basis only.

A TR 226: Evaluation of Athletic Injuries II
(2-3) Cr. 3. S.
Prereq: Permission of athletic training program director
Sport injury assessment procedures and evaluation techniques for lower body injuries. Includes an overview of common illnesses of athletes and sport specific injuries. Designed for students in the athletic training major.

A TR 227: Athletic Injuries II Clinical Practicum
(0-3) Cr. 1. S.
Prereq: Permission of athletic training program director
Athletic training clinical experience to accompany A TR 226. Open to students in the athletic training major. Offered on a satisfactory-fail basis only.

A TR 240: Introduction to Taping, Equipment, and Bracing Techniques
(0-3) Cr. 1. S.
Prereq: Permission of athletic training program director
Basic information and laboratory instruction regarding basic taping techniques, athletic equipment fitting procedures, and the use and proper fitting of prophylactic braces. Open to students in the athletic training major. Offered on a satisfactory-fail basis only.

A TR 323: Therapeutic Modalities for Athletic Trainers
(2-2) Cr. 3. F.
Prereq: Permission of athletic training program director
Theory and technique of therapeutic modalities used in the management of injuries.

A TR 324: Therapeutic Modalities Clinical Practicum
(0-3) Cr. 1. F.
Prereq: Permission of athletic training program director
Athletic training clinical experience to accompany A TR 323. Open to students in athletic training major. Offered on a satisfactory-fail basis only.

A TR 326: Rehabilitation of Athletic Injuries
(2-2) Cr. 3. S.
Prereq: Permission of athletic training program director
Theory and practical application of rehabilitation principles used in the management of athletic injuries.

A TR 327: Rehabilitation of Athletic Injuries Clinical Practicum
(0-3) Cr. 1. S.
Prereq: Permission of athletic training program director
Athletic training clinical experience to accompany A TR 326. Open to students in the athletic training major. Offered on a satisfactory-fail basis only.

A TR 425: Organization and Administration of Athletic Training
(3-0) Cr. 3. F.
Prereq: Permission of athletic training program director, senior classification
Current administrative, professional, and legal issues pertaining to athletic training. Job search techniques and strategies including preparation of materials for athletic training students.

A TR 450: Medical Concerns for the Athletic Trainer
(3-0) Cr. 3. F.
Prereq: Permission of athletic training program director
Current medical issues and concerns, including pathology of illness and injury, dermatological conditions, exposure to allied health care professionals, and pharmacological indications in relation to the profession of athletic training and in patient/athlete care.

A TR 488: Evidence Based Practice in Athletic Training
Cr. 2. S.
Prereq: Permission of athletic training program director
Clinical experiences in application of athletic training techniques under supervision of certified athletic trainers. Participation in monthly research journal discussion. Offered on a satisfactory-fail basis only.

A TR 489: Review of Athletic Training Competencies and Clinical Proficiencies
Cr. 1. F.S.
Prereq: Senior classification, permission of athletic training program director
Preparation for professional endorsement and certification by review of required competencies and clinical proficiencies. Required for endorsement or approval to sit for Board of Certification Exam. Offered on a satisfactory-fail basis only.

Courses primarily for undergraduates:

DANCE 120: Modern Dance I
(0-3) Cr. 1. F.S.
Introduction and practice of basic dance concepts, including preparatory techniques and guided creativity problems. No previous modern dance experience required. Offered on a satisfactory-fail basis only.

DANCE 130: Ballet I
(0-3) Cr. 1. F.S.
Introduction to the basic skills, vocabulary, and tradition of ballet with concentration on control and proper alignment. No previous ballet experience required. Offered on a satisfactory-fail basis only.

DANCE 140: Jazz I
(0-3) Cr. 1. F.S.
Introduction to the modern jazz style with concentration on isolation and syncopation. No previous jazz experience required. Offered on a satisfactory-fail basis only.

DANCE 150: Tap Dance I
(0-3) Cr. 1. F.
Instruction and practice in basic tap technique and terminology. No previous tap experience required. Offered on a satisfactory-fail basis only.

DANCE 160: Ballroom Dance I
(0-2) Cr. 1. F.S.
Instruction and practice in foxtrot, waltz, swing, cha cha, rhumba, tango, and selected contemporary dances. Offered on a satisfactory-fail basis only.

DANCE 199: Dance Continuum
Cr. 0.5-2. Repeatable, maximum of 6 credits. F.S.
Prereq: Permission of instructor
Advance registration required. Continued instruction and practice in either modern dance, recreational dance, ballet, jazz and/or compositional skills. Offered on a satisfactory-fail basis only.

DANCE 211: Fundamentals and Methods of Social and World Dance
(1-3) Cr. 1. S.
Skill enhancement, teaching, progressions with emphasis on world and social dance. Designed for kinesiology and health majors, open to others.

DANCE 220: Modern Dance Composition
(1-3) Cr. 2. F.
Prereq: DANCE 120 or previous modern dance experience
Theory and practice of the creative skills involved in solo and small group composition.

DANCE 222: Modern Dance II
(0-3) Cr. 1. F.
Prereq: DANCE 120 or previous modern dance experience
Dance techniques emphasizing strength, balance, endurance, rhythmic activity and extended combinations.

DANCE 223: Modern Dance III
(0-3) Cr. 1. S.
Prereq: DANCE 222
Continued experience in dance techniques and extended combinations. Emphasis on maturation of skill and artistry. Exposure to a variety of modern dance technical styles.

DANCE 224: Concert and Theatre Dance
(Cross-listed with THTRE). (0-3) Cr. 0.5-2. Repeatable, maximum of 6 credits. F.S.
Prereq: By audition only
Choreography, rehearsal, and performance in campus dance concerts and/or musical theatre productions. Offered on a satisfactory-fail basis only.

DANCE 232: Ballet II
(0-3) Cr. 1. S.
Prereq: Previous ballet experience
Technical skills in the classical movement vocabulary. Emphasis on alignment, techniques, sequence development, and performing quality.

DANCE 233: Ballet III
(0-3) Cr. 1. F.
Prereq: DANCE 232
Concentration on technical proficiency at the intermediate level. Pointe work and partnering opportunities available.

DANCE 242: Jazz II
(0-3) Cr. 1. S.
Prereq: Previous jazz dance experience
Dance concepts within the jazz idiom. Instruction in extended movement sequences and artistic interpretation.

DANCE 270: Dance Appreciation
(3-0) Cr. 3. F.S.SS.
Introduction to the many forms and functions of dance in world cultures. Develop abilities to distinguish and analyze various dance styles. No dance experience required.
Meets International Perspectives Requirement.

DANCE 320: Sound and Movement
(2-2) Cr. 3. S.
Prereq: DANCE 220
Intermediate composition based on the relationship of movement to improvised sounds, rhythmic scores, and the musical works of composers from various periods.

DANCE 360: History and Philosophy of Dance
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: DANCE 270
Study of the history of dance from early to modern times with emphasis on the theories and philosophies of contemporary modern dance, dancers, and dance educators.

DANCE 370: Advanced Studies in Dance
Cr. 1-3. Repeatable, maximum of 8 credits. F.S.
Prereq: 2 credits in dance
Advance registration required. Designed to meet special interests and talents of students to include both group and independent study in various aspects of dance as a performing art including production, choreography, and performance.

DANCE 384: Teaching Children's Dance
(1-3) Cr. 2. S.
Content, experiences, and methods of a comprehensive dance program at the elementary school level. Theories and practice in guiding elementary school children in expressive movement experiences.

DANCE 385: Methods of Teaching Dance
(1-3) Cr. 2. F.
Methods and techniques of teaching social and world dance forms. Introduction to teaching educational modern dance.

DANCE 386: Teaching Dance Technique and Composition
(1-3) Cr. 2.
Prereq: DANCE 320
Teaching yoga, body therapies, mindfulness and dance composition to enhance the physical and mental performance of the individual.

DANCE 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in dance and permission of coordinator
Independent study of problems or areas of interest in dance.

DANCE 490A: Independent Study: Dance
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: 6 credits in dance and permission of coordinator
Independent study of problems or areas of interest in dance.

DANCE 490H: Independent Study in Dance - Honors
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: 6 credits in dance and permission of coordinator
Independent study of problems or areas of interest in dance for those admitted to the honors program.

Courses primarily for undergraduates:

H S 105: First Aid and Emergency Care
(1-2) Cr. 2. F.S.SS.
Discussion and application of the basic techniques of utilizing bloodborne pathogen safety measures, administering first aid and cardiopulmonary resuscitation. ARC layperson certification available.

H S 110: Personal and Consumer Health
(3-0) Cr. 3. F.S.
Physical, mental, emotional and social aspects of health as a basis for understanding and promoting health, and preventing poor health conditions. Study of personal responsibility on the long-term benefits of maintaining a high level of wellness and health. Identification and mitigation of negative lifestyle habits.

H S 215: Drug Education
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101 or PSYCH 230
Discussion of use, abuse and addiction of mood modifying substances in contemporary society. Includes study of tobacco, alcohol, and other drugs.

H S 275: Health Education in the Elementary School
(3-0) Cr. 3. F.S.
Prereq: HD FS 102 or HD FS 226
The application of instructional strategies related to health education and physical education for teachers at the elementary level. Credit for both H S 275 and 375 may not be applied toward graduation.

H S 285: Pre-Internship in Kinesiology and Health
(Cross-listed with KIN). Cr. 1-2. F.S.SS.
Prereq: Kinesiology and Health major and permission of internship coordinator
Pre-internship experience with a health or fitness organization based on option. Offered on a satisfactory-fail basis only.

H S 305: Instructor's First Aid and Cardio-pulmonary Resuscitation
(1-2) Cr. 2. F.S.
Prereq: H S 105
Discussion and practice of skills needed to teach first aid and cardiopulmonary resuscitation. ARC certification available.

H S 310: Community and Public Health
(3-0) Cr. 3. F.S.
Prereq: H S 110
Introduction to community health problems, programs of prevention, environmental health agencies, and health services. Study of local, state, and national community health agencies, their purposes and functions.

H S 350: Human Diseases
(3-0) Cr. 3. F.S.SS.
Prereq: H S 110 and BIOL 255, BIOL 256
Discussion of disease process and ill-health in the twentieth century. Emphasis on epidemiology, prevention, treatment, and the understanding of the etiology of communicable and noncommunicable diseases.

H S 375: Teaching-Learning Process in Health Education
(3-0) Cr. 3. F.
Prereq: H S 105, H S 110, H S 215
Principles, methods, materials, and resources involved in the teaching of health. Includes organization and development of the health education curriculum (K-12). Credit for both H S 275 and 375 may not be applied toward graduation.

H S 380: Worksite Health Promotion
(3-0) Cr. 3. F.S.
Prereq: KIN 258, KIN 366
The design and implementation of worksite health promotion programs and the benefits these programs have for both employees and employers. Review of various health risk appraisals and planning theory-based incentive programs designed to promote positive lifestyles.

H S 385: Strategies for Professional School and Field Experience Opportunities
(Cross-listed with KIN). Cr. 0.5. F.S.
Prereq: Junior classification; to be taken minimum of two semesters prior to graduation or field experience placement.
Search techniques and preparation of relevant material for work and/or professional school admission. Information specifically related to health care and kinesiology fields. Field experience process and procedures will be reviewed.

H S 390: Administration of the School Health Program
(3-0) Cr. 3. F.
Prereq: H S 310
History and legal basis of school health programs. Procedures for developing, organizing, administering, and evaluating a modern program of health services, healthful school living, and health instruction. Includes administration, community and school relationships.

H S 417: Supervised Teaching in Health Education in the Secondary School
Cr. 12. F.S.
Prereq: H S 375
Advance registration required.

H S 417A: Supervised Teaching in Health Education in the Secondary School: Initial Endorsement
Cr. 16. F.S.
Prereq: H S 375
Students must be fully admitted to Teacher Education and must apply for approval to enroll at the beginning of the semester prior to registering.

H S 417B: Supervised Teaching in Health Education in the Secondary School: Additional Endorsement
Cr. arr. F.S.
Prereq: H S 375
Students must be fully admitted to Teacher Education and must apply for approval to enroll at the beginning of the semester prior to registering.

H S 430: Community Health Program Development
(3-0) Cr. 3. F.
Prereq: H S 380
Techniques of needs assessment, program design, administration, and evaluation of community health education programs in various settings.

H S 464: Physical Activity Epidemiology
(Dual-listed with H S 564). (3-0) Cr. 3. S.
Prereq: KIN 358 or H S 350; STAT 101 or STAT 401
Understanding health benefits of physical activity on chronic disease prevention and health promotion throughout the life span, from clinical and public health perspectives. Discussion and application of real-life physical activity assessment, research, guidelines, and promotion in population levels.

H S 485: Directed Field Experience in Health Promotion
Cr. 8-16.
Prereq: All required health studies courses and permission of coordinator
Advance registration required. Supervised experience in health promotion field. Offered on a satisfactory-fail basis only.

H S 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in health studies and permission of coordinator

Courses primarily for graduate students, open to qualified undergraduates:

H S 564: Physical Activity Epidemiology
(Dual-listed with H S 464). (3-0) Cr. 3. S.
Prereq: KIN 358 or H S 350; STAT 101 or STAT 401
Understanding health benefits of physical activity on chronic disease prevention and health promotion throughout the life span, from clinical and public health perspectives. Discussion and application of real-life physical activity assessment, research, guidelines, and promotion in population levels.

Courses primarily for undergraduates:

KIN 101: Swimming I
(0-3) Cr. 1. F.S.SS.
Basic course for nonswimmers. Emphasis on two fundamental strokes and personal water safety skills. Offered on a satisfactory-fail basis only.

KIN 102: Swimming II
(0-3) Cr. 1. F.S.
Prereq: KIN 101 or equivalent skill
Intermediate course. Emphasis on learning and improving five basic strokes and personal water safety skills. Offered on a satisfactory-fail basis only.

KIN 108: Aquatic Fitness
(0-3) Cr. 1. F.S.
Prereq: KIN 102 or equivalent skill
Water related exercises, activities, and swimming workouts to improve physical fitness. Offered on a satisfactory-fail basis only.

KIN 122: Badminton
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental badminton skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 129: Bowling
(0-2) Cr. 1. F.S.SS.
Introduction to bowling skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 135: Golf
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental golf skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 144: Racquetball
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental racquetball skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 153: Ice Skating
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental ice skating skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 158: Tennis
(0-2) Cr. 1. F.S.SS.
Introduction to basic skills (forehand, backhand, service) and basic knowledge of game play. Offered on a satisfactory-fail basis only.

KIN 163: Physical Fitness
(0-3) Cr. 1. F.S.SS.
Evaluation of fitness status. Exercises, activities, and programs to improve physical fitness. Improve physical fitness and weight control. Offered on a satisfactory-fail basis only. Credit for only KIN 163 or 258 may be applied toward graduation.

KIN 164: Walking for Fitness
(0-3) Cr. 1. F.S.SS.
Fitness walking as an activity to improve health and fitness; values of this type of activity as a lifetime endeavor with knowledge and usage of pedometers. Offered on a satisfactory-fail basis only.

KIN 165: Running for Fitness
(0-2) Cr. 1. F.S.SS.
Running as a physical activity to improve physical fitness and health. Promotion of this activity as a lifetime endeavor. Offered on a satisfactory-fail basis only.

KIN 166: Weight Training
(0-3) Cr. 1. F.S.SS.
Introduction to fundamental skills of weight training and strategic game play. Offered on a satisfactory-fail basis only.

KIN 168: Judo
(0-2) Cr. 1. F.S.
Fundamentals of self defense, focusing on throwing with the hands, hips and feet as well as applying pins, chokes and arm-bars. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self control, & indomitable spirit. Emphasis on learning a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only.

KIN 170: Tae Kwon Do/Karate I
(0-2) Cr. 1. F.S.
Teaches fundamentals of self-defense, focusing on hand and foot striking and blocking techniques. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only.

KIN 171: Tae Kwon Do/Karate II
(0-2) Cr. 1. F.S.
Teaches advanced application of self-defense focusing on hand and foot striking and blocking techniques. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only.

KIN 173: Hap Ki Do/Martial Self-Defense
(0-2) Cr. 1. F.S.
Teaches fundamentals of self-defense focusing on joint locks, pressure points and throwing techniques to escape from an attacker. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health & citizenship. Offered on a satisfactory-fail basis only.

KIN 182: Volleyball
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental volleyball skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 185: Soccer
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental soccer skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 210: Concepts of Fitness and Wellness
(2-0) Cr. 2. F.S.
Coverage of behavioral skills needed to adopt and maintain lifestyles conducive to fitness and wellness. Provides students with knowledge and skills needed to adopt and maintain healthy lifestyles. Includes self-assessments and content on physical activity, nutrition, weight control, stress management and other lifestyle behaviors related to health. For non-kinesiology majors.

KIN 231: Fundamentals of Tumbling and Gymnastics
(0-3) Cr. 1. F.
Prereq: Eligibility for admission to KIN teacher education program
Fundamentals of tumbling and gymnastics apparatus. Skill enhancement, analysis, understanding practice and the development of progressions.

KIN 232: Fundamentals of Team Sports
(0-3) Cr. 1. F.
Prereq: Eligibility for admission to KIN teacher education program
Fundamentals of indoor and outdoor team sports, for example basketball, volleyball, flag football, and soccer. Skill enhancement, analysis, understanding practice and the development of progressions.

KIN 236: Fundamentals of Individual Sports and Fitness
(0-3) Cr. 1. S.
Prereq: Eligibility for admission to KIN teacher education program
Fundamentals of individual sports and fitness, for example disc golf, bowling, badminton, and weight training. Skill enhancement, analysis, understanding practice and the development of progressions.

KIN 252: Disciplines and Professions in Kinesiology and Health
(1-0) Cr. 1. F.S.
Overview of the various disciplines and professions that comprise the field of Kinesiology (the study of human movement) and help students determine the career option that best fits their interests.

KIN 253: Orientation and Learning Community in Kinesiology and Health
(1-0) Cr. 1. F.S.
Prereq: Concurrent enrollment or credit in KIN 252
Overview of ISU policies and procedures, academic advising operations, degree requirements, program of study planning, and campus resources. Students will have out-of-class activities and work with faculty, staff and mentors to explore careers in Kinesiology and complete assignments related to identification & development of their skills and interests. Department of Kinesiology students only. Offered on a satisfactory-fail basis only.

KIN 258: Physical Fitness and Conditioning
(1-3) Cr. 2. F.S.
Prereq: Kinesiology and health majors only
Introduction to five components of fitness: cardiorespiratory, muscular strength, muscular endurance, flexibility, and body composition. Students will be introduced to basic exercise prescription and evaluation principles, develop skills to assess each component of fitness, and learn different exercise modalities to enhance each component. Credit for only one of the following courses may be applied toward graduation: KIN 163, 258.

KIN 259: Leadership Techniques for Fitness Programs
(1-3) Cr. 2. F.S.
Prereq: KIN 258
Development of exercise leadership skills for a variety of activities. Includes planning, promotion, and teaching techniques for developing fitness in others using a variety of exercise modalities including group fitness and weight training. Kinesiology and health majors only.

KIN 266: Advanced Strength Training and Conditioning
(1-2) Cr. 2. F.S.
Prereq: KIN 258
This course is designed to enhance the student's current level of knowledge and expertise to an advanced level in the area of strength training and conditioning. The course will prepare students interested in taking the National Strength and Conditioning Association Certified and Conditioning Specialist's exam. The course will focus on the assessment and implementation of training programs with strong emphasis on the areas of resistance training, metabolic training, flexibility, reaction time, speed, and agility. Kinesiology and health majors only and permission of instructor needed.

KIN 280: Directed Field Experience in Elementary Physical Education
(0-3) Cr. 1. F.S.
Observing, planning, and facilitating movement experiences of children in an elementary school setting. Offered on a satisfactory-fail basis only.

KIN 281: Directed Field Experience in Secondary Physical Education
(0-3) Cr. 1. F.S.
Prereq: Admission to Educator Preparation Program
Observing, planning, and facilitating movement experiences of students in a middle and/or high school setting. Offered on a satisfactory-fail basis only.

KIN 282: Field Experience with Educational Outreach
(0-2) Cr. 1. F.S.
Prereq: Admission to Educator Preparation Program
Planning and facilitating physical education experiences for children in a community outreach setting. Experiences take place on campus. Offered on a satisfactory-fail basis only.

KIN 284: Elementary and Pre-school Movement Education
(2-3) Cr. 3. F.S.SS.
Prereq: 3 credits in human development and family studies
Approaches to teaching movement skills, health-related fitness and school-based physical activities (in the classroom, in PE, during recess) to pre-school and elementary school age children are covered. Emphasis is placed on planning and conducting developmentally appropriate movement experiences for preschool and elementary aged children throughout the school day based upon educational psychology, exercise psychology and motor development research. Practical experience is provided. Credit in only one of the following courses may be applied toward graduation: KIN 284, 312.

KIN 285: Pre-Internship in Kinesiology and Health
(Cross-listed with H S). Cr. 1-2. F.S.SS.
Prereq: Kinesiology and Health major and permission of internship coordinator
Pre-internship experience with a health or fitness organization based on option. Offered on a satisfactory-fail basis only.

KIN 290: Independent Study
Cr. 1. Repeatable, maximum of 3 credits. F.
Study under supervision of faculty.

KIN 312: Movement Education in Elementary School Physical Education
(2-2) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280
Planning for management and instruction of developmentally appropriate physical education for children pre-school through grade six. Laboratory experience required. Credit for only one of KIN 284 or KIN 312 may be applied toward graduation.

KIN 313: Teaching Secondary Physical Education
(2-3) Cr. 3. S.
Prereq: Admission to Educator Preparation Program, KIN 281
Current theory, practice and research on teaching focusing on management, instructional, and learning styles of students in secondary schools.

KIN 315: Coaching Theory and Administrative Issues
(3-0) Cr. 3. F.S.SS.
Study in the theory, ethics, strategy, and mechanics of coaching various interscholastic and/or intercollegiate sports. Emphasis on formulating a philosophy, identifying goals and psychological aspects, teaching skills, and developing strategies.

KIN 345: Management of Health-Fitness Programs and Facilities
(3-0) Cr. 3. F.S.
Application of management concepts to the fitness industry, e.g., understanding customers, marketing, program management, financial management, legal issues, and evaluation and planning.

KIN 355: Biomechanics
(3-0) Cr. 3. F.S.SS.
Prereq: PHYS 111 or PHYS 115
Mechanical basis of human performance; application of mechanical principles to exercise, sport and other physical activities.

KIN 358: Physiology of Exercise
(3-0) Cr. 3. F.S.SS.
Prereq: BIOL 255, BIOL 255L, BIOL 256 and BIOL 256L
Physiological basis of human performance; effects of physical activity on body functions.

KIN 360: Sociology of Sport and Exercise
(3-0) Cr. 3. F.S.
Prereq: SOC 134 and one of STAT 101, STAT 104 or STAT 226/STAT 326, or KIN 471
Sport and exercise as social systems and as institutions related to other institutions such as the polity, the economy, mass media, and education.

KIN 363: Basic Electrocardiography
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Understanding of human electrocardiography, including normal and abnormal 12-lead ECGs and arrhythmia identification.

KIN 365: Sport Psychology
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101 or PSYCH 230
Psychological factors that influence performance in sport settings. The influence of personality, anxiety, motivation and social factors. Psychological skills training and strategic methods for improvement of athletic performance.

KIN 366: Exercise Psychology
(3-0) Cr. 3. F.S.SS.
Prereq: PSYCH 101 or PSYCH 230
Psychological theories for understanding and predicting health-oriented exercise behavior. Psychological and psychobiological responses to exercise. Psychological interventions for increasing exercise participation and adherence rates.

KIN 372: Motor Control and Learning Across the Lifespan
(3-0) Cr. 3. F.S.SS.
Prereq: PSYCH 101 or PSYCH 230, BIOL 255, BIOL 256
Introduction to major concepts of neuromotor control, behavioral motor control and motor learning in the child, adult and older adult, with emphasis on the adult system.

KIN 385: Strategies for Professional School and Field Experience Opportunities
(Cross-listed with H S). Cr. 0.5. F.S.
Prereq: Junior classification; to be taken minimum of two semesters prior to graduation or field experience placement.
Search techniques and preparation of relevant material for work and/or professional school admission. Information specifically related to health care and kinesiology fields. Field experience process and procedures will be reviewed.

KIN 391: Service Learning Leadership Experience
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Applied service learning experiences designed to provide students with opportunities to apply classroom knowledge to real world applications. Students will gain professional skills and programming experience while supporting health, education and wellness programming in school, work site or community settings. Offered on a satisfactory-fail basis only.

KIN 395: Adapted Physical Education
(Dual-listed with KIN 595). (2-3) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280/281
Etiology, characteristics, needs and movement experiences for individuals with disabling conditions. Designed to provide appropriate methods of physical education instruction for students including those with disabilities as identified by the Individuals with Disabilities Education Act and students who are talented and gifted. Assessments and strategies to differentiate instruction and to adapt activities for all exceptional learners will be addressed. Laboratory experience required. KIN 595 may not be taken by students who previously earned credit in KIN 395.

KIN 399: Recreational Sport Management
(3-0) Cr. 3. F.
Prereq: SOC 134
The role of sport in developing fitness, recreational opportunities, and tourism, with special emphasis on issues related to youth sport, volunteerism, and the marketing of sport events and facilities.

KIN 417: Supervised Teaching in Physical Education in the Secondary School
Cr. arr. F.S.
Prereq: KIN 281, KIN 282, KIN 313, KIN 355, KIN 395, KIN 471, KIN 475; admission to Teacher Education; approval before enrolling in the course.
Supervised teaching in the secondary schools.

KIN 418: Supervised Teaching in Physical Education in the Elementary School
Cr. 8. F.S.
Prereq: KIN 280, KIN 282, KIN 312, KIN 355, KIN 395, KIN 471, KIN 475. Students must be fully admitted to Teacher Education and must apply for approval to enroll at the beginning of the semester prior to registering
Supervised teaching in the elementary schools.

KIN 445: Legal Aspects of Sport
(3-0) Cr. 3. S.
Students will understand legal concepts and terminology relevant to sport/activity, identify strategies for limiting liability in sport/fitness programs, and identify solutions for elimination of discriminatory practices in sport and physical activity.

KIN 455: Research Topics in Biomechanics
(3-0) Cr. 3.
Prereq: KIN 355 or permission of instructor
Examination of biomechanics and kinesiology research literature to evaluate the application of mechanical principles and analyses to human movement in exercise, sport, physical activity, and activities of daily living and to assess research outcomes and their implications for motor performance, movement energetic, musculoskeletal loading, and injury.

KIN 458: Principles of Fitness Assessment and Exercise Prescription
(3-2) Cr. 4. F.S.
Prereq: KIN 258, KIN 358
Principles of cardiac risk factor identification and modification; risk classification of potential exercise clients; fitness assessments; developing comprehensive exercise prescriptions for individuals.

KIN 459: Internship in Exercise Leadership
(0-3) Cr. 1. F.S.
Prereq: C- or better in KIN 259, CPR certification, concurrent enrollment in KIN 458
Observation and practice of exercise leadership techniques in an on-campus adult fitness program.

KIN 462: Medical Aspects of Exercise
(3-0) Cr. 3. F.S.
Prereq: KIN 358
The role of exercise in preventive medicine. Impact of exercise on various diseases, and the effect of various medical conditions on the ability to participate in vigorous exercise and competitive sports. Principles of exercise testing and prescription for individuals with these conditions. Environmental and nutritional aspects of exercise.

KIN 467: Exercise and Health: Behavior Change
(Dual-listed with KIN 567). (3-0) Cr. 3. S.
Prereq: Introductory course with emphasis on exercise psychology (i.e., KIN 366 or equivalent)
Advanced analysis of theoretical health behavior models and their application to physical activity behavior. Includes practical techniques, tools and interventions (e.g., counseling skills, motivational interviewing) to enhance exercise prescription and motivation, and considerations for working with special populations.

KIN 471: Measurement in Physical Education
(Dual-listed with KIN 571). (2-3) Cr. 3. S.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practice and research on teaching focusing on management, instructional, and learning styles of students in secondary schools.

KIN 472: Neural Basis of Human Movement
(Dual-listed with KIN 572). (3-0) Cr. 3. S.
Prereq: KIN 372 or PSYCH 310
Addresses the role of the central nervous system in the control of voluntary human movement, with the focus on the cerebral cortex, basal ganglia and cerebellum. Content organized around specific nervous system damage (such as stroke, apraxia, spasticity, or spinal cord damage) and functional movements (such as reaching and grasping, balance and gait). Converging evidence from human movement disorders, brain imaging, animal lesion and single cell studies provide the primary basis for the content.

KIN 473: Physical Dimensions of Aging
Cr. 3. F.
Prereq: KIN 355 or KIN 358 or KIN 372
Understanding the physiological, behavioral, and cognitive changes associated with aging with focus on the effects of physical activity on the aging human system. Discussions of what it means to become older, what a person can expect during the aging process, and what kind of control a person has over the aging process.

KIN 475: Physical Education Curriculum Design and Program Organization
(Dual-listed with KIN 575). (3-0) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practices and principles applied to curriculum development for programs in physical education, K-12. Organizing for teaching in a variety of school settings.

KIN 480: Functional Anatomy
(3-0) Cr. 3. F.S.
Prereq: KIN 355; BIOL 155 or BIOL 255 and BIOL 256
The structure and function of human muscular, skeletal and nervous systems. The relationship of these systems to efficient and safe human motion.

KIN 481: Biomechanics Lab
(0-2) Cr. 1.
Prereq: KIN 355
Learning lab techniques in Biomechanics and engaging in the experimental process.

KIN 482: Exercise Physiology Lab
(0-2) Cr. 1.
Prereq: KIN 358
Learning lab techniques in Exercise Physiology and engaging in the experimental process.

KIN 483: Exercise Psychology Lab
(0-2) Cr. 1.
Prereq: KIN 366
Learning lab techniques in Exercise Psychology and engaging in the experimental process.

KIN 484: Assessment and Control of Locomotion
(0-2) Cr. 1.
Prereq: KIN 372
Learning lab techniques in Motor Control and engaging in the experimental process.

KIN 485: Internship in Exercise Science
Cr. 1-16.
Prereq: Senior classification and advance registration
Observation and practice in fitness agencies. Offered on a satisfactory-fail basis only.

KIN 485A: Internship in Exercise Science: Health/Fitness Management.
Cr. 1-16.
Prereq: Prereq: C- or better in KIN 458, KIN 459 and KIN 462, Kinesiology and Health majors only. Cumulative GPA 2.0.
Observation and practice in selected exercise science agencies. Offered on a satisfactory-fail basis only.

KIN 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits from KIN advanced core and permission of coordinator
Independent study of problems of areas of interest in exercise and sport science and related areas.

KIN 490A: Independent Study: Exercise and Sport Science
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits from KIN advanced core and permission of coordinator
Independent study of problems of areas of interest in exercise and sport science and related areas.

KIN 490H: Independent Study: Honors
Cr. 1-2. Repeatable, maximum of 4 credits.
Prereq: 6 credits from KIN advanced core and permission of coordinator
Independent study of problems of areas of interest in exercise and sport science and related areas.

KIN 495: Special Topics in Kinesiology
Cr. 1-3.
Prereq: Junior or Senior classification
Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

KIN 501: Research Methods in Physical Activity
(3-0) Cr. 3. Repeatable.
Prereq: Graduate classification in kinesiology and health
Methods and techniques used in the design and interpretation of research involving physical activity. Emphasis on styles of writing, library use, and computer applications.

KIN 505: Research Laboratory Techniques in Exercise Physiology
(0-4) Cr. 2.
Prereq: KIN 358 or equivalent course with basic laboratory experience
Application and use of laboratory research equipment in exercise physiology, including operation, calibration, and use in selected situations.

KIN 510: Advanced Medical Aspects of Exercise
(2-0) Cr. 2.
Prereq: KIN 358
The role of exercise in preventive medicine. Impact of exercise on various diseases, and the effect of various medical conditions on the ability to participate in vigorous exercise and competitive sports. Principles of exercise testing and prescription for individuals with these conditions.

KIN 512: Movement Education in Elementary School Physical Education
(2-2) Cr. 3. F.
Planning for management and instruction of developmentally appropriate physical education for children pre-school through grade six. Laboratory experience required. Emphasis on evaluating published research on physical education and school-wide physical activity.

KIN 515: Injury Biomechanics
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Kin 355 or permission of instructor.
Utilization of biomechanical principles to model injury mechanisms. Introduction to tissue mechanics of bone, articular cartilage, ligament, tendon, and muscle. Biomechanics of lower extremity, upper extremity, and head/neck/trunk injuries.

KIN 516: Quantitative Analysis of Human Movement
(3-1) Cr. 3.
Prereq: KIN 355
Application of the principles of mechanics to the analysis of human motion. Investigation of the effects of kinematics and kinetics on the human body with special emphasis on exercise and sport applications. Includes consideration of two-dimensional and three-dimensional imaging techniques and force measurements.

KIN 517: Musculoskeletal Modeling
(3-1) Cr. 3. F.
Prereq: KIN 355 or permission from instructor
Systematic problem-solving approaches and design of computer programs for biomechanical analyses. Estimation of anthropometric parameters and mechanical properties of muscles, bones, and joints. Integration of anthropometrics, kinematics, and muscle mechanics into simulations of human movement.

KIN 518: Student Teaching in Elementary Physical Education
(0-8) Cr. 8. F.S.
Prereq: KIN 512, KIN 570, KIN 575
Student teaching for 8 weeks in an elementary school.

KIN 519: Student Teaching in Secondary Physical Education
(0-8) Cr. 8. F.S.
Prereq: KIN 512, KIN 570, KIN 575
Student teaching for 8 weeks in a middle or high school.

KIN 520: The Social Analysis of Sport
(3-0) Cr. 3.
Prereq: KIN 360; open to majors only or by permission of instructor
Sociological analysis of sport with emphasis on sociological theory, sports structure, and function in modern industrialized society; the systems of sport in regard to their role structure; formal organization, and professionalization and its differentiation along social class, age, and sex.

KIN 521: Advanced Topics in Exercise and Sport Psychology
(3-0) Cr. 3.
Prereq: KIN 365 or KIN 366, 3 courses in psychology; open to majors only or by permission of instructor
Aspects of psychology which form a basis for understanding and explaining behavior in the context of exercise and sport. Emphasis on evaluating published research, particularly theory and research methodology. Student presentations.

KIN 549: Advanced Vertebrate Physiology I
(Cross-listed with AN S, NUTRS). (4-0) Cr. 4. F.
Prereq: Biol 335; credit or enrollment in BBMB 404 or BBMB 420
Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems.

KIN 550: Advanced Physiology of Exercise I
(2-3) Cr. 3.
Prereq: KIN 505
Concepts and methods of assessing neurological, muscular, cardiovascular, and respiratory adjustments to exercise.

KIN 551: Advanced Physiology of Exercise II
(2-3) Cr. 3.
Prereq: KIN 505
Analysis of factors affecting work capacity and performance. Human energy metabolism concepts and measurement.

KIN 552: Advanced Vertebrate Physiology II
(Cross-listed with AN S, NUTRS). (3-0) Cr. 3. S.
Prereq: BIOL 335; credit or enrollment in BBMB 404 or BBMB 420
Cardiovascular, renal, respiratory, and digestive physiology.

KIN 558: Physical Fitness - Principles, Programs and Evaluation
(2-3) Cr. 3.
Prereq: KIN 358
Physiological principles of physical fitness, design and administration of fitness programs; testing, evaluation, and prescription; electrocardiogram interpretation.

KIN 560: Principles of Motor Control and Learning
(2-3) Cr. 3.
Prereq: KIN 372
Theoretical perspectives of motor control and learning will be examined as well as factors that facilitate motor learning. Motor control and learning will also be addressed by studying functional tasks such as reach and grasp, posture and locomotor, handwriting, catching and/or speech.

KIN 561: Motor Development and Physical Activity
(2-0) Cr. 2-3.
Prereq: PSYCH 230
Addresses theories and underlying mechanisms of motor development and motor control applied to typically and atypically developing children. Developmental control of balance, locomotion, reach-to-grasp, and other functional skills will be discussed, as will the role of physical activity in a child's life.

KIN 567: Exercise and Health: Behavior Change
(Dual-listed with KIN 467). (3-0) Cr. 3. S.
Prereq: Introductory course with emphasis on exercise psychology (i.e., KIN 366 or equivalent)
Advanced analysis of theoretical health behavior models and their application to physical activity behavior. Includes practical techniques, tools and interventions (e.g., counseling skills, motivational interviewing) to enhance exercise prescription and motivation, and considerations for working with special populations.

KIN 570: Physical Activity Assessment for Health Related Research
(2-2) Cr. 3.
This course will cover the broad scope of research in physical activity and public health. Emphasis will be placed on the application of physical activity assessment techniques since accurate measures are needed to more accurately assess the health benefits from physical activity and to evaluate the effectiveness of behavioral interventions designed to promote physical activity.

KIN 571: Measurement in Physical Education
(Dual-listed with KIN 471). (2-3) Cr. 3. S.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practice and research on teaching focusing on management, instructional, and learning styles of students in secondary schools.

KIN 572: Neural Basis of Human Movement
(Dual-listed with KIN 472). (3-0) Cr. 3. S.
Prereq: KIN 372 or PSYCH 310
Addresses the role of the central nervous system in the control of voluntary human movement, with the focus on the cerebral cortex, basal ganglia and cerebellum. Content organized around specific nervous system damage (such as stroke, apraxia, spasticity, or spinal cord damage) and functional movements (such as reaching and grasping, balance and gait). Converging evidence from human movement disorders, brain imaging, animal lesion and single cell studies provide the primary basis for the content.

KIN 575: Physical Education Curriculum Design and Program Organization
(Dual-listed with KIN 475). (3-0) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practices and principles applied to curriculum development for programs in physical education, K-12. Organizing for teaching in a variety of school settings.

KIN 590: Special Topics
Cr. 1-3. Repeatable.

KIN 590A: Special Topics: Physical Education
Cr. 1-3. Repeatable.

KIN 590B: Special Topics: Health and Exercise Promotion
Cr. 1-3. Repeatable.

KIN 590D: Special Topics: Exercise Physiology
Cr. 1-3. Repeatable.

KIN 590E: Special Topics: Sport Sociology
Cr. 1-3. Repeatable.

KIN 590F: Special Topics: Sport/Exercise Psychology
Cr. 1-3. Repeatable.

KIN 590G: Special Topics: Motor Behavior
Cr. 1-3. Repeatable.

KIN 590H: Special Topics: Biomechanics
Cr. 1-3. Repeatable.

KIN 590I: Special Topics: Research Ethics
Cr. 1-3. Repeatable.

KIN 591: Supervised Field Experience
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 591A: Supervised Field Experience: Physical Education
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 591B: Supervised Field Experience: Health and Exercise Promotion
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 591D: Supervised Field Experience: Exercise Physiology
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 592: Practicum in College Teaching
Cr. 1-3. Repeatable, maximum of 3 credits. F.S.SS.
Supervised experience with teaching an upper division, classroom-based course. Offered on a satisfactory-fail basis only.

KIN 595: Adapted Physical Education
(Dual-listed with KIN 395). (2-3) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280/281
Etiology, characteristics, needs and movement experiences for individuals with disabling conditions. Designed to provide appropriate methods of physical education instruction for students including those with disabilities as identified by the Individuals with Disabilities Education Act and students who are talented and gifted. Assessments and strategies to differentiate instruction and to adapt activities for all exceptional learners will be addressed. Laboratory experience required. KIN 595 may not be taken by students who previously earned credit in KIN 395.

KIN 599: Creative Component
Cr. 1-3. Repeatable.

Courses for graduate students:

KIN 615: Seminar
Cr. 1-3. Repeatable.

KIN 620: Advance Research Methods in Physical Activity
(3-0) Cr. 3. S.
Prereq: KIN 501, STAT 401 and STAT 402. Doctoral students only
Culminating seminar designed to synthesize statistical and design courses with practical research issues using data from physical activity.

KIN 670: Molecular Biology of Muscle
(Cross-listed with AN S). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BBMB 405, BBMB 420, or BBMB 502
Ultrastructure of muscle; chemistry, structure, function, and molecular biology of muscle proteins. Molecular aspects of muscle contraction, development and turnover. Cytoskeletal proteins and dynamics.

KIN 699: Research
Cr. 1-6. Repeatable.

Courses primarily for undergraduates:

A TR 218: Orientation to Athletic Training Clinical Experience
(0-2) Cr. 0.5. F.
Pre-athletic training clinical experience designed to orientate students to the athletic training profession prior to enrolling in athletic training course sequence. Students will observe athletic trainers in various athletic training clinical sites. Open to pre-athletic training students only. Offered on a satisfactory-fail basis only.

A TR 219: Clinical Practicum in Athletic Training
(0-2) Cr. 1. F.
Athletic training clinical experiences designed to review human anatomical structures including origin, insertion, action, innervations of muscles. Students will gain experience with palpation of these structures to help identify location of anatomical landmarks. Students will also gain experience identifying bones, ligaments, and tendons. Open to athletic training students only.

A TR 220: Basic Athletic Training
(1-2) Cr. 2.
Prereq: BIOL 155 or BIOL 255 and BIOL 256
Introduction to methods of prevention and immediate care of athletic injuries. Basic information concerning health supervision of athletes, and some basic wrapping and strapping techniques for common injuries. Non A TR majors only.

A TR 221: Pre-Athletic Training Clinical Practicum
(0-3) Cr. 1. S.
Prereq: Credit or enrollment in A TR 222
Athletic training clinical observation experiences to accompany A TR 222. Utilize knowledge to evaluate, analyze and demonstrate appropriate taping, wrapping and basic skill techniques. Open to students interested in the athletic training option. Offered on a satisfactory-fail basis only.

A TR 222: Basic Athletic Training for Athletic Trainers
(2-2) Cr. 3. S.
Prereq: BIOL 255, BIOL 255L
Provides pre-athletic training students with the knowledge of the profession of a certified athletic trainer, factors associated with injury prevention, treatment, emergency care of athletic injuries, protective equipment, basic organization, administrative, and legal concepts in the athletic training setting. To be taken concurrently with A TR 221.

A TR 223: Clinical Practicum in Athletic Training
(0-3) Cr. 1. F.
Prereq: Permission of Athletic Training Program Director
Athletic training clinical experiences for athletic training students during pre-season intercollegiate football. Clinical experiences include: Professional Rescuer CPR, AED certification, emergency splinting and spineboarding, medical record keeping and HIPPA regulations, environmental conditions, prevention of injury screening strategies, athletic training room and education program policies and procedures, review of athletic taping techniques, acute injury management, mouthpiece formation, and anatomy review. Offered on a satisfactory-fail basis only.

A TR 224: Evaluation of Athletic Injuries I
(2-3) Cr. 3. F.
Prereq: Permission of athletic training program director
Sport injury assessment procedures and evaluation techniques for lower body injuries. Includes an overview of mechanisms of injury, general musculoskeletal disorders, and spine or neurological dysfunction. Designed for students in the athletic training major.

A TR 225: Athletic Injuries I Clinical Practicum
(0-3) Cr. 1. F.
Prereq: Permission of athletic training program director
Athletic training clinical experience to accompany A TR 224. Open to students in the athletic training major. Offered on a satisfactory-fail basis only.

A TR 226: Evaluation of Athletic Injuries II
(2-3) Cr. 3. S.
Prereq: Permission of athletic training program director
Sport injury assessment procedures and evaluation techniques for lower body injuries. Includes an overview of common illnesses of athletes and sport specific injuries. Designed for students in the athletic training major.

A TR 227: Athletic Injuries II Clinical Practicum
(0-3) Cr. 1. S.
Prereq: Permission of athletic training program director
Athletic training clinical experience to accompany A TR 226. Open to students in the athletic training major. Offered on a satisfactory-fail basis only.

A TR 240: Introduction to Taping, Equipment, and Bracing Techniques
(0-3) Cr. 1. S.
Prereq: Permission of athletic training program director
Basic information and laboratory instruction regarding basic taping techniques, athletic equipment fitting procedures, and the use and proper fitting of prophylactic braces. Open to students in the athletic training major. Offered on a satisfactory-fail basis only.

A TR 323: Therapeutic Modalities for Athletic Trainers
(2-2) Cr. 3. F.
Prereq: Permission of athletic training program director
Theory and technique of therapeutic modalities used in the management of injuries.

A TR 324: Therapeutic Modalities Clinical Practicum
(0-3) Cr. 1. F.
Prereq: Permission of athletic training program director
Athletic training clinical experience to accompany A TR 323. Open to students in athletic training major. Offered on a satisfactory-fail basis only.

A TR 326: Rehabilitation of Athletic Injuries
(2-2) Cr. 3. S.
Prereq: Permission of athletic training program director
Theory and practical application of rehabilitation principles used in the management of athletic injuries.

A TR 327: Rehabilitation of Athletic Injuries Clinical Practicum
(0-3) Cr. 1. S.
Prereq: Permission of athletic training program director
Athletic training clinical experience to accompany A TR 326. Open to students in the athletic training major. Offered on a satisfactory-fail basis only.

A TR 425: Organization and Administration of Athletic Training
(3-0) Cr. 3. F.
Prereq: Permission of athletic training program director, senior classification
Current administrative, professional, and legal issues pertaining to athletic training. Job search techniques and strategies including preparation of materials for athletic training students.

A TR 450: Medical Concerns for the Athletic Trainer
(3-0) Cr. 3. F.
Prereq: Permission of athletic training program director
Current medical issues and concerns, including pathology of illness and injury, dermatological conditions, exposure to allied health care professionals, and pharmacological indications in relation to the profession of athletic training and in patient/athlete care.

A TR 488: Evidence Based Practice in Athletic Training
Cr. 2. S.
Prereq: Permission of athletic training program director
Clinical experiences in application of athletic training techniques under supervision of certified athletic trainers. Participation in monthly research journal discussion. Offered on a satisfactory-fail basis only.

A TR 489: Review of Athletic Training Competencies and Clinical Proficiencies

Cr. 1. F.S.

Prereq: Senior classification, permission of athletic training program director

Preparation for professional endorsement and certification by review of required competencies and clinical proficiencies. Required for endorsement or approval to sit for Board of Certification Exam. Offered on a satisfactory-fail basis only.

Courses primarily for undergraduates:

DANCE 120: Modern Dance I

(0-3) Cr. 1. F.S.

Introduction and practice of basic dance concepts, including preparatory techniques and guided creativity problems. No previous modern dance experience required. Offered on a satisfactory-fail basis only.

DANCE 130: Ballet I

(0-3) Cr. 1. F.S.

Introduction to the basic skills, vocabulary, and tradition of ballet with concentration on control and proper alignment. No previous ballet experience required. Offered on a satisfactory-fail basis only.

DANCE 140: Jazz I

(0-3) Cr. 1. F.S.

Introduction to the modern jazz style with concentration on isolation and syncopation. No previous jazz experience required. Offered on a satisfactory-fail basis only.

DANCE 150: Tap Dance I

(0-3) Cr. 1. F.

Instruction and practice in basic tap technique and terminology. No previous tap experience required. Offered on a satisfactory-fail basis only.

DANCE 160: Ballroom Dance I

(0-2) Cr. 1. F.S.

Instruction and practice in foxtrot, waltz, swing, cha cha, rhumba, tango, and selected contemporary dances. Offered on a satisfactory-fail basis only.

DANCE 199: Dance Continuum

Cr. 0.5-2. Repeatable, maximum of 6 credits. F.S.

Prereq: Permission of instructor

Advance registration required. Continued instruction and practice in either modern dance, recreational dance, ballet, jazz and/or compositional skills. Offered on a satisfactory-fail basis only.

DANCE 211: Fundamentals and Methods of Social and World Dance

(1-3) Cr. 1. S.

Skill enhancement, teaching, progressions with emphasis on world and social dance. Designed for kinesiology and health majors, open to others.

DANCE 220: Modern Dance Composition

(1-3) Cr. 2. F.

Prereq: DANCE 120 or previous modern dance experience

Theory and practice of the creative skills involved in solo and small group composition.

DANCE 222: Modern Dance II

(0-3) Cr. 1. F.

Prereq: DANCE 120 or previous modern dance experience

Dance techniques emphasizing strength, balance, endurance, rhythmic activity and extended combinations.

DANCE 223: Modern Dance III

(0-3) Cr. 1. S.

Prereq: DANCE 222

Continued experience in dance techniques and extended combinations. Emphasis on maturation of skill and artistry. Exposure to a variety of modern dance technical styles.

DANCE 224: Concert and Theatre Dance

(Cross-listed with THTRE). (0-3) Cr. 0.5-2. Repeatable, maximum of 6 credits. F.S.

Prereq: By audition only

Choreography, rehearsal, and performance in campus dance concerts and/or musical theatre productions. Offered on a satisfactory-fail basis only.

DANCE 232: Ballet II

(0-3) Cr. 1. S.

Prereq: Previous ballet experience

Technical skills in the classical movement vocabulary. Emphasis on alignment, techniques, sequence development, and performing quality.

DANCE 233: Ballet III

(0-3) Cr. 1. F.

Prereq: DANCE 232

Concentration on technical proficiency at the intermediate level. Pointe work and partnering opportunities available.

DANCE 242: Jazz II

(0-3) Cr. 1. S.

Prereq: Previous jazz dance experience

Dance concepts within the jazz idiom. Instruction in extended movement sequences and artistic interpretation.

DANCE 270: Dance Appreciation

(3-0) Cr. 3. F.S.SS.

Introduction to the many forms and functions of dance in world cultures. Develop abilities to distinguish and analyze various dance styles. No dance experience required.

Meets International Perspectives Requirement.

DANCE 320: Sound and Movement
(2-2) Cr. 3. S.
Prereq: DANCE 220
Intermediate composition based on the relationship of movement to improvised sounds, rhythmic scores, and the musical works of composers from various periods.

DANCE 360: History and Philosophy of Dance
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: DANCE 270
Study of the history of dance from early to modern times with emphasis on the theories and philosophies of contemporary modern dance, dancers, and dance educators.

DANCE 370: Advanced Studies in Dance
Cr. 1-3. Repeatable, maximum of 8 credits. F.S.
Prereq: 2 credits in dance
Advance registration required. Designed to meet special interests and talents of students to include both group and independent study in various aspects of dance as a performing art including production, choreography, and performance.

DANCE 384: Teaching Children's Dance
(1-3) Cr. 2. S.
Content, experiences, and methods of a comprehensive dance program at the elementary school level. Theories and practice in guiding elementary school children in expressive movement experiences.

DANCE 385: Methods of Teaching Dance
(1-3) Cr. 2. F.
Methods and techniques of teaching social and world dance forms. Introduction to teaching educational modern dance.

DANCE 386: Teaching Dance Technique and Composition
(1-3) Cr. 2.
Prereq: DANCE 320
Teaching yoga, body therapies, mindfulness and dance composition to enhance the physical and mental performance of the individual.

DANCE 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in dance and permission of coordinator
Independent study of problems or areas of interest in dance.

DANCE 490A: Independent Study: Dance
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: 6 credits in dance and permission of coordinator
Independent study of problems or areas of interest in dance.

DANCE 490H: Independent Study in Dance - Honors
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: 6 credits in dance and permission of coordinator
Independent study of problems or areas of interest in dance for those admitted to the honors program.

Courses primarily for undergraduates:

H S 105: First Aid and Emergency Care
(1-2) Cr. 2. F.S.SS.
Discussion and application of the basic techniques of utilizing bloodborne pathogen safety measures, administering first aid and cardiopulmonary resuscitation. ARC layperson certification available.

H S 110: Personal and Consumer Health
(3-0) Cr. 3. F.S.
Physical, mental, emotional and social aspects of health as a basis for understanding and promoting health, and preventing poor health conditions. Study of personal responsibility on the long-term benefits of maintaining a high level of wellness and health. Identification and mitigation of negative lifestyle habits.

H S 215: Drug Education
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101 or PSYCH 230
Discussion of use, abuse and addiction of mood modifying substances in contemporary society. Includes study of tobacco, alcohol, and other drugs.

H S 275: Health Education in the Elementary School
(3-0) Cr. 3. F.S.
Prereq: HD FS 102 or HD FS 226
The application of instructional strategies related to health education and physical education for teachers at the elementary level. Credit for both H S 275 and 375 may not be applied toward graduation.

H S 285: Pre-Internship in Kinesiology and Health
(Cross-listed with KIN). Cr. 1-2. F.S.SS.
Prereq: Kinesiology and Health major and permission of internship coordinator
Pre-internship experience with a health or fitness organization based on option. Offered on a satisfactory-fail basis only.

H S 305: Instructor's First Aid and Cardio-pulmonary Resuscitation
(1-2) Cr. 2. F.S.
Prereq: H S 105
Discussion and practice of skills needed to teach first aid and cardiopulmonary resuscitation. ARC certification available.

H S 310: Community and Public Health
(3-0) Cr. 3. F.S.
Prereq: H S 110
Introduction to community health problems, programs of prevention, environmental health agencies, and health services. Study of local, state, and national community health agencies, their purposes and functions.

H S 350: Human Diseases
(3-0) Cr. 3. F.S.SS.
Prereq: H S 110 and BIOL 255, BIOL 256
Discussion of disease process and ill-health in the twentieth century. Emphasis on epidemiology, prevention, treatment, and the understanding of the etiology of communicable and noncommunicable diseases.

H S 375: Teaching-Learning Process in Health Education
(3-0) Cr. 3. F.
Prereq: H S 105, H S 110, H S 215
Principles, methods, materials, and resources involved in the teaching of health. Includes organization and development of the health education curriculum (K-12). Credit for both H S 275 and 375 may not be applied toward graduation.

H S 380: Worksite Health Promotion
(3-0) Cr. 3. F.S.
Prereq: KIN 258, KIN 366
The design and implementation of worksite health promotion programs and the benefits these programs have for both employees and employers. Review of various health risk appraisals and planning theory-based incentive programs designed to promote positive lifestyles.

H S 385: Strategies for Professional School and Field Experience Opportunities
(Cross-listed with KIN). Cr. 0.5. F.S.
Prereq: Junior classification; to be taken minimum of two semesters prior to graduation or field experience placement.
Search techniques and preparation of relevant material for work and/or professional school admission. Information specifically related to health care and kinesiology fields. Field experience process and procedures will be reviewed.

H S 390: Administration of the School Health Program
(3-0) Cr. 3. F.
Prereq: H S 310
History and legal basis of school health programs. Procedures for developing, organizing, administering, and evaluating a modern program of health services, healthful school living, and health instruction. Includes administration, community and school relationships.

H S 417: Supervised Teaching in Health Education in the Secondary School
Cr. 12. F.S.
Prereq: H S 375
Advance registration required.

H S 417A: Supervised Teaching in Health Education in the Secondary School: Initial Endorsement
Cr. 16. F.S.
Prereq: H S 375
Students must be fully admitted to Teacher Education and must apply for approval to enroll at the beginning of the semester prior to registering.

H S 417B: Supervised Teaching in Health Education in the Secondary School: Additional Endorsement
Cr. arr. F.S.
Prereq: H S 375
Students must be fully admitted to Teacher Education and must apply for approval to enroll at the beginning of the semester prior to registering.

H S 430: Community Health Program Development
(3-0) Cr. 3. F.
Prereq: H S 380
Techniques of needs assessment, program design, administration, and evaluation of community health education programs in various settings.

H S 464: Physical Activity Epidemiology
(Dual-listed with H S 564). (3-0) Cr. 3. S.
Prereq: KIN 358 or H S 350; STAT 101 or STAT 401
Understanding health benefits of physical activity on chronic disease prevention and health promotion throughout the life span, from clinical and public health perspectives. Discussion and application of real-life physical activity assessment, research, guidelines, and promotion in population levels.

H S 485: Directed Field Experience in Health Promotion
Cr. 8-16.
Prereq: All required health studies courses and permission of coordinator
Advance registration required. Supervised experience in health promotion field. Offered on a satisfactory-fail basis only.

H S 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in health studies and permission of coordinator

Courses primarily for graduate students, open to qualified undergraduates:

H S 564: Physical Activity Epidemiology
(Dual-listed with H S 464). (3-0) Cr. 3. S.
Prereq: KIN 358 or H S 350; STAT 101 or STAT 401
Understanding health benefits of physical activity on chronic disease prevention and health promotion throughout the life span, from clinical and public health perspectives. Discussion and application of real-life physical activity assessment, research, guidelines, and promotion in population levels.

Courses primarily for undergraduates:

KIN 101: Swimming I
(0-3) Cr. 1. F.S.SS.
Basic course for nonswimmers. Emphasis on two fundamental strokes and personal water safety skills. Offered on a satisfactory-fail basis only.

KIN 102: Swimming II
(0-3) Cr. 1. F.S.
Prereq: KIN 101 or equivalent skill
Intermediate course. Emphasis on learning and improving five basic strokes and personal water safety skills. Offered on a satisfactory-fail basis only.

KIN 108: Aquatic Fitness
(0-3) Cr. 1. F.S.
Prereq: KIN 102 or equivalent skill
Water related exercises, activities, and swimming workouts to improve physical fitness. Offered on a satisfactory-fail basis only.

KIN 122: Badminton
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental badminton skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 129: Bowling
(0-2) Cr. 1. F.S.SS.
Introduction to bowling skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 135: Golf
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental golf skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 144: Racquetball
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental racquetball skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 153: Ice Skating
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental ice skating skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 158: Tennis
(0-2) Cr. 1. F.S.SS.
Introduction to basic skills (forehand, backhand, service) and basic knowledge of game play. Offered on a satisfactory-fail basis only.

KIN 163: Physical Fitness
(0-3) Cr. 1. F.S.SS.
Evaluation of fitness status. Exercises, activities, and programs to improve physical fitness. Improve physical fitness and weight control. Offered on a satisfactory-fail basis only. Credit for only KIN 163 or 258 may be applied toward graduation.

KIN 164: Walking for Fitness
(0-3) Cr. 1. F.S.SS.
Fitness walking as an activity to improve health and fitness; values of this type of activity as a lifetime endeavor with knowledge and usage of pedometers. Offered on a satisfactory-fail basis only.

KIN 165: Running for Fitness
(0-2) Cr. 1. F.S.SS.
Running as a physical activity to improve physical fitness and health. Promotion of this activity as a lifetime endeavor. Offered on a satisfactory-fail basis only.

KIN 166: Weight Training
(0-3) Cr. 1. F.S.SS.
Introduction to fundamental skills of weight training and strategic game play. Offered on a satisfactory-fail basis only.

KIN 168: Judo
(0-2) Cr. 1. F.S.
Fundamentals of self defense, focusing on throwing with the hands, hips and feet as well as applying pins, chokes and arm-bars. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self control, & indomitable spirit. Emphasis on learning a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only.

KIN 170: Tae Kwon Do/Karate I
(0-2) Cr. 1. F.S.
Teaches fundamentals of self-defense, focusing on hand and foot striking and blocking techniques. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only.

KIN 171: Tae Kwon Do/Karate II
(0-2) Cr. 1. F.S.
Teaches advanced application of self-defense focusing on hand and foot striking and blocking techniques. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only.

KIN 173: Hap Ki Do/Martial Self-Defense
(0-2) Cr. 1. F.S.
Teaches fundamentals of self-defense focusing on joint locks, pressure points and throwing techniques to escape from an attacker. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health & citizenship. Offered on a satisfactory-fail basis only.

KIN 182: Volleyball
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental volleyball skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 185: Soccer
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental soccer skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 210: Concepts of Fitness and Wellness
(2-0) Cr. 2. F.S.
Coverage of behavioral skills needed to adopt and maintain lifestyles conducive to fitness and wellness. Provides students with knowledge and skills needed to adopt and maintain healthy lifestyles. Includes self-assessments and content on physical activity, nutrition, weight control, stress management and other lifestyle behaviors related to health. For non-kinesiology majors.

KIN 231: Fundamentals of Tumbling and Gymnastics
(0-3) Cr. 1. F.
Prereq: Eligibility for admission to KIN teacher education program
Fundamentals of tumbling and gymnastics apparatus. Skill enhancement, analysis, understanding practice and the development of progressions.

KIN 232: Fundamentals of Team Sports
(0-3) Cr. 1. F.
Prereq: Eligibility for admission to KIN teacher education program
Fundamentals of indoor and outdoor team sports, for example basketball, volleyball, flag football, and soccer. Skill enhancement, analysis, understanding practice and the development of progressions.

KIN 236: Fundamentals of Individual Sports and Fitness
(0-3) Cr. 1. S.
Prereq: Eligibility for admission to KIN teacher education program
Fundamentals of individual sports and fitness, for example disc golf, bowling, badminton, and weight training. Skill enhancement, analysis, understanding practice and the development of progressions.

KIN 252: Disciplines and Professions in Kinesiology and Health
(1-0) Cr. 1. F.S.
Overview of the various disciplines and professions that comprise the field of Kinesiology (the study of human movement) and help students determine the career option that best fits their interests.

KIN 253: Orientation and Learning Community in Kinesiology and Health
(1-0) Cr. 1. F.S.
Prereq: Concurrent enrollment or credit in KIN 252
Overview of ISU policies and procedures, academic advising operations, degree requirements, program of study planning, and campus resources. Students will have out-of-class activities and work with faculty, staff and mentors to explore careers in Kinesiology and complete assignments related to identification & development of their skills and interests. Department of Kinesiology students only. Offered on a satisfactory-fail basis only.

KIN 258: Physical Fitness and Conditioning
(1-3) Cr. 2. F.S.
Prereq: Kinesiology and health majors only
Introduction to five components of fitness: cardiorespiratory, muscular strength, muscular endurance, flexibility, and body composition. Students will be introduced to basic exercise prescription and evaluation principles, develop skills to assess each component of fitness, and learn different exercise modalities to enhance each component. Credit for only one of the following courses may be applied toward graduation: KIN 163, 258.

KIN 259: Leadership Techniques for Fitness Programs
(1-3) Cr. 2. F.S.
Prereq: KIN 258
Development of exercise leadership skills for a variety of activities. Includes planning, promotion, and teaching techniques for developing fitness in others using a variety of exercise modalities including group fitness and weight training. Kinesiology and health majors only.

KIN 266: Advanced Strength Training and Conditioning
(1-2) Cr. 2. F.S.
Prereq: KIN 258
This course is designed to enhance the student's current level of knowledge and expertise to an advanced level in the area of strength training and conditioning. The course will prepare students interested in taking the National Strength and Conditioning Association Certified and Conditioning Specialist's exam. The course will focus on the assessment and implementation of training programs with strong emphasis on the areas of resistance training, metabolic training, flexibility, reaction time, speed, and agility. Kinesiology and health majors only and permission of instructor needed.

KIN 280: Directed Field Experience in Elementary Physical Education
(0-3) Cr. 1. F.S.
Observing, planning, and facilitating movement experiences of children in an elementary school setting. Offered on a satisfactory-fail basis only.

KIN 281: Directed Field Experience in Secondary Physical Education
(0-3) Cr. 1. F.S.
Prereq: Admission to Educator Preparation Program
Observing, planning, and facilitating movement experiences of students in a middle and/or high school setting. Offered on a satisfactory-fail basis only.

KIN 282: Field Experience with Educational Outreach
(0-2) Cr. 1. F.S.
Prereq: Admission to Educator Preparation Program
Planning and facilitating physical education experiences for children in a community outreach setting. Experiences take place on campus. Offered on a satisfactory-fail basis only.

KIN 284: Elementary and Pre-school Movement Education
(2-3) Cr. 3. F.S.SS.
Prereq: 3 credits in human development and family studies
Approaches to teaching movement skills, health-related fitness and school-based physical activities (in the classroom, in PE, during recess) to pre-school and elementary school age children are covered. Emphasis is placed on planning and conducting developmentally appropriate movement experiences for preschool and elementary aged children throughout the school day based upon educational psychology, exercise psychology and motor development research. Practical experience is provided. Credit in only one of the following courses may be applied toward graduation: KIN 284, 312.

KIN 285: Pre-Internship in Kinesiology and Health
(Cross-listed with H S). Cr. 1-2. F.S.SS.
Prereq: Kinesiology and Health major and permission of internship coordinator
Pre-internship experience with a health or fitness organization based on option. Offered on a satisfactory-fail basis only.

KIN 290: Independent Study
Cr. 1. Repeatable, maximum of 3 credits. F.
Study under supervision of faculty.

KIN 312: Movement Education in Elementary School Physical Education
(2-2) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280
Planning for management and instruction of developmentally appropriate physical education for children pre-school through grade six. Laboratory experience required. Credit for only one of KIN 284 or KIN 312 may be applied toward graduation.

KIN 313: Teaching Secondary Physical Education
(2-3) Cr. 3. S.
Prereq: Admission to Educator Preparation Program, KIN 281
Current theory, practice and research on teaching focusing on management, instructional, and learning styles of students in secondary schools.

KIN 315: Coaching Theory and Administrative Issues
(3-0) Cr. 3. F.S.SS.
Study in the theory, ethics, strategy, and mechanics of coaching various interscholastic and/or intercollegiate sports. Emphasis on formulating a philosophy, identifying goals and psychological aspects, teaching skills, and developing strategies.

KIN 345: Management of Health-Fitness Programs and Facilities
(3-0) Cr. 3. F.S.
Application of management concepts to the fitness industry, e.g., understanding customers, marketing, program management, financial management, legal issues, and evaluation and planning.

KIN 355: Biomechanics
(3-0) Cr. 3. F.S.SS.
Prereq: PHYS 111 or PHYS 115
Mechanical basis of human performance; application of mechanical principles to exercise, sport and other physical activities.

KIN 358: Physiology of Exercise
(3-0) Cr. 3. F.S.SS.
Prereq: BIOL 255, BIOL 255L, BIOL 256 and BIOL 256L
Physiological basis of human performance; effects of physical activity on body functions.

KIN 360: Sociology of Sport and Exercise
(3-0) Cr. 3. F.S.
Prereq: SOC 134 and one of STAT 101, STAT 104 or STAT 226/STAT 326, or KIN 471
Sport and exercise as social systems and as institutions related to other institutions such as the polity, the economy, mass media, and education.

KIN 363: Basic Electrocardiography
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Understanding of human electrocardiography, including normal and abnormal 12-lead ECGs and arrhythmia identification.

KIN 365: Sport Psychology
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101 or PSYCH 230
Psychological factors that influence performance in sport settings. The influence of personality, anxiety, motivation and social factors. Psychological skills training and strategic methods for improvement of athletic performance.

KIN 366: Exercise Psychology
(3-0) Cr. 3. F.S.SS.
Prereq: PSYCH 101 or PSYCH 230
Psychological theories for understanding and predicting health-oriented exercise behavior. Psychological and psychobiological responses to exercise. Psychological interventions for increasing exercise participation and adherence rates.

KIN 372: Motor Control and Learning Across the Lifespan
(3-0) Cr. 3. F.S.SS.
Prereq: PSYCH 101 or PSYCH 230, BIOL 255, BIOL 256
Introduction to major concepts of neuromotor control, behavioral motor control and motor learning in the child, adult and older adult, with emphasis on the adult system.

KIN 385: Strategies for Professional School and Field Experience Opportunities
(Cross-listed with H S). Cr. 0.5. F.S.
Prereq: Junior classification; to be taken minimum of two semesters prior to graduation or field experience placement.
Search techniques and preparation of relevant material for work and/or professional school admission. Information specifically related to health care and kinesiology fields. Field experience process and procedures will be reviewed.

KIN 391: Service Learning Leadership Experience
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Applied service learning experiences designed to provide students with opportunities to apply classroom knowledge to real world applications. Students will gain professional skills and programming experience while supporting health, education and wellness programming in school, work site or community settings. Offered on a satisfactory-fail basis only.

KIN 395: Adapted Physical Education
(Dual-listed with KIN 595). (2-3) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280/281
Etiology, characteristics, needs and movement experiences for individuals with disabling conditions. Designed to provide appropriate methods of physical education instruction for students including those with disabilities as identified by the Individuals with Disabilities Education Act and students who are talented and gifted. Assessments and strategies to differentiate instruction and to adapt activities for all exceptional learners will be addressed. Laboratory experience required. KIN 595 may not be taken by students who previously earned credit in KIN 395.

KIN 399: Recreational Sport Management
(3-0) Cr. 3. F.
Prereq: SOC 134
The role of sport in developing fitness, recreational opportunities, and tourism, with special emphasis on issues related to youth sport, volunteerism, and the marketing of sport events and facilities.

KIN 417: Supervised Teaching in Physical Education in the Secondary School
Cr. arr. F.S.
Prereq: KIN 281, KIN 282, KIN 313, KIN 355, KIN 395, KIN 471, KIN 475; admission to Teacher Education; approval before enrolling in the course.
Supervised teaching in the secondary schools.

KIN 418: Supervised Teaching in Physical Education in the Elementary School
Cr. 8. F.S.
Prereq: KIN 280, KIN 282, KIN 312, KIN 355, KIN 395, KIN 471, KIN 475. Students must be fully admitted to Teacher Education and must apply for approval to enroll at the beginning of the semester prior to registering
Supervised teaching in the elementary schools.

KIN 445: Legal Aspects of Sport
(3-0) Cr. 3. S.
Students will understand legal concepts and terminology relevant to sport/activity, identify strategies for limiting liability in sport/fitness programs, and identify solutions for elimination of discriminatory practices in sport and physical activity.

KIN 455: Research Topics in Biomechanics
(3-0) Cr. 3.
Prereq: KIN 355 or permission of instructor
Examination of biomechanics and kinesiology research literature to evaluate the application of mechanical principles and analyses to human movement in exercise, sport, physical activity, and activities of daily living and to assess research outcomes and their implications for motor performance, movement energetic, musculoskeletal loading, and injury.

KIN 458: Principles of Fitness Assessment and Exercise Prescription
(3-2) Cr. 4. F.S.
Prereq: KIN 258, KIN 358
Principles of cardiac risk factor identification and modification; risk classification of potential exercise clients; fitness assessments; developing comprehensive exercise prescriptions for individuals.

KIN 459: Internship in Exercise Leadership
(0-3) Cr. 1. F.S.
Prereq: C- or better in KIN 259, CPR certification, concurrent enrollment in KIN 458
Observation and practice of exercise leadership techniques in an on-campus adult fitness program.

KIN 462: Medical Aspects of Exercise
(3-0) Cr. 3. F.S.
Prereq: KIN 358
The role of exercise in preventive medicine. Impact of exercise on various diseases, and the effect of various medical conditions on the ability to participate in vigorous exercise and competitive sports. Principles of exercise testing and prescription for individuals with these conditions. Environmental and nutritional aspects of exercise.

KIN 467: Exercise and Health: Behavior Change
(Dual-listed with KIN 567). (3-0) Cr. 3. S.
Prereq: Introductory course with emphasis on exercise psychology (i.e., KIN 366 or equivalent)
Advanced analysis of theoretical health behavior models and their application to physical activity behavior. Includes practical techniques, tools and interventions (e.g., counseling skills, motivational interviewing) to enhance exercise prescription and motivation, and considerations for working with special populations.

KIN 471: Measurement in Physical Education
(Dual-listed with KIN 571). (2-3) Cr. 3. S.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practice and research on teaching focusing on management, instructional, and learning styles of students in secondary schools.

KIN 472: Neural Basis of Human Movement
(Dual-listed with KIN 572). (3-0) Cr. 3. S.
Prereq: KIN 372 or PSYCH 310
Addresses the role of the central nervous system in the control of voluntary human movement, with the focus on the cerebral cortex, basal ganglia and cerebellum. Content organized around specific nervous system damage (such as stroke, apraxia, spasticity, or spinal cord damage) and functional movements (such as reaching and grasping, balance and gait). Converging evidence from human movement disorders, brain imaging, animal lesion and single cell studies provide the primary basis for the content.

KIN 473: Physical Dimensions of Aging
Cr. 3. F.
Prereq: KIN 355 or KIN 358 or KIN 372
Understanding the physiological, behavioral, and cognitive changes associated with aging with focus on the effects of physical activity on the aging human system. Discussions of what it means to become older, what a person can expect during the aging process, and what kind of control a person has over the aging process.

KIN 475: Physical Education Curriculum Design and Program Organization
(Dual-listed with KIN 575). (3-0) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practices and principles applied to curriculum development for programs in physical education, K-12. Organizing for teaching in a variety of school settings.

KIN 480: Functional Anatomy
(3-0) Cr. 3. F.S.
Prereq: KIN 355; BIOL 155 or BIOL 255 and BIOL 256
The structure and function of human muscular, skeletal and nervous systems. The relationship of these systems to efficient and safe human motion.

KIN 481: Biomechanics Lab
(0-2) Cr. 1.
Prereq: KIN 355
Learning lab techniques in Biomechanics and engaging in the experimental process.

KIN 482: Exercise Physiology Lab
(0-2) Cr. 1.
Prereq: KIN 358
Learning lab techniques in Exercise Physiology and engaging in the experimental process.

KIN 483: Exercise Psychology Lab
(0-2) Cr. 1.
Prereq: KIN 366
Learning lab techniques in Exercise Psychology and engaging in the experimental process.

KIN 484: Assessment and Control of Locomotion
(0-2) Cr. 1.
Prereq: KIN 372
Learning lab techniques in Motor Control and engaging in the experimental process.

KIN 485: Internship in Exercise Science
Cr. 1-16.
Prereq: Senior classification and advance registration
Observation and practice in fitness agencies. Offered on a satisfactory-fail basis only.

KIN 485A: Internship in Exercise Science: Health/Fitness Management.
Cr. 1-16.
Prereq: Prereq: C- or better in KIN 458, KIN 459 and KIN 462, Kinesiology and Health majors only. Cumulative GPA 2.0.
Observation and practice in selected exercise science agencies. Offered on a satisfactory-fail basis only.

KIN 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits from KIN advanced core and permission of coordinator
Independent study of problems of areas of interest in exercise and sport science and related areas.

KIN 490A: Independent Study: Exercise and Sport Science
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits from KIN advanced core and permission of coordinator
Independent study of problems of areas of interest in exercise and sport science and related areas.

KIN 490H: Independent Study: Honors
Cr. 1-2. Repeatable, maximum of 4 credits.
Prereq: 6 credits from KIN advanced core and permission of coordinator
Independent study of problems of areas of interest in exercise and sport science and related areas.

KIN 495: Special Topics in Kinesiology
Cr. 1-3.
Prereq: Junior or Senior classification
Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

KIN 501: Research Methods in Physical Activity
(3-0) Cr. 3. Repeatable.
Prereq: Graduate classification in kinesiology and health
Methods and techniques used in the design and interpretation of research involving physical activity. Emphasis on styles of writing, library use, and computer applications.

KIN 505: Research Laboratory Techniques in Exercise Physiology
(0-4) Cr. 2.
Prereq: KIN 358 or equivalent course with basic laboratory experience
Application and use of laboratory research equipment in exercise physiology, including operation, calibration, and use in selected situations.

KIN 510: Advanced Medical Aspects of Exercise
(2-0) Cr. 2.
Prereq: KIN 358
The role of exercise in preventive medicine. Impact of exercise on various diseases, and the effect of various medical conditions on the ability to participate in vigorous exercise and competitive sports. Principles of exercise testing and prescription for individuals with these conditions.

KIN 512: Movement Education in Elementary School Physical Education
(2-2) Cr. 3. F.
Planning for management and instruction of developmentally appropriate physical education for children pre-school through grade six. Laboratory experience required. Emphasis on evaluating published research on physical education and school-wide physical activity.

KIN 515: Injury Biomechanics
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Kin 355 or permission of instructor.
Utilization of biomechanical principles to model injury mechanisms. Introduction to tissue mechanics of bone, articular cartilage, ligament, tendon, and muscle. Biomechanics of lower extremity, upper extremity, and head/neck/trunk injuries.

KIN 516: Quantitative Analysis of Human Movement
(3-1) Cr. 3.
Prereq: KIN 355
Application of the principles of mechanics to the analysis of human motion. Investigation of the effects of kinematics and kinetics on the human body with special emphasis on exercise and sport applications. Includes consideration of two-dimensional and three-dimensional imaging techniques and force measurements.

KIN 517: Musculoskeletal Modeling
(3-1) Cr. 3. F.
Prereq: KIN 355 or permission from instructor
Systematic problem-solving approaches and design of computer programs for biomechanical analyses. Estimation of anthropometric parameters and mechanical properties of muscles, bones, and joints. Integration of anthropometrics, kinematics, and muscle mechanics into simulations of human movement.

KIN 518: Student Teaching in Elementary Physical Education
(0-8) Cr. 8. F.S.
Prereq: KIN 512, KIN 570, KIN 575
Student teaching for 8 weeks in an elementary school.

KIN 519: Student Teaching in Secondary Physical Education
(0-8) Cr. 8. F.S.
Prereq: KIN 512, KIN 570, KIN 575
Student teaching for 8 weeks in a middle or high school.

KIN 520: The Social Analysis of Sport
(3-0) Cr. 3.
Prereq: KIN 360; open to majors only or by permission of instructor
Sociological analysis of sport with emphasis on sociological theory, sports structure, and function in modern industrialized society; the systems of sport in regard to their role structure; formal organization, and professionalization and its differentiation along social class, age, and sex.

KIN 521: Advanced Topics in Exercise and Sport Psychology
(3-0) Cr. 3.
Prereq: KIN 365 or KIN 366, 3 courses in psychology; open to majors only or by permission of instructor
Aspects of psychology which form a basis for understanding and explaining behavior in the context of exercise and sport. Emphasis on evaluating published research, particularly theory and research methodology. Student presentations.

KIN 549: Advanced Vertebrate Physiology I
(Cross-listed with AN S, NUTRS). (4-0) Cr. 4. F.
Prereq: Biol 335; credit or enrollment in BBMB 404 or BBMB 420
Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems.

KIN 550: Advanced Physiology of Exercise I
(2-3) Cr. 3.
Prereq: KIN 505
Concepts and methods of assessing neurological, muscular, cardiovascular, and respiratory adjustments to exercise.

KIN 551: Advanced Physiology of Exercise II
(2-3) Cr. 3.
Prereq: KIN 505
Analysis of factors affecting work capacity and performance. Human energy metabolism concepts and measurement.

KIN 552: Advanced Vertebrate Physiology II
(Cross-listed with AN S, NUTRS). (3-0) Cr. 3. S.
Prereq: BIOL 335; credit or enrollment in BBMB 404 or BBMB 420
Cardiovascular, renal, respiratory, and digestive physiology.

KIN 558: Physical Fitness - Principles, Programs and Evaluation
(2-3) Cr. 3.
Prereq: KIN 358
Physiological principles of physical fitness, design and administration of fitness programs; testing, evaluation, and prescription; electrocardiogram interpretation.

KIN 560: Principles of Motor Control and Learning
(2-3) Cr. 3.
Prereq: KIN 372
Theoretical perspectives of motor control and learning will be examined as well as factors that facilitate motor learning. Motor control and learning will also be addressed by studying functional tasks such as reach and grasp, posture and locomotor, handwriting, catching and/or speech.

KIN 561: Motor Development and Physical Activity
(2-0) Cr. 2-3.
Prereq: PSYCH 230
Addresses theories and underlying mechanisms of motor development and motor control applied to typically and atypically developing children. Developmental control of balance, locomotion, reach-to-grasp, and other functional skills will be discussed, as will the role of physical activity in a child's life.

KIN 567: Exercise and Health: Behavior Change
(Dual-listed with KIN 467). (3-0) Cr. 3. S.
Prereq: Introductory course with emphasis on exercise psychology (i.e., KIN 366 or equivalent)
Advanced analysis of theoretical health behavior models and their application to physical activity behavior. Includes practical techniques, tools and interventions (e.g., counseling skills, motivational interviewing) to enhance exercise prescription and motivation, and considerations for working with special populations.

KIN 570: Physical Activity Assessment for Health Related Research
(2-2) Cr. 3.
This course will cover the broad scope of research in physical activity and public health. Emphasis will be placed on the application of physical activity assessment techniques since accurate measures are needed to more accurately assess the health benefits from physical activity and to evaluate the effectiveness of behavioral interventions designed to promote physical activity.

KIN 571: Measurement in Physical Education
(Dual-listed with KIN 471). (2-3) Cr. 3. S.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practice and research on teaching focusing on management, instructional, and learning styles of students in secondary schools.

KIN 572: Neural Basis of Human Movement
(Dual-listed with KIN 472). (3-0) Cr. 3. S.
Prereq: KIN 372 or PSYCH 310
Addresses the role of the central nervous system in the control of voluntary human movement, with the focus on the cerebral cortex, basal ganglia and cerebellum. Content organized around specific nervous system damage (such as stroke, apraxia, spasticity, or spinal cord damage) and functional movements (such as reaching and grasping, balance and gait). Converging evidence from human movement disorders, brain imaging, animal lesion and single cell studies provide the primary basis for the content.

KIN 575: Physical Education Curriculum Design and Program Organization
(Dual-listed with KIN 475). (3-0) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practices and principles applied to curriculum development for programs in physical education, K-12. Organizing for teaching in a variety of school settings.

KIN 590: Special Topics
Cr. 1-3. Repeatable.

KIN 590A: Special Topics: Physical Education
Cr. 1-3. Repeatable.

KIN 590B: Special Topics: Health and Exercise Promotion
Cr. 1-3. Repeatable.

KIN 590D: Special Topics: Exercise Physiology
Cr. 1-3. Repeatable.

KIN 590E: Special Topics: Sport Sociology
Cr. 1-3. Repeatable.

KIN 590F: Special Topics: Sport/Exercise Psychology
Cr. 1-3. Repeatable.

KIN 590G: Special Topics: Motor Behavior
Cr. 1-3. Repeatable.

KIN 590H: Special Topics: Biomechanics
Cr. 1-3. Repeatable.

KIN 590I: Special Topics: Research Ethics
Cr. 1-3. Repeatable.

KIN 591: Supervised Field Experience
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 591A: Supervised Field Experience: Physical Education
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 591B: Supervised Field Experience: Health and Exercise Promotion
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 591D: Supervised Field Experience: Exercise Physiology
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 592: Practicum in College Teaching
Cr. 1-3. Repeatable, maximum of 3 credits. F.S.SS.
Supervised experience with teaching an upper division, classroom-based course. Offered on a satisfactory-fail basis only.

KIN 595: Adapted Physical Education
(Dual-listed with KIN 395). (2-3) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280/281
Etiology, characteristics, needs and movement experiences for individuals with disabling conditions. Designed to provide appropriate methods of physical education instruction for students including those with disabilities as identified by the Individuals with Disabilities Education Act and students who are talented and gifted. Assessments and strategies to differentiate instruction and to adapt activities for all exceptional learners will be addressed. Laboratory experience required. KIN 595 may not be taken by students who previously earned credit in KIN 395.

KIN 599: Creative Component
Cr. 1-3. Repeatable.

Courses for graduate students:

KIN 615: Seminar
Cr. 1-3. Repeatable.

KIN 620: Advance Research Methods in Physical Activity
(3-0) Cr. 3. S.
Prereq: KIN 501, STAT 401 and STAT 402. Doctoral students only
Culminating seminar designed to synthesize statistical and design courses with practical research issues using data from physical activity.

KIN 670: Molecular Biology of Muscle
(Cross-listed with AN S). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BBMB 405, BBMB 420, or BBMB 502
Ultrastructure of muscle; chemistry, structure, function, and molecular biology of muscle proteins. Molecular aspects of muscle contraction, development and turnover. Cytoskeletal proteins and dynamics.

KIN 699: Research
Cr. 1-6. Repeatable.

Culinary Food Science (H SCI)

The Culinary Food Science degree program is a food science-based degree in which students develop basic culinary skills along with knowledge of the accompanying sciences. As a graduate, you'll combine food product development skills and entrepreneurial talents with scientific and technological knowledge.

The department also offers a culinary science minor.

Administered by the Department of Food Science and Human Nutrition

Total Degree Requirement: 120 cr.
Students must fulfill International Perspectives and U.S. Diversity requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communications and Library: 10 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 6-12 cr.

Select Humanities course from approved list		3
If H Sci student, select:		6
Additional Humanities course		
Additional Humanities or Social Science course		
ECON 101	Principles of Microeconomics	3

Ethics and Environmental: 3-6 cr.

FS HN 342	World Food Issues: Past and Present	3
If AgLS student, select from:		2-3
ENV S 120	Introduction to Renewable Resources	
ENV S 201	Introduction to Environmental Issues	

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from:		3-4
MATH 140	College Algebra	
MATH 143	Preparation for Calculus	
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Select at least 3 credits from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
Total Credits		6-8

Physical Sciences: 9 cr.

CHEM 163	College Chemistry	4
or CHEM 177	General Chemistry I	
CHEM 163L	Laboratory in College Chemistry	1
or CHEM 177L	Laboratory in General Chemistry I	
CHEM 231	Elementary Organic Chemistry	3
CHEM 231L	Laboratory in Elementary Organic Chemistry	1
Total Credits		9

Biological Sciences: 12-13 cr.

BBMB 301	Survey of Biochemistry	3
BIOL 211	Principles of Biology I	3
BIOL 212	Principles of Biology II	3
MICRO 201	Introduction to Microbiology	2-3
or MICRO 302	Biology of Microorganisms	
MICRO 201L	Introductory Microbiology Laboratory	1
or MICRO 302L	Microbiology Laboratory	
Total Credits		12-13

Animal Science Coursework: 6 cr.

AN S 270	Foods of Animal Origin	2
AN S 270L	Foods of Animal Origin Laboratory	1
AN S 460	Processed Meats	3
Total Credits		6

Food Science and Human Nutrition: 41 cr.

FS HN 101	Food and the Consumer	3
FS HN 104	Introduction to Professional Skills in Culinary Science	1
FS HN 110	Professional and Educational Preparation	1

FS HN 167	Introduction to Human Nutrition	3
FS HN 203	Contemporary Issues in Food Science and Human Nutrition	1
FS HN 214	Scientific Study of Food	3
FS HN 215	Advanced Food Preparation Laboratory	2
FS HN 265	Nutrition for Active and Healthy Lifestyles	3
FS HN 311	Food Chemistry	3
FS HN 311L	Food Chemistry Laboratory	1
FS HN 314	Foundations of Culinary Science	1
FS HN 403	Food Laws and Regulations	2
FS HN 405	Food Quality Assurance	3
FS HN 406	Sensory Evaluation of Food	3
FS HN 411	Food Ingredient Interactions and Formulations	2
FS HN 412	Food Product Development	3
FS HN 420	Food Microbiology	3
FS HN 480	Professional Communication in Food Science and Human Nutrition	1
Take one of the following courses for 2 credits:		2
FS HN 491B	Supervised Work Experience: Food Science	
or FS HN 49	Supervised Work Experience: Culinary Science	
Total Credits		41

Hotel, Restaurant, Institutional Management: 16 cr.

MKT 340	Principles of Marketing	3
HSP M 233	Hospitality Sanitation and Safety	3
HSP M 380	Quantity Food Production Management	3
HSP M 380L	Quantity Food Production and Service Management Experience	2
HSP M 383	Introduction to Wine, Beer, and Spirits	2
HSP M 487	Fine Dining Event Management	3
Total Credits		16

Electives 0-8 cr. Select from any university coursework to earn at least 120 total credits.

Go to FS HN courses.

Culinary Food Science, B.S.

Freshman

Fall	Credits	Spring	Credits
FS HN 110	1	FS HN 101	3
CHEM 163 or 177	4	FS HN 104	1
CHEM 163L or 177L	1	FS HN 167	3
BIOL 211	3	BIOL 212	3
MATH 140, 143, 160, 165, or 181	3-4	ECON 101	3
ENGL 150	3	STAT 101 or 104	3-4
LIB 160	1		
	16-17		16-17

Sophomore

Fall	Credits	Spring	Credits
CHEM 231	3	FS HN 265	3
CHEM 231L	1	BBMB 301	3
ENGL 250	3	MICRO 201 or 302	2-3
FS HN 203	1	MICRO 201L or 302L	1
HSP M 233	3	FS HN 214	3
SP CM 212	3	FS HN 215	2
	14		14-15

Junior

Fall	Credits	Spring	Credits
AN S 270	2	FS HN 314	1
AN S 270L	1	FS HN 342	3
FS HN 311	3	FS HN 403	2
FS HN 311L	1	HSP M 380	3
FS HN 411	2	HSP M 380L	2
FS HN 420	3	Humanities	3
Humanities (H Sci) or ENV S course (AgLS)	2-3		
	14-15		14

Senior

Fall	Credits	Spring	Credits
FS HN 406	3	AN S 460	3
FS HN 491B or 491D, Internship	2	FS HN 405	3
HSP M 383	2	FS HN 412	3
HSP M 487	3	FS HN 480	1
MKT 340	3	Humanities or Social Science (H Sci) or elective (AgLS)	3
U.S. Diversity course	3	Electives*	3
	16		16

Footnotes

* Choose elective courses to total equal to or greater than 120 credits.

Note This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

Program: Dance

Administered by the Department of Kinesiology.

Coursework in dance provides opportunities for students to develop an understanding and appreciation of dance as part of a liberal education. Those interested in teaching dance and Physical Education in the public schools may major in Kinesiology and Health (Teacher Licensure option) and minor in Dance.

An interdisciplinary Performing Arts major with a Dance emphasis is available through the College of Liberal Arts and Sciences. For further information see Index, Theatre and Performing Arts.

Courses primarily for undergraduates:

DANCE 120: Modern Dance I
(0-3) Cr. 1. F.S.
Introduction and practice of basic dance concepts, including preparatory techniques and guided creativity problems. No previous modern dance experience required. Offered on a satisfactory-fail basis only.

DANCE 130: Ballet I
(0-3) Cr. 1. F.S.
Introduction to the basic skills, vocabulary, and tradition of ballet with concentration on control and proper alignment. No previous ballet experience required. Offered on a satisfactory-fail basis only.

DANCE 140: Jazz I
(0-3) Cr. 1. F.S.
Introduction to the modern jazz style with concentration on isolation and syncopation. No previous jazz experience required. Offered on a satisfactory-fail basis only.

DANCE 150: Tap Dance I
(0-3) Cr. 1. F.
Instruction and practice in basic tap technique and terminology. No previous tap experience required. Offered on a satisfactory-fail basis only.

DANCE 160: Ballroom Dance I
(0-2) Cr. 1. F.S.
Instruction and practice in foxtrot, waltz, swing, cha cha, rhumba, tango, and selected contemporary dances. Offered on a satisfactory-fail basis only.

DANCE 199: Dance Continuum
Cr. 0.5-2. Repeatable, maximum of 6 credits. F.S.
Prereq: Permission of instructor
Advance registration required. Continued instruction and practice in either modern dance, recreational dance, ballet, jazz and/or compositional skills. Offered on a satisfactory-fail basis only.

DANCE 211: Fundamentals and Methods of Social and World Dance
(1-3) Cr. 1. S.
Skill enhancement, teaching, progressions with emphasis on world and social dance. Designed for kinesiology and health majors, open to others.

DANCE 220: Modern Dance Composition
(1-3) Cr. 2. F.
Prereq: DANCE 120 or previous modern dance experience
Theory and practice of the creative skills involved in solo and small group composition.

DANCE 222: Modern Dance II
(0-3) Cr. 1. F.
Prereq: DANCE 120 or previous modern dance experience
Dance techniques emphasizing strength, balance, endurance, rhythmic activity and extended combinations.

DANCE 223: Modern Dance III
(0-3) Cr. 1. S.
Prereq: DANCE 222
Continued experience in dance techniques and extended combinations. Emphasis on maturation of skill and artistry. Exposure to a variety of modern dance technical styles.

DANCE 224: Concert and Theatre Dance
(Cross-listed with THTRE). (0-3) Cr. 0.5-2. Repeatable, maximum of 6 credits. F.S.
Prereq: By audition only
Choreography, rehearsal, and performance in campus dance concerts and/or musical theatre productions. Offered on a satisfactory-fail basis only.

DANCE 232: Ballet II
(0-3) Cr. 1. S.
Prereq: Previous ballet experience
Technical skills in the classical movement vocabulary. Emphasis on alignment, techniques, sequence development, and performing quality.

DANCE 233: Ballet III
(0-3) Cr. 1. F.
Prereq: DANCE 232
Concentration on technical proficiency at the intermediate level. Pointe work and partnering opportunities available.

DANCE 242: Jazz II
(0-3) Cr. 1. S.
Prereq: Previous jazz dance experience
Dance concepts within the jazz idiom. Instruction in extended movement sequences and artistic interpretation.

DANCE 270: Dance Appreciation
(3-0) Cr. 3. F.S.SS.
Introduction to the many forms and functions of dance in world cultures. Develop abilities to distinguish and analyze various dance styles. No dance experience required.
Meets International Perspectives Requirement.

DANCE 320: Sound and Movement
(2-2) Cr. 3. S.
Prereq: DANCE 220
Intermediate composition based on the relationship of movement to improvised sounds, rhythmic scores, and the musical works of composers from various periods.

DANCE 360: History and Philosophy of Dance
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: DANCE 270
Study of the history of dance from early to modern times with emphasis on the theories and philosophies of contemporary modern dance, dancers, and dance educators.

DANCE 370: Advanced Studies in Dance
Cr. 1-3. Repeatable, maximum of 8 credits. F.S.
Prereq: 2 credits in dance
Advance registration required. Designed to meet special interests and talents of students to include both group and independent study in various aspects of dance as a performing art including production, choreography, and performance.

DANCE 384: Teaching Children's Dance
(1-3) Cr. 2. S.
Content, experiences, and methods of a comprehensive dance program at the elementary school level. Theories and practice in guiding elementary school children in expressive movement experiences.

DANCE 385: Methods of Teaching Dance
(1-3) Cr. 2. F.
Methods and techniques of teaching social and world dance forms. Introduction to teaching educational modern dance.

DANCE 386: Teaching Dance Technique and Composition
(1-3) Cr. 2.
Prereq: DANCE 320
Teaching yoga, body therapies, mindfulness and dance composition to enhance the physical and mental performance of the individual.

DANCE 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in dance and permission of coordinator
Independent study of problems or areas of interest in dance.

DANCE 490A: Independent Study: Dance
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: 6 credits in dance and permission of coordinator
Independent study of problems or areas of interest in dance.

DANCE 490H: Independent Study in Dance - Honors
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: 6 credits in dance and permission of coordinator
Independent study of problems or areas of interest in dance for those admitted to the honors program.

Diet and Exercise (H SCI)

Curriculum in Diet and Exercise B.S./M.S.

Administered by the Department of Food Science and Human Nutrition and Department of Kinesiology

This is an accelerated program with concurrent enrollment in the undergraduate and graduate degree programs. Courses included have been approved as meeting the academic requirements of the Didactic Program in Dietetics (DPD) in preparation for admission to accredited dietetics internship programs; the DPD is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics. There is a $30 fee for the verification statement of completion of the accredited dietetics program. Additionally, courses are included to meet the American College of Sports Medicine (ACSM) requirements for certification at the level of Certified Exercise Physiologist.

Total Degree Requirements: 124 cr. for bachelor's degree and 34-41 cr. for master's degree
Students must fulfill International Perspectives and U.S. Diversity requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements.

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communications and Library: 10 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		10

Social Sciences: 6 cr.

PSYCH 101	Introduction to Psychology	3
PSYCH 230	Developmental Psychology	3
Total Credits		6

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from:		3-4
MATH 140	College Algebra	

MATH 143	Preparation for Calculus	
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Select at least 3 credits from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
STAT 226	Introduction to Business Statistics I	
Total Credits		6-8

Physical Sciences: 13-17 cr.

Select from:		5-8
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	
CHEM 177 & 177L & CHEM 178	General Chemistry I and Laboratory in General Chemistry I and General Chemistry II	
CHEM 231	Elementary Organic Chemistry	3
CHEM 231L	Laboratory in Elementary Organic Chemistry	1
PHYS 115	Physics for the Life Sciences	4-5
or PHYS 111	General Physics	
Total Credits		13-17

Biological Sciences: 19 cr.

BBMB 301	Survey of Biochemistry	3
BIOL 211	Principles of Biology I	3
BIOL 212	Principles of Biology II	3
BIOL 255	Fundamentals of Human Anatomy	3
BIOL 255L	Fundamentals of Human Anatomy Laboratory	1
BIOL 256	Fundamentals of Human Physiology	3
BIOL 256L	Fundamentals of Human Physiology Laboratory	1
MICRO 201	Introduction to Microbiology	2
Total Credits		19

Diet and Exercise undergraduate courses to be completed or in progress when applying for admission to the program: 20-22 cr.

Select from:		1-2
FS HN 110	Professional and Educational Preparation	
KIN 252 & KIN 253	Disciplines and Professions in Kinesiology and Health and Orientation and Learning Community in Kinesiology and Health	
FS HN 167	Introduction to Human Nutrition	3
FS HN 214	Scientific Study of Food	3
FS HN 215	Advanced Food Preparation Laboratory	1-2
or FS HN 115	Food Preparation Laboratory	
FS HN 265	Nutrition for Active and Healthy Lifestyles	3
FS HN 340	Foundations of Dietetic Practice	1
FS HN 360	Advanced Human Nutrition and Metabolism	3
H S 110	Personal and Consumer Health	3
KIN 258	Physical Fitness and Conditioning	2
Total Credits		20-22

Acceptance into the BS/MS PROGRAM is required BEFORE spring semester of the THIRD year.

Humanities and Ethics: 6-9 cr.

Select 6 credits from approved Humanities list		6
Select 3 credits from approved Ethics list		3

Note: If ethics course is on the humanities list, it can meet both requirements.

Diet and Exercise remaining undergraduate courses to complete the bachelor's degree requirements: 43 cr.

H S 380	Worksite Health Promotion	3
A TR 220	Basic Athletic Training	2
or H S 305	Instructor's First Aid and Cardio-pulmonary Resuscitation	
KIN 259	Leadership Techniques for Fitness Programs	2
KIN 345	Management of Health-Fitness Programs and Facilities	3
KIN 358	Physiology of Exercise	3
Select from:		3
KIN 355	Biomechanics	
KIN 360	Sociology of Sport and Exercise	
KIN 366	Exercise Psychology	
KIN 372	Motor Control and Learning Across the Lifespan	
KIN 462	Medical Aspects of Exercise	3
FS HN 361	Nutrition and Health Assessment	2
FS HN 367	Medical Terminology for Health Professionals	1
FS HN 403	Food Laws and Regulations	2
FS HN 411	Food Ingredient Interactions and Formulations	2
FS HN 466	Nutrition Counseling and Education Methods	3
HSP M 380	Quantity Food Production Management	3
HSP M 380L	Quantity Food Production and Service Management Experience	2
HSP M 392	Foodservice Systems Management II	3
NUTRS 563	Community Nutrition *	3
NUTRS 564	Medical Nutrition and Disease II *	3
Total Credits		43

Diet and Exercise graduate courses to complete the master's degree requirements: 34-41 cr.

FS HN 581	Seminar **	1
FS HN 590C	Special Topics: Teaching **	1
FS HN 681	Seminar **	1
FS HN 682	Seminar Reflection **	R
NUTRS 501	Biochemical and Physiological Basis of Nutrition: Macronutrients and Micronutrients	4
NUTRS 561	Medical Nutrition and Disease I	4
NUTRS 563	Community Nutrition *	3
NUTRS 564	Medical Nutrition and Disease II *	3
KIN 501	Research Methods in Physical Activity	3
KIN 505	Research Laboratory Techniques in Exercise Physiology	2
Select 3-6 credits (FSHN students select 3 credits, KIN students select 6 credits) from:		3-6
KIN 511		
KIN 550	Advanced Physiology of Exercise I	
KIN 567	Exercise and Health: Behavior Change	
KIN 570	Physical Activity Assessment for Health Related Research	
KIN 551	Advanced Physiology of Exercise II	3
KIN 558	Physical Fitness - Principles, Programs and Evaluation	3
Select 2-3 credits for creative component or 6 credits for thesis research:		2-6
FS HN 599	Creative Component	
KIN 599	Creative Component	
KIN 699	Research	
NUTRS 699	Research in Nutritional Sciences	
STAT 401	Statistical Methods for Research Workers	4

* Course counts toward both bachelor's and master's degrees.

** Requirement for students in the FS HN Department.

Go to FS HN courses.

Go to KIN courses.

Diet and Exercise, B.S./M.S.

First Year

Fall	Credits	Spring	Credits
FS HN 110, or KIN 252 and 253	1-2	FS HN 167	3
CHEM 163 or 177	4	CHEM 178 (if CHEM 177 taken) or Elective	3
CHEM 163L or 177L	1	BIOL 212	3
BIOL 211	3	PSYCH 101	3
ENGL 150	3	H S 110	3
LIB 160	1		
MATH 140, 143, 160, 165, or 181	3-4		
	16-18		15

Second Year

Fall	Credits	Spring	Credits	Summer	Credits
CHEM 231	3	FS HN 265	3	A TR 220 (Or, H S 305 in spring or fall)	2
CHEM 231L	1	BBMB 301	3		
BIOL 255	3	BIOL 256	3		
BIOL 255L	1	BIOL 256L	1		
PSYCH 230	3	FS HN 214	3		
ENGL 250	3	FS HN 115 or 215	1-2		
MICRO 201	2				
	16		14-15		2

Third Year

Fall	Credits	Spring	Credits	Summer	Credits
FS HN 340	1	Acceptance into the program required before spring of the third year		KIN 599 or FS HN 599 or KIN 699 or NUTRS 699	1-3
FS HN 360	3	FS HN 361	2	STAT 401	4
KIN 258	2	FS HN 367	1		
PHYS 115 (4 cr) or 111 (5 cr)	4-5	H S 380	3		
SP CM 212	3	HSP M 380	3		
STAT 101, 104, or 226	3-4	HSP M 380L	2		

Apply for admission to the BS/MS program by Oct. 1	KIN 259	2
	KIN 358	3
	16-18	16

Fourth Year

Fall	Credits	Spring	Credits	Summer	Credits
KIN 558 (offered odd years), or KIN 355, 360, 366, or 372	3	KIN 462	3	KIN 599 or FS HN 599 or KIN 699 or NUTRS 699	1-3
KIN 501	3	KIN 511, 550, 567, or 570	3	FS HN 403	2
KIN 505	2	KIN 551 (offered odd years, or HSP M 392)	3		
NUTRS 561	4	NUTRS 564	3		
NUTRS 563 (Time conflict with NUTRS 501 next fall)	3	FS HN 581 / FS HN 682 (FSHN Dept)	1		
FS HN 682 (FSHN Dept)	0	Humanities/ Ethics course	3		
	15		16		3-5

Fifth Year

Fall	Credits	Spring	Credits	Summer	Credits
FS HN 411	2	FS HN 466	3	KIN 699 or NUTRS 699 or KIN 599 or FS HN 599	1
Additional course: KIN 511, 550, 567, 570 (KIN Dept)	3	FS HN 590C (FSHN Dept)	1		
NUTRS 501	4	HSP M 392	3		
KIN 558 (offered odd yrs, or KIN 355, 360, 366, or 372)	3	KIN 345	3		
Humanities/ International Perspectives	3	KIN 699 or NUTRS 699 or KIN 599 or FS HN 599	2		
FS HN 682 (FSHN Dept)	0	FS HN 681	1		
	15		13		1

Planned course offerings may change, and students need to check the online Schedule of Classes each term to confirm course offerings: http://classes.iastate.edu/. This sequence is only an example.

Dietetics (H SCI)

Dietitians are nutrition experts who strive for optimal health and nutrition of individuals and the population. The curriculum for the dietetics program as well as the diet and exercise program meet the academic requirements of the Didactic Program in Dietetics and prepares students for a career in the field of dietetics. The program is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency for the Academy of Nutrition and Dietetics.

Administered by the Department of Food Science and Human Nutrition

The dietetics undergraduate curriculum meets the academic requirements as the Didactic Program in Dietetics and is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics. Graduates of the program are eligible to apply for admission to accredited supervised practice programs/dietetics internships. There is a $30 fee for the verification statement of completion of the accredited dietetics program.

Total Degree Requirement: 120 cr.

Students must fulfill International Perspectives and U.S. Diversity requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communications and Library: 10 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 6-12 cr.

Select Humanities course from approved list		3
PSYCH 101	Introduction to Psychology	3
If H Sci student, select:		6
Additional Humanities course		
Additional Humanities or Social Science course		

Ethics and Environmental: 3-6 cr.

FS HN 342	World Food Issues: Past and Present	3
If AgLS student, select from:		2-3
ENV S 120	Introduction to Renewable Resources	
ENV S 201	Introduction to Environmental Issues	

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from:		3-4
MATH 140	College Algebra	
MATH 143	Preparation for Calculus	
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Select at least 3 credits from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
Total Credits		6-8

Physical Sciences: 9-12 cr.

Select from:		5-8
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	
CHEM 177 & 177L & CHEM 178	General Chemistry I and Laboratory in General Chemistry I and General Chemistry II	
CHEM 231	Elementary Organic Chemistry	3
CHEM 231L	Laboratory in Elementary Organic Chemistry	1
Total Credits		9-12

Biological Sciences: 20-21 cr.

BBMB 301	Survey of Biochemistry	3
BIOL 211	Principles of Biology I	3
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 255	Fundamentals of Human Anatomy	3
BIOL 255L	Fundamentals of Human Anatomy Laboratory	1
Select from:		3-4
BIOL 256 & 256L	Fundamentals of Human Physiology and Fundamentals of Human Physiology Laboratory	
BIOL 334	Metabolic Physiology of Mammals	
BIOL 335	Principles of Human and Other Animal Physiology	
MICRO 201	Introduction to Microbiology	2
MICRO 201L	Introductory Microbiology Laboratory	1
Total Credits		20-21

Food Science and Human Nutrition: 40-41 cr.

FS HN 110	Professional and Educational Preparation	1
FS HN 167	Introduction to Human Nutrition	3
FS HN 203	Contemporary Issues in Food Science and Human Nutrition	1
FS HN 214	Scientific Study of Food	3
FS HN 215	Advanced Food Preparation Laboratory	2
or FS HN 115	Food Preparation Laboratory	
FS HN 265	Nutrition for Active and Healthy Lifestyles	3
FS HN 340	Foundations of Dietetic Practice	1
FS HN 360	Advanced Human Nutrition and Metabolism	3
FS HN 361	Nutrition and Health Assessment	2
FS HN 362	Nutrition in Growth and Development	3
FS HN 367	Medical Terminology for Health Professionals	1
FS HN 403	Food Laws and Regulations	2
FS HN 411	Food Ingredient Interactions and Formulations	2
FS HN 461	Medical Nutrition and Disease I	4
FS HN 463	Community Nutrition	3
FS HN 464	Medical Nutrition and Disease II	3
FS HN 466	Nutrition Counseling and Education Methods	3
FS HN 480	Professional Communication in Food Science and Human Nutrition	1
Total Credits		41

Management: 11 cr.

HSP M 380	Quantity Food Production Management	3
HSP M 380L	Quantity Food Production and Service Management Experience	2
HSP M 391	Foodservice Systems Management I	3
HSP M 392	Foodservice Systems Management II	3
Total Credits		11

Electives: 0-13 cr. Select from any university coursework to earn at least 120 total credits.

Admission to the dietetics program: Students enter the university designated as pre-dietetics. During spring semester of the second year, interested students apply to the Didactic Program in Dietetics. Admission to the program is based on overall GPA (3.0 or above required), completion of required coursework, and completion of the application with interest in becoming a registered dietitian. Students then progress toward earning a Bachelor of Science degree in Dietetics and receive a Verification Statement upon graduation, which is needed to enter an accredited dietetics internship.

Go to FS HN courses.

Dietetics, B.S.

First Year

Fall	Credits	Spring	Credits
FS HN 110	1	FS HN 167	3
CHEM 163 or 177	4	CHEM 178 (if CHEM 177 taken) or elective *	3
CHEM 163L or 177L	1	BIOL 212	3
BIOL 211	3	BIOL 212L	1
MATH 140, 143, 160, 165, or 181	3	PSYCH 101	3
ENGL 150	3	Humanities course	3
LIB 160	1		
	16		16

Second Year

Fall	Credits	Spring	Credits
CHEM 231	3	FS HN 265	3
CHEM 231L	1	BBMB 301	3
BIOL 255	3	BIOL 256 and 256L, or BIOL 334 or 335	3-4
BIOL 255L	1	MICRO 201	2
ENGL 250	3	MICRO 201L	1
FS HN 203	1	Humanities course (H Sci) or Elective* (AgLS)	3
STAT 101 or 104	3-4	Apply for admission to the program by March 1	
	15-16		15-16

Third Year

Fall	Credits	Spring	Credits
Acceptance into the Didactic Program in Dietetics is required before the third year		FS HN 361	2
FS HN 340	1	FS HN 362	3
FS HN 360	3	FS HN 367	1
FS HN 214	3	HSP M 380	3
FS HN 215 or 115	1-2	HSP M 380L	2
SP CM 212	3	FS HN 342	3
Humanities/social sci. (H Sci) or ENV S (AgLS)	3	Elective*	1
	14-15		15

Fourth Year

Fall	Credits	Spring	Credits
FS HN 461	4	FS HN 464	3
FS HN 463	3	HSP M 392	3
HSP M 391	3	FS HN 403	2
FS HN 411	2	FS HN 480	1
FS HN 466	3	Electives*	5-6
	15		14-15

Footnotes

* Choose elective courses to total equal to or greater than 120 credits.

Note This sequence is only an example, and the number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

Event Management

Administered by the Department of Apparel, Events, and Hospitality Management.

The program offers study for the degree of Bachelor of Science with a major in event management. The program prepares undergraduate students for careers in leading event and meeting management businesses. Through the major, students gain background and experiences in planning, budgeting, and implementing conferences, meetings, and other special events in the public or private sectors. Course work provides students with a general education plus professional preparation focusing on the concepts and principles involved in meeting and event planning strategy; special event

management; stakeholder development; budgets and finance; site selection; contracts, vendors, and negotiations; marketing and promotions; food and beverage management; meeting technology; event evaluation; and hospitality law. Supporting courses include foodservice, catering, promotion, brand management, trend analysis, fashion, and resource management. Learning experiences are provided through planning university events such as Dance Marathon, Family Weekend, CHS Week, Student Union Board, and Homecoming, as well as other campus and community events.

Graduates from this program are prepared for careers in event planning (corporate events, celebrations, education, promotions, commemorations, trade shows, weddings, conferences, association events, exhibitions, festivals, philanthropies, entertainment, fundraising, conventions, and sport events) and small business development (entrepreneurship). Graduates demonstrate leadership characteristics and make decisions based on integrating knowledge of financial, human resources, promotion, and event management principles. Students are required to complete an internship in event management prior to graduation.

The AESHM Department offers a minor in event management. The minor can be earned by successfully completing the following for a total of 15 credits.

9 credits are required:		9
EVENT 271	Introduction to Event Management	3
EVENT 371	Conference and Meeting Planning	3
EVENT 471	Special Events Coordination	3
And six credits of the following:		
AESHM 287	Principles of Management in Human Sciences	
AESHM 340	Hospitality and Apparel Marketing Strategies	
or MKT 340	Principles of Marketing	
AESHM 342	Aesthetics of Consumer Experience	
AESHM 474	Entrepreneurship in Human Sciences	
HSP M 437	Hospitality Information Technology	
P R 220	Principles of Public Relations	
Total Credits		15

Curriculum in Event Management

Administered by the Apparel, Events, and Hospitality Management Department.

Leading to the degree Bachelor of Science.

Total credits required: 123 including a minimum of 18 credits from the AESHM Department at Iowa State University for the degree. The curriculum in event management prepares students for careers in leading event and meeting management businesses. Courses are required in general education, and the professional area. Students majoring in Event Management are required to earn C- or better in all AESHM and EVENT courses, and all courses in the EVENT Core. Communication Proficiency Requirement: Grade of C or better in ENGL 150 Critical Thinking and Communication, and ENGL 250 Written, Oral, Visual, and Electronic Composition.

A minor in event management is available; see requirements under Apparel, Events, and Hospitality Courses and Programs.

Cr. Degree Requirements

Communication Skills

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
One of the following:		3
COMST 102	Introduction to Interpersonal Communication	
COMST 214	Professional Communication	
SP CM 212	Fundamentals of Public Speaking	
Total Credits		10

Natural Sciences and Mathematical Disciplines

Select one MATH course from:		3
MATH 104	Introduction to Probability	
MATH 105	Introduction to Mathematical Ideas	
MATH 140	College Algebra	
MATH 150	Discrete Mathematics for Business and Social Sciences	
MATH 160	Survey of Calculus	
Select one from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
Natural Sciences		3
Select from: Astronomy, Biology, Biochemistry, Chemistry, Ecology, Entomology, Environmental Science, Environmental Studies, FS HN 101 or FS HN 167, Genetics, Geology, Meteorology, Horticulture, Microbiology, Physics or A M D 204		
Total Credits		9-10

Social Sciences

ECON 101	Principles of Microeconomics	3
6 credits from the following:		6
ECON 102	Principles of Macroeconomics	
HD FS 102	Individual and Family Development, Health, and Well-being	
PSYCH 101	Introduction to Psychology	
PSYCH 230	Developmental Psychology	
PSYCH 280	Social Psychology	

SOC 134	Introduction to Sociology	
A M D 165	Dress and Diversity in Society	
Total Credits		9

Humanities

World Languages and Cultures course suggested OR courses from African and African American Studies, American Indian Studies, Anthropology, Art History, Classical Studies, History, Literature, Philosophy, Religious Studies, Music or Dance Appreciation, Women's Studies, Theater, CMDIS 286, INTST 235		6-8
Total Credits		6-8

Core Courses

EVENT 271	Introduction to Event Management	3
EVENT 371	Conference and Meeting Planning	3
EVENT 471	Special Events Coordination	3
HSP M 101	Introduction to the Hospitality Industry	3
HSP M 260	Global Tourism Management	3
AESHM 470F	Supervised Professional Internship: Event Management	3-6
AESHM 474	Entrepreneurship in Human Sciences	3
Total Credits		21-24

Professional Courses

ACCT 284	Financial Accounting	3
AESHM 112	Orientation for AESHM	1
AESHM 113E	Professional Development for AESHM: Event Management and Hospitality Management	1
AESHM 175D	Financial Applications for Retail and Hospitality Industries: Hospitality Management	2
AESHM 287	Principles of Management in Human Sciences	3
AESHM 311E	Seminar on Careers and Internships: Event Management and Hospitality Management	1
AESHM 340	Hospitality and Apparel Marketing Strategies	3
AESHM 342	Aesthetics of Consumer Experience	3
AESHM 411E	Seminar on Current Issues: Events and Hospitality	1
AESHM 438	Human Resource Management	3
Select one from:		3
ACCT 215	Legal Environment of Business	
HSP M 315	Hospitality Law	
Total Credits		24

Event Management Electives

Select from:		27
ADVRT 230	Advertising Principles	3
ADVRT 301	Research and Strategic Planning for Advertising and Public Relations	3
AESHM 170	Supervised Work Experience I	1
AESHM 211	Leadership Experiences and Development (LEAD)	3
AESHM 222	Creativity on Demand	3
AESHM 270F	Supervised Work Experience II: Event Management	1-2
AESHM 272	Fashion Show Production and Promotion	1-3
AESHM 381	International Field Study	1-3
AESHM 421	Developing Global Leadership: Maximizing Human Potential	3
AESHM 470F	Supervised Professional Internship: Event Management	3-6
A M D 257	Museum Studies	3
A M D 275	Retail Merchandising	3
A M D 377	Visual Presentation and Promotions	3
ARTIS 212	Studio Fundamentals: Computers	2
EVENT 203X	Event Management Sophomore Mentorship	
EVENT 289	Contemporary Club Management	3
EVENT 320	Attractions and Amusement Park Administration	3
EVENT 328X	Incentive Meeting Management	
EVENT 333	Entertainment Venue Management	3
EVENT 373	Wedding Planning and Management	3
EVENT 378X	Sustainable Event Management	
EVENT 379X	Nonprofit Fundraising Event Planning	
EVENT 423X	International Meetings and Conferences Management	
HSP M 383	Introduction to Wine, Beer, and Spirits	2
HSP M 383L	Introduction to Wine, Beer and Spirits Laboratory	1
HSP M 437	Hospitality Information Technology	3
P R 220	Principles of Public Relations	3
P R 305	Publicity Methods	3

Event Management, B.S.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	ECON 101	3
AESHM 112	1	Humanities "Select from" Course	3
AESHM 113E	1	AESHM 175D	2
HSP M 101	3	Event Management Electives Course	3

Natural Science "Select from" Course	3	ENGL 250	3
Social Science "Select from" Course	3	LIB 160	1
	14		15

Sophomore

Fall	Credits	Spring	Credits
EVENT 271	3	AESHM 287	3
General Elective	3	ACCT 284	3
Humanities "Select from" course	3	Select from:	3
Math "Select from" course	3	ACCT 215 or HSP M 315	
Social Science "Select from" Course	3	HSP M 315	
		Event Managment Electives	3
		Event Managment Electives	3
	15		15

Junior

Fall	Credits	Spring	Credits	Summer	Credits
AESHM 311E	1	AESHM 340	3	AESHM 470F	3
AESHM 342	3	HSP M 260	3		
EVENT 371	3	Select from:	3-4		
Event Management Electives course	3	STAT 101 or 104			
Speech/ Communication "Select from" Course	3	Event Management Electives Course	3		
General Elective	3	General Elective	3		
	16		15-16		3

Senior

Fall	Credits	Spring	Credits
AESHM 411E	1	AESHM 438	3
AESHM 474	3	EVENT 471	3
Event Management Electives Course	3	Event Management Electives Course	3
Event Management Electives Course	3	Event Management Electives Course	3
General Elective	3	General Elective	3
General Elective	3		
	16		15

Total Credits: 124-125

Courses primarily for undergraduates:

EVENT 271: Introduction to Event Management
(3-0) Cr. 3. F.S.
Overview of the event management industries. Techniques and procedures required for producing successful and sustainable events.

EVENT 289: Contemporary Club Management
(Cross-listed with HSP M). (3-0) Cr. 3. F.S.
Prereq: HSP M 101
Organization and management of private clubs including city, country, and other recreational and social clubs. Field trip may be required.

EVENT 290: Independent Study
Cr. 1-2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Freshman or Sophomore Classification. Permission of instructor, adviser, and department chair.
Independent study on topics of special interest to the student, facilitated by approved faculty member. No more than 9 credits of EVENT 290 and EVENT 490 may be applied towards graduation requirements.

EVENT 320: Attractions and Amusement Park Administration
(Cross-listed with HSP M). (3-0) Cr. 3. S.
Prereq: HSP M 101 or permission of instructor
Examination of current issues in the attractions and amusement park industry. Emphasis will be placed on development and design along with the functional departments of modern amusement parks and themed attractions.

EVENT 333: Entertainment Venue Management
(3-0) Cr. 3. F.S.
Prereq: EVENT 271 or equivalent
Organization and management of various types of entertainment venues including clubs, theaters, auditoriums, and arenas.

EVENT 371: Conference and Meeting Planning
(3-0) Cr. 3. F.S.
Prereq: EVENT 271 and junior standing
Application of event management principles to conference and meeting planning. Providing a comprehensive introduction to the key elements of the global conference, convention and meetings focus on destination marketing and professional development.

EVENT 373: Wedding Planning and Management
(3-0) Cr. 3. F.S.
Prereq: EVENT 371 and Event Management major
Overview of wedding event industry. Focus on wedding planning processes and implementation, design, and business planning and development.

EVENT 393: Event Management Workshop
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: EVENT Junior or Senior Classification and Permission of Instructor
Intensive 2 to 8 week workshop exploration. Topics vary each time offered. Maximum of 6 Event 393 credits can be applied to graduation.

EVENT 471: Special Events Coordination
(3-0) Cr. 3. F.S.
Prereq: EVENT 371 and junior standing; permission of instructor.
Advanced application event management. Provide leadership and communicate direction for production of an event including developing event strategy, financial management, wayfinding, volunteer management, and marketing.

EVENT 490: Independent Study
Cr. arr. Repeatable.
Prereq: Sections B-D: Program approval; Section H: Full membership in Honors Program
Independent study.

EVENT 490B: Independent Study: Conferences
Cr. arr. Repeatable.
Prereq: Program approval
Independent study.

EVENT 490C: Independent Study: Special Events
Cr. arr. Repeatable.
Prereq: Program approval.
Independent study.

EVENT 490D: Independent Study: Event Management
Cr. arr. Repeatable.
Prereq: Sections B-D: Program approval; Section H: Full membership in Honors Program
Independent study.

Family and Consumer Sciences, MFCS

Master of Family and Consumer Sciences (M.F.C.S.)

The College of Human Sciences offers a nonthesis master's degree program that might appeal to individuals with a bachelor's degree in family and consumer sciences/home economics subject area or related disciplines. This program is considered to be a professional master's degree. For students interested in further graduate study beyond the MFCS, the nonthesis degree program may mean additional requirements before completion of a Ph.D. or other terminal degree graduate program.

Students select either a comprehensive option or a specialization option. The comprehensive option requires 36 credits covering a variety of family and consumer sciences subject matter. Off-campus courses are offered via the World Wide Web (WWW). Specializations are available in Nutrition; Dietetics; Human Development and Family Studies; Hospitality Management; and Apparel, Merchandising, and Design.

In addition, students may select a 36-credit specialization in Family Financial Planning (FFP), a 36-credit specialization in Gerontology, a 36-credit specialization in Dietetics, or a 36-credit specialization in Youth Development. The FFP, Gerontology, Dietetics, and Youth Development specializations, offered in collaboration with six to eight other universities in the Great Plains Interactive Distance Education Alliance, are offered exclusively through courses on the Web. The FFP program has been approved by the Board of Examiners of the Certified Financial Planner Board of Standards as a program with the competencies required to permit those completing the degree to sit for the CFP® Certification Examination. CFP® is a certification mark owned by the Certified Financial Planner Board of Standards.

The Program of Study committee, in consultation with the student, establishes the courses to be taken and the acceptability of transfer credits. The major professor is selected from the discipline in which the concentration of coursework will be taken. Written and oral final integrative examinations are required in lieu of a thesis or creative component. A thesis or creative component could be included on mutual agreement of the student and major professor, with approval of the Graduate College.

Admission requirements for the MFCS include a bachelor's degree in a family and consumer sciences/home economics subject area or related disciplines, Graduate Record Examination (GRE) scores (not required for the FFP and Geron specializations), official transcripts, three letters of recommendation, a goal statement, and graduation in the upper one-half of class with a bachelor's degree from a regionally accredited U.S. institution or graduation in the upper one-half of class from a recognized foreign institution. Non-English speaking international students are required to have a TOEFL score of at least 550 at time of admission.

Graduate Certificates

http://www.hs.iastate.edu/online-grad/programs/

An 18-credit graduate certificate in Family Financial Planning is offered for students who do not need a master's degree and want to obtain the educational requirements of the Certified Financial Planner Board of Standards CFP® Certification Examination.

A 21-credit graduate certificate in Gerontology is offered.

A 13-credit Youth Development Specialist graduate certificate is offered.

A 13-credit graduate certificate in Youth Program Management & Evaluation is offered.

For additional information, students should contact the Research and Graduate Education Office, E262 Lagomarcino, Ames, Iowa 50011-3191, mfcsinfo@iastate.edu

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Family and Consumer Sciences Education and Studies

Family and Consumer Sciences Education and Studies offers a curriculum for the Bachelor of Science degree.

The curriculum in Family and Consumer Sciences Education and Studies (FCEDS) prepares graduates with a broad understanding of individual and family well-being. Graduates apply knowledge and research in family and consumer sciences content in global professional settings. They work in an integrative fashion to improve well-being by addressing and acting on complex problems confronting individuals, families, and communities. The study of Family and Consumer Sciences Education incorporates the following 16 areas (http://www.nasafacs.org/national-standards-and-competencies.html): Career, Community and Family Connections; Consumer and Family Resources; Consumer Services; Education and Early Childhood; Facilities Management and Maintenance; Family; Family and Community Services; Food Production and Services; Food Science, Dietetics, and Nutrition; Hospitality, Tourism and Recreation; Housing and Interior Design; Human Development; Interpersonal Relationship; Nutrition and Wellness; Parenting; and Textiles, Fashion and Apparel.

Students in the curriculum choose one of three options: Teacher Licensure, Communications, or Professional Studies.

Graduates of the Teacher Licensure option may teach family and consumer sciences in middle, junior high, and senior high schools. Students who enroll in Teacher Licensure must apply and be accepted into the teacher education program prior to enrolling in advanced courses and must meet general education requirements for teacher licensure. This program option is approved by the Iowa Department of Education for the preparation of comprehensive and occupational career and technical education family and consumer sciences teachers.

Graduates of the Communications option have a broad-based knowledge of family and consumer sciences and the ability to communicate in a global and technologically changing society. They are able to plan, develop, creatively present and evaluate information. Students apply the principles of educational presentations, journalism, marketing, and public relations to the family and consumer sciences field within businesses, agencies, and organizations that work to empower individuals, families, and communities.

Graduates of the Professional Studies option pursue individualized career goals in family and consumer sciences that apply integrative knowledge of family and consumer sciences in diverse careers for global settings. Students are prepared to work in a variety of careers ranging from non-

profit organizations to the private sector in a business or entrepreneurial venture working with family nutrition, financial planning, life planning, current issues or other topics from the 16 content areas that affect individuals, families and communities.

Students in FCEDS may choose coursework that leads to becoming a Certified Family Life Educator (CFLE), a program that has been approved by the National Council on Family Relations. These courses provide the basic education for students interested in working with families, including adolescents, parents, or adults working to strengthen relationships. The student takes courses that support the development of knowledge and skills in family life content areas selected by the National Council on Family Relations. The certification is a voluntary credential that requires the individual to complete a degree in an approved program and to have at least two years of work experience in family life education settings. Iowa State University does not grant the Certified Family Life Educator credential. The certification is granted only by the National Council on Family Relations. See http://www.hdfs.hs.iastate.edu/undergraduate-majors/cfle/ and/or http://www.ncfr.org/cfle-certification.

Graduates may also choose from one of several nationally recognized professional certifications available from the American Association of Family and Consumer Sciences (AAFCS) Council for Certification. This program measures competencies of FCS professionals using high-quality, rigorous assessments. Certifications that are currently available are (http://www.aafcs.org/CredentialingCenter/Certification.asp): **CFCS:** Certified in Family and Consumer Sciences; **CFCS-HDFS:** Certified in Human Development and Family Studies; **CFCS-HNFS:** Certified in Hospitality, Nutrition, and Food Science; and **CPFFE:** Certified Personal and Family Finance Educator.

There is also an opportunity to obtain a family and consumer sciences-general endorsement or teacher licensure as a post baccalaureate student.

Communication Proficiency Requirement: A student must achieve a grade of C or higher in ENGL 150, Critical Thinking and Communication, and ENGL 250, Written, Oral, Visual, and Electronic Composition. A student achieving a grade of C- or lower in 150 and/or 250 must either repeat the course(s), earning a minimum grade of C, or, in consultation with the adviser and the coordinator of freshman English, complete another appropriate English writing course with a minimum grade of C.

The HD FS department offers an Educational Services in Family and Consumer Sciences minor. The minor consists of at least 15 credits including 6 credits taken at Iowa State University in courses numbered 300 or above.

The Educational Services in Family and Consumer Sciences minor may be earned by completing 15 credits:

FCEDS 206	Professional Roles in Family and Consumer Sciences	2
FCEDS 306	Educational Principles for Family and Consumer Sciences and Family Life Education	4
FCEDS 413	Planning and Assessment for Family and Consumer Sciences and Family Life Education	4
FCEDS 491A	Supervised Experiences in a Professional Setting: Communications	5
or FCEDS 491B	Supervised Experiences in a Professional Setting: Professional Studies	
Total Credits		15

Family and Consumer Sciences Education and Studies, B.S.-communications option

Freshman

Fall	Credits	Spring	Credits
HD FS 102	3	CHEM 160 (or Natural Sciences Course from approved FCEDS list)	3
HD FS 110	1	FS HN 167	3
HD FS 183	1	STAT 101 or 104	4
LIB 160	1	FS HN 342 or SOC 134	3
ENGL 150	3	HD FS 103	0.5
RELIG 205[Humanities course]	3	Humanities Course from approved FCEDS list	3
PSYCH 131[HD FS Learning Community Selection-elective]	1		
	13		16.5

Sophomore

Fall	Credits	Spring	Credits
FCEDS 206	2	ENGL 250	3
AESHM 287	3	HD FS 249	3
ECON 101	3	HD FS 283	3
BIOL 101 or 155	3	HD FS 377	3
HD FS 218	2	P R 305	3
HD FS 239	3	COMST 102, 214, 218, SP CM 212, or SP CM 312	3
	16		18

Junior

Fall	Credits	Spring	Credits
ENGL 302	3	ENGL 314	3
FCEDS 306	4	HD FS 369	3
HD FS 276	3	HD FS 486	3
HD FS 367	3	Elective	3

H S 215	3	P R 220	3
	16		15

Senior

Fall	Credits	Spring	Credits
AESHM 421	3	FCEDS 491A[3-6 credits]	6
HD FS 395	3	Electives[(5-9 credits to equal 123.5 total credits)]	8
HD FS 449	3		
JL MC 242	3		
DSN S 232, JL MC 462, JL MC 476, or JL MC 477	3		
	15		14

Family and Consumer Sciences Education and Studies, B.S.-professional studies option

Freshman

Fall	Credits	Spring	Credits
HD FS 102	3	CHEM 160 (or Natural Sciences course from approved FCEDS list)	3
HD FS 110	1	FS HN 167	3
HD FS 183	1	FS HN 342 or SOC 134	3
LIB 160	1	HD FS 103	0.5
ENGL 150	3	MATH or STAT Course[from approved FCEDS list]	3
PSYCH 131[HD FS Learning Community Selection-elective]	1	CHS Elective	3
RELIG 205[Humanities course]	3		
	13		15.5

Sophomore

Fall	Credits	Spring	Credits
FCEDS 206	2	ENGL 250	3
HD FS 218	2	HD FS 249	3
HD FS 239	3	COMST 102, 214, 218, SP CM 212, or SP CM 312	3
ECON 101	3	HD FS 283	3
BIOL 101 or 155	3	HD FS 276	3
CHS Elective	3	HD FS 377	3
	16		18

Junior

Fall	Credits	Spring	Credits
HD FS 341, 383, or 482	3	HD FS 369	3
HD FS 367	3	ENGL 302 or 314	3
AESHM 342, PHIL 340, or A M D 362	3	HD FS 486	3
CHS Elective (300 level or above)	3	CHS Elective (300 level or above)	3
Natural Sciences, Social Sciences, Humanities or Art & Design Course	3	Natural Sciences, Social Sciences, Humanities or Art & Design Course	3
	15		15

Senior

Fall	Credits	Spring	Credits
AESHM 421	3	FCEDS 491B (3-6 credits)	6
HD FS 395	3	H S 215	3
AESHM 474 or MGMT 310	3	Electives[to equal 123.5 total credits]	4
HD FS 449	3		
Humanities Course[from approved FCEDS list]	3		
P R 220, 305, ENGL 302, or ENGL 314	3		
	18		13

Family and Consumer Sciences Education and Studies, B.S.- teacher licensure option

Freshman

Fall	Credits	Spring	Credits
C I 204	3	C I 219	1
ENGL 150	3	FS HN 167	3
HD FS 102	3	FS HN 342 or SOC 134	3
HD FS 110 or 111	1	HD FS 276	3
LIB 160	1	HD FS 283	3
PSYCH 131[HD FS Learning Community Selection-elective]	1	MATH or STAT Course (from approved FCEDS list)	3
RELIG 205 (Humanities course)	3	Take PRAXIS 1 CORE	
	15		16

Sophomore

Fall	Credits	Spring	Credits
FCEDS 206	2	CHEM 160	3
C I 202	3	ENGL 250	3
HD FS 239	3	HD FS 224	3
BIOL 101 or 155	3	A M D 204	4
COMST 102, 214, 218, SP CM 212, or SP CM 312	3	FS HN 111	2
HD FS 103	0.5	FS HN 115	1

Apply to Teacher Ed			
	14.5		16
Junior			
Fall	**Credits**	**Spring**	**Credits**
FCEDS 306	4	FCEDS 418	3
FCEDS 480B	1	FCEDS 413	4
A M D 121	3	C I 333	3
Humanities	3	SP ED 401	3
HD FS 249	3	HD FS 227 or 226	3
	14		16
Senior			
Fall	**Credits**	**Spring**	**Credits**
One of the following:	2-3	FCEDS 417A	8
ARTID 250		FCEDS 417B	8
ARTID 251		PRAXIS II in content & pedagogy to be taken prior to license approval	
ARTID 255			
ARTID 355			
ARTID 356			
FCEDS 480B	1		
C I 406	3		
C I 426	3		
ECON 101	3		
One of the following: HD FS 342, 383, 395; AESHM 421; A M D 165; H S 110; or MKT 340	3		
	15-16		16

US Diversity and International Perspectives Requirement: Students in Family and Consumer Sciences Education fulfill the US Diversity by taking HD FS 276 and the International Perspectives Requirement by taking FS HN 342.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

Curriculum in Family and Consumer Sciences Education and Studies

Administered by the Department of Human Development and Family Studies. Leading to a degree bachelor of science.

This curriculum provides a broad-based program of study focusing on preparation for professional careers related to education or community leadership. Courses are required in general education and the College core.

Students in the program choose one of three options: Teacher Licensure, Communications, or Professional Studies.

Option 1, **Teacher Licensure**, is designed for students seeking careers as family and consumer sciences educators in a variety of settings such as middle, junior high, and senior high schools. Further information about licensure programs appears under Teacher Education.

Option 2, **Communications**, is designed for students seeking careers emphasizing the use of principles in journalism, marketing, communications, and public relations with diverse populations in business or social agency settings as well as extension, community agencies, community colleges, and youth and adult education programs in the global community.

Option 3, **Professional Studies**, is designed to provide students with the opportunity to pursue an individualized program which is planned with their academic advisers. Careers include working with diverse populations in Extension, business, community agencies, and community colleges, or non-profit groups and organizations involving youth and adult education programs.

A minor in Educational Services in Family and Consumer Sciences is available, see requirements under Human Development and Family Studies Courses and Programs or in the catalog section Family and Consumer Sciences Education and Studies.

Total Credits required: 122.5-123.5

Communications and Library

ENGL 150	Critical Thinking and Communication **	3
ENGL 250	Written, Oral, Visual, and Electronic Composition **	3
One of the following		3
COMST 102	Introduction to Interpersonal Communication	
COMST 214	Professional Communication	
COMST 218	Conflict Management	
SP CM 212	Fundamentals of Public Speaking	
SP CM 312	Business and Professional Speaking	
LIB 160	Information Literacy	1
Total Credits		10

** Must receive a "C" or above.

Natural Sciences and Mathematical Disciplines

BIOL 101	Introductory Biology	3

or BIOL 155	Human Biology	
STAT 101	Principles of Statistics Communications Option	3-4
or STAT 104	Introduction to Statistics	
or approved MATH or STAT course from FCEDS list (Teacher Licensure & Professional Studies)		
CHEM 160	Chemistry in Modern Society	3
Teacher Licensure and Communications must have completed high school Chemistry		
Total Credits		9-10

Social Sciences

ECON 101	Principles of Microeconomics	3
HD FS 102	Individual and Family Development, Health, and Well-being *	3
One of the following		3
FS HN 342	World Food Issues: Past and Present	
SOC 134	Introduction to Sociology	
Total Credits		9

*Students in Teacher Licensure must receive a "C-" or above

Humanities

Select 6 credits from FCEDS list of approved Humanities courses.

Total Credits: 6

Family and Consumer Sciences Education and Studies Core

HD FS 103	Professional Principles for Working with Children	.5
HD FS 110	Freshman Learning Community Orientation	1
or HD FS 111	New Transfer Student Seminar	
FCEDS 206	Professional Roles in Family and Consumer Sciences **	2
HD FS 239	Consumer Issues *	3
HD FS 276	Human Sexuality *	3
HD FS 283	Personal and Family Finance *	3
Total Credits		12.5

*Students in Teacher Licensure must receive a "C-" or above

** Students in Teacher Licensure must receive a "C" or above.

Total Credits: 75-76

Option 1: Teacher Licensure

Total Credits for FCEDS (Teacher Licensure): 122.5-123.5

C I 202	Learning Technologies in the 7-12 Classroom **	3
C I 204	Social Foundations of Education in the United States **	3
C I 219	Orientation to Teacher Education: Math, Science, FCS Education, and History/Social Science Majors	1
C I 333	Educational Psychology **	3
C I 406	Social Justice Education and Teaching: Secondary **	3
C I 426	Principles of Secondary Education **	3
FCEDS 306	Educational Principles for Family and Consumer Sciences and Family Life Education **	4
FCEDS 413	Planning and Assessment for Family and Consumer Sciences and Family Life Education **	4
FCEDS 418	Foundations of Career and Technical Education in Family and Consumer Sciences **	3
FCEDS 417A	Supervised Teaching in Family and Consumer Sciences: Vocational family and consumer sciences. **	8
FCEDS 417B	Supervised Teaching in Family and Consumer Sciences: Family and consumer sciences. **	8
FCEDS 480A	Pre-Student Teaching Experience in FCS Education: Practicum in FCS Labs (24 hours)	1
FCEDS 480B	Pre-Student Teaching Experience in FCS Education: Practicum in Diverse Settings (24 hours)	1
FS HN 111	Fundamentals of Food Preparation *	2
FS HN 115	Food Preparation Laboratory *	1
FS HN 167	Introduction to Human Nutrition *	3
HD FS 224	Development in Young Children: Birth through Age 8 *	3
HD FS 249	Parenting and Family Diversity Issues *	3
A M D 121	Apparel Assembly Processes *	3
A M D 204	Textile Science *	4
SP ED 401	Teaching Secondary Students with Exceptionalities in General Education **	3
One of the following		3
ARTID 250	Fundamentals of Interior Design *	
ARTID 251	Human Factors in Design *	
ARTID 255	Forces That Shape Interior Space *	
ARTID 355	Interior Design History/Theory/Criticism I *	
ARTID 356	Interior Design History/Theory/Criticism II *	
One of the following		3
HD FS 226	Development and Guidance in Middle Childhood *	
HD FS 227	Adolescent and Emerging Adulthood *	
One of the following		3

AESHM 421	Developing Global Leadership: Maximizing Human Potential	3
A M D 165	Dress and Diversity in Society *	
HD FS 342	Guidance and Group Management in Early Childhood *	
HD FS 383	Fundamentals of Financial Planning *	
HD FS 395	Children, Families, and Public Policy *	
H S 110	Personal and Consumer Health *	
MKT 340	Principles of Marketing *	

*Must receive a "C-" or above

** Must receive a "C" or above.

Option 2: Communications

Total Credits for FCEDS (Communication Option): 122.5

AESHM 287	Principles of Management in Human Sciences	3
AESHM 421	Developing Global Leadership: Maximizing Human Potential	3
ENGL 302	Business Communication	3
FCEDS 306	Educational Principles for Family and Consumer Sciences and Family Life Education	4
FS HN 167	Introduction to Human Nutrition	3
HD FS 249	Parenting and Family Diversity Issues	3
HD FS 367	Abuse and Illness in Families	3
HD FS 369	Research Methods in Human Development and Family Studies	3
HD FS 377	Aging and the Family	3
HD FS 395	Children, Families, and Public Policy	3
HD FS 418B	Professional Practice Reflection/Discussion: Internships	2
HD FS 449	Program Evaluation and Proposal Writing	3
HD FS 486	Administration of Human Services Programs	3
H S 215	Drug Education	3
P R 305	Publicity Methods	3
Select one of the following		3
ENGL 313	Rhetorical Website Design	
ENGL 314	Technical Communication	
ENGL 332	Visual Communication of Quantitative Information	
ENGL 415	Business and Technical Editing	
ENGL 416	Visual Aspects of Business and Technical Communication	
Choose 6 credits from the following		6
DSN S 232	Digital Design Communications	
P R 220	Principles of Public Relations	
JL MC 406	Media Management	
JL MC 476	World Communication Systems	
JL MC 477	Ethnicity, Gender, Class and the Media	
JL MC 110	Orientation to Journalism and Communication	1
FCEDS 491A	Supervised Experiences in a Professional Setting: Communications	6
Electives		15
Total Credits		76

Option 3: Professional Studies

Total credits for FCEDS (Professional Studies): 123.5

FCEDS 306	Educational Principles for Family and Consumer Sciences and Family Life Education	4
AESHM 421	Developing Global Leadership: Maximizing Human Potential	3
One of the following:		3
AESHM 474	Entrepreneurship in Human Sciences	
MGMT 310	Entrepreneurship and Innovation	
FS HN 167	Introduction to Human Nutrition	3
HD FS 249	Parenting and Family Diversity Issues	3
HD FS 367	Abuse and Illness in Families	3
HD FS 369	Research Methods in Human Development and Family Studies	3
HD FS 377	Aging and the Family	3
HD FS 395	Children, Families, and Public Policy	3
HD FS 418B	Professional Practice Reflection/Discussion: Internships	2
HD FS 449	Program Evaluation and Proposal Writing	3
HD FS 486	Administration of Human Services Programs	3
One of the following		3
HD FS 341	Household Finance and Policy	
HD FS 383	Fundamentals of Financial Planning	
HD FS 482	Family Savings and Investments	
One of the following		3
AESHM 342	Aesthetics of Consumer Experience	
A M D 362	Cultural Perspectives of Dress	
PHIL 340	Aesthetics	
Two of the following		6
ENGL 302	Business Communication	
ENGL 314	Technical Communication	
P R 220	Principles of Public Relations	
P R 305	Publicity Methods	

FCEDS 491B	Supervised Experiences in a Professional Setting: Professional Studies	6
College of Human Science Electives, choose from AESHM, FCEDS, FS, HN, HD FS, HSP M, H S, or AMD (TC) minimum 9 credits at 300 level or above; elective total will vary to equal a total of 123.5 credits		13-14
University Electives		9
Total Credits		76-77

Graduate Study

The Human Development and Family Studies department and the college of Human Sciences participates in several Master of Family and Consumer Sciences (MFCS) degree programs. See the following link for information on these options: http://www.online.hs.iastate.edu/graduate-programs/masters/.

Courses primarily for undergraduates:

FCEDS 206: Professional Roles in Family and Consumer Sciences
(1-1) Cr. 2. F.
Prereq: HD FS 103 or concurrent enrollment in HD FS 103
Influencing factors that have contributed to the development and mission of Family and Consumer Sciences. Program goals, objectives and professional ethics. Introduction to various roles in professional settings, e.g., community agencies, secondary schools, business and industry, and Cooperative Extension. Includes 12 hours of a practicum experience outside of the regular class schedule.

FCEDS 306: Educational Principles for Family and Consumer Sciences and Family Life Education
(3-2) Cr. 4. F.
Prereq: 15 credits in family and consumer sciences subject matter
Principles of teaching and learning applied to family and consumer sciences content, including incorporating reading and STEM strategies. Instructional methods appropriate for formal and non-formal educational settings. Specific strategies for diverse audiences. Includes 12 hour arranged practicum. May be used for family life certification.

FCEDS 413: Planning and Assessment for Family and Consumer Sciences and Family Life Education
(3-2) Cr. 4. S.
Prereq: FCEDS 306
Development of curriculum and assessment tools for family and consumer sciences programs for school settings. Accommodating exceptional learners. Includes 12 hours of Career and Technical Student Organization Competitive Event Assessment. May be used for family life certification.

FCEDS 417: Supervised Teaching in Family and Consumer Sciences
Cr. 3-8. Repeatable. F.S.
Prereq: FCEDS 413; 24 credits in family and consumer sciences subject matter; cumulative grade point of 2.50; full admission to teacher education
Supervised teaching experience in secondary schools. Examination of ways to implement actions that reflect a professional philosophy of family and consumer sciences for teaching middle and high school level students. Reservation required.

FCEDS 417A: Supervised Teaching in Family and Consumer Sciences: Vocational family and consumer sciences.
Cr. 3-8. Repeatable. F.S.
Prereq: FCEDS 413, 24 credits in family and consumer sciences subject matter, cumulative grade point of 2.50, full admission to teacher education
Supervised teaching experience in secondary schools. Examination of ways to implement actions that reflect a professional philosophy of family and consumer sciences for teaching middle and high school level students. Reservation required.

FCEDS 417B: Supervised Teaching in Family and Consumer Sciences: Family and consumer sciences.
Cr. 3-8. Repeatable. F.S.
Prereq: FCEDS 413, 24 credits in family and consumer sciences subject matter, cumulative grade point of 2.50, full admission to teacher education
Supervised teaching experience in secondary schools. Examination of ways to implement actions that reflect a professional philosophy of family and consumer sciences for teaching middle and high school level students. Reservation required.

FCEDS 418: Foundations of Career and Technical Education in Family and Consumer Sciences
(Dual-listed with FCEDS 518). (3-0) Cr. 3. S.
Prereq: 400 hours employment in a family and consumer sciences related field.
Philosophy of career and technical education. Historical development of family and consumer sciences. Planning and implementing programs in family and consumer sciences including FCCLA. Impact of selected legislation on family and consumer sciences programs. Techniques for cooperative education, school-to-work, and work-based education programs. May be used toward Multioccupations Endorsement.

FCEDS 480: Pre-Student Teaching Experience in Family and Consumer Sciences Education
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Admission to teacher education.
Laboratory experience in foods, textiles and human development in family and consumer sciences secondary programs. At least 2 hour blocks of time needed for field experience. Observation of family and consumer sciences laboratories in diverse classrooms. Planning, implementing, managing and assessing laboratory lessons in family and consumer sciences. Offered on a satisfactory-fail basis only.

FCEDS 480A: Pre-Student Teaching Experience in FCS Education: Practicum in FCS Labs (24 hours)
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Admission to teacher education
Laboratory experience in foods, textiles and human development in family and consumer sciences secondary programs. At least 2 hour blocks of time needed for field experience. Observation of family and consumer sciences laboratories in diverse classrooms. Planning, implementing, managing and assessing laboratory lessons in family and consumer sciences. Offered on a satisfactory-fail basis only.

FCEDS 480B: Pre-Student Teaching Experience in FCS Education: Practicum in Diverse Settings (24 hours)
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Admission to teacher education.
Laboratory experience in foods, textiles and human development in family and consumer sciences secondary programs. At least 2 hour blocks of time needed for field experience. Observation of family and consumer sciences laboratories in diverse classrooms. Planning, implementing, managing and assessing laboratory lessons in family and consumer sciences. Offered on a satisfactory-fail basis only.

FCEDS 490: Independent Study
Cr. arr. F.S.SS.

FCEDS 490G: Independent Study: General
Cr. arr. F.S.SS.

FCEDS 490H: Independent Study: Honors
Cr. arr. F.S.SS.

FCEDS 491: Supervised Experiences in a Professional Setting
Cr. 3-8. Repeatable. F.S.SS.
Prereq: HD FS 418B; 24 credits in family and consumer sciences; reservation required
Supervised professional experience in an approved setting such as Cooperative Extension, business, community, human service, or government agency. Offered on a satisfactory-fail basis only.

FCEDS 491A: Supervised Experiences in a Professional Setting: Communications
Cr. 3-8. Repeatable, maximum of 8 credits. F.S.SS.
Prereq: HD FS 418B; 24 credits in family and consumer sciences; reservation required
Supervised professional experience in an approved setting such as Cooperative Extension, business, community, human service, or government agency. Offered on a satisfactory-fail basis only.

FCEDS 491B: Supervised Experiences in a Professional Setting: Professional Studies
Cr. 3-8. Repeatable, maximum of 8 credits. F.S.SS.
Prereq: HD FS 418B; 24 credits in family and consumer sciences; reservation required
Supervised professional experience in an approved setting such as Cooperative Extension, business, community, human service, or government agency. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

FCEDS 500: Short Course: Current Family and Consumer Sciences Offerings
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 credits in family and consumer sciences or education

FCEDS 500F: Short Course: Career and Technical Education
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 credits in family and consumer sciences or education

FCEDS 500G: Short Course: General
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 credits in family and consumer sciences or education

FCEDS 500K: Short Course: Textile Selection and Apparel Construction Methods
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 6 credits in family and consumer sciences or education

FCEDS 507: Program Development and Assessment in Family and Consumer Sciences
(3-0) Cr. 3. S.
Prereq: Professional experience in family and consumer sciences or related area
Application of principles of program development and assessment to formal and non-formal educational settings, e.g., secondary school family and consumer sciences programs, training positions in business, Cooperative Extension, human services agencies. Planning and constructing test items and other assessments of school and non-school learning.

FCEDS 508: Models for Teaching Family and Consumer Sciences
(3-0) Cr. 3. F.Alt. SS., offered odd-numbered years.
Prereq: 6 credits in family and consumer sciences
Selecting and applying teaching strategies and instructional materials based on theories of learning and human development that reflect a professional philosophy of family and consumer sciences. Application to formal and non-formal educational settings with diverse audiences.

FCEDS 515: Assessment in Family and Consumer Sciences
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Introductory statistical and program development skills
Role of assessment in family and consumer sciences education programs. Planning and constructing test items and other assessments of school and nonschool learning.

FCEDS 518: Foundations of Career and Technical Education in Family and Consumer Sciences
(Dual-listed with FCEDS 418). (3-0) Cr. 3. S.
Prereq: 400 hours employment in a family and consumer sciences related field.
Philosophy of career and technical education. Historical development of family and consumer sciences. Planning and implementing programs in family and consumer sciences including FCCLA. Impact of selected legislation on family and consumer sciences programs. Techniques for cooperative education, school-to-work, and work-based education programs. May be used toward Multioccupations Endorsement.

Family Financial Planning

Interinstitutional Graduate Program

Iowa State University offers a Master's degree in Family and Consumer Sciences with specialization in Family Financial Planning. This is an interinstitutional distance education program offered entirely online. The student selects the home institution that grants the degree. After admission at the home institution, the student takes courses from each of the participating institutions: Iowa State University; Kansas State University; Montana State University; University of Nebraska; North Dakota State University; Oklahoma State University; South Dakota State University.

At Iowa State University, Family Financial Planning is a specialization within the Master of Family and Consumer Sciences degree program (MFCS-FFP) that consists of 36 semester credits. Neither a thesis nor a creative component is required. Students typically complete the program in three years while employed full time. A computer with minimum specifications, Web access, and an email address are required for completing the program.

FFP Graduate Certificate Program

The Graduate Certificate in Family Financial Planning consists of the six courses from the MFCS-FFP that contain the competencies required for the Certified Financial Planner (CFP®) Certification Examination. Students interested in attaining the CFP® credential and not a master's degree should enroll in the certificate program.

Courses included in the FFP graduate certificate program include:

FFP 540	Estate Planning for Families	3
FFP 545	Retirement Planning, Employee Benefits, and the Family	3
FFP 555	Insurance Planning for Families	3
FFP 565	Personal Income Taxation	3
FFP 583	Investing for the Family's Future	3
FFP 595	Financial Planning - Case Studies	3

Both the Master's degree and Graduate Certificate programs at Iowa State University are registered with Certified Financial Planner Board of Standards Inc. As a CFP Board-registered Program, ISU FFP courses satisfy CFP Board's education requirement, allowing an individual to sit for the CFP® Certification Examination.

Iowa State University does not certify individuals to use the CFP®, CERTIFIED FINANCIAL PLANNER™ title. CFP certification is granted only by Certified Financial Planner Board of Standards Inc. to those persons who, in addition to completing an educational requirement such as this CFP Board-Registered Program, have met its ethics, experience and examination requirements. (CFP Board of Standards web site: www.cfp.net (http://www.cfp.net).)

Certified Financial Planner Board of Standards Inc. owns the certification marks CFP®, CERTIFIED FINANCIAL PLANNER™ and the federally registered CFP (with flame logo), which it awards to individuals who successfully complete initial and ongoing certification requirements.

Admission Procedures: Admission to the FFP Certificate Program requires exactly the same procedures as admission to the Graduate College. See Graduate College section in the catalog.

Registration

Students choosing to receive their degree from Iowa State University complete all the admissions, registration and fee payment processes through ISU.

Courses primarily for graduate students, open to qualified undergraduates:

FFP 520: Financial Theory and Research I
(3-0) Cr. 3. F.S.SS.
Theories of family functioning, macroeconomic theory related to family resource allocation decisions, the family as an economic unit, and the interaction of the economy and families. (on-line course offering via Distance Education).

FFP 525: Financial Theory and Research II
(3-0) Cr. 3. F.S.SS.
Microeconomic theory as it relates to family resource allocation decisions, theories of household behavior, the lifecycle hypothesis, behavioral economics, behavioral finance, theories of behavioral change, and psychological theories of family well-being. Focus on empirical research investigating household financial decision-making. (on-line course offering via Distance Education).

FFP 530: Fundamentals of Family Financial Planning
(3-0) Cr. 3. F.S.SS.
The nature and functioning of financial systems, including currencies, markets, monetary and fiscal policy, and supply/demand for land, labor, and capital. Focus is on the impact of global financial interdependence on individuals and families in the U.S. Current and emerging issues, as well as current research and theory relative to financial systems. (on-line course offering via Distance Education).

FFP 535: Financial Counseling
(3-0) Cr. 3. F.S.SS.
Theory and research regarding the interactive process between the client and the practitioner, including communication techniques, motivation and esteem building, the counseling environment, ethics, and methods of data intake, verification, and analysis. Other topics include legal issues, compensation, uses of technology to identify resources, information management, and current or emerging issues. (on-line course offering via Distance Education).

FFP 540: Estate Planning for Families
(3-0) Cr. 3. F.S.SS.
Fundamentals of the estate planning process, including estate settlement, estate and gift taxes, property ownership and transfer, and powers of appointment. Tools and techniques used in implementing an effective estate plan, ethical considerations used in providing estate planning services, and new and emerging issues in the field. Case studies provide experience in developing estate plans suitable for varied family forms. (on-line course offering via Distance Education).

FFP 541: Housing and Real Estate in Family Financial Planning
(Cross-listed with HD FS). (3-0) Cr. 3. Alt. SS., offered even-numbered years.
The role of housing and real estate in the family financial planning process, including taxation, mortgages, financial calculations, legal concerns, and ethical issues related to home ownership and real estate investments. Emphasis on emerging issues in the context of housing and real estate. (on-line course offering via Distance Education).

FFP 545: Retirement Planning, Employee Benefits, and the Family
(3-0) Cr. 3. F.S.SS.
Study of micro and macro considerations for retirement planning. Survey of various types of retirement plans, ethical considerations in providing retirement planning services, assessing and forecasting financial needs in retirement, and integration of retirement plans with government benefits.(on-line course offering via Distance Education).

FFP 550: Military Personal Financial Readiness
(3-0) Cr. 3. F.SS.
Overview of the topics relevant to the financial planning process that address the unique needs of military service members and their families. (on-line course offering via Distance Education).

FFP 555: Insurance Planning for Families
(3-0) Cr. 3. F.S.SS.
In-depth study of risk management concepts, tools, and strategies for individuals and families, including life insurance; property and casualty insurance; liability insurance; accident, disability, health, and long-term care insurance; and government-subsidized programs. Current and emerging issues and ethical considerations relative to risk management. Case studies provide experience in selecting insurance products suitable for individuals and family, study of investment options for clients including common stocks, fixed income securities, convertible securities, and related choices. Relationships between investment options and employee/employer benefit plan choices. Current and emerging issues and ethics are included. (on-line course offering via Distance Education).

FFP 565: Personal Income Taxation
(3-0) Cr. 3. F.S.SS.
In-depth information on income tax practices and procedures including tax regulations, tax return preparation, the tax audit processes, the appeals process, preparation for an administrative or judicial forum, and ethical considerations of taxation. New and emerging issues related to taxation. Family/individual case studies provide practice in applying and analyzing tax information and recommending appropriate tax strategies. (on-line course offering via Distance Education).

FFP 570: Professional Practices in Financial Planning
(3-0) Cr. 3. F.S.SS.
Challenges of managing financial planning practices including, but not limited to: business valuation, personnel, marketing, client services, ethics and technological applications. Relying both on a theoretical as well as an applied approach, students analyze case studies that provide relevant, practical exposure to practice management issues, with a strong emphasis on current research findings. (on-line course offering via Distance Education).

FFP 583: Investing for the Family's Future
(Cross-listed with HD FS). (3-0) Cr. 3. F.
Prereq: HD FS 483
Evaluation of investment markets for the household. Analysis of how families choose where to put their savings. Emphasis is on using the family's overall financial and economic goals to help inform investment choices. (on-line course offering via Distance Education).

FFP 591: Practicum
Cr. 3-6. F.S.SS.
Supervised experience in family financial planning.

FFP 595: Financial Planning - Case Studies
(3-0) Cr. 3. F.S.SS.
Prereq: FFP 530, FFP 540, FFP 545, FFP 555, FFP 565, FFP 583
Professional issues in financial planning, including ethical considerations, regulation and certification requirements, communication skills, and professional responsibility. Students are expected to utilize skills obtained in other courses and work experiences in the completion of personal finance case studies, the development of a targeted investment policy, and other related financial planning assignments. (on-line course offering via Distance Education).

Food Science (H SCI)

Food science is a degree program focused on food issues from the time crops leave the field until consumers buy the food products. Food scientists apply basic science (chemistry, biology, physics) to improve processing, preservation, and safety of food and to develop new food products. There are two options in food science, and both options are approved by the Institute of Food Technologists: food science and technology option, and food science and industry option.

The department also offers a food science minor.

Administered by the Department of Food Science and Human Nutrition

Students select one of the following options and complete all requirements for that option: food science and technology option or food science and industry option. Courses listed below are required for all of the options, except where specified by option below.

Total Degree Requirement: 120 cr.
Students must fulfill International Perspectives and U.S. Diversity requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communications and Library: 10 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 6-12 cr.

Select Humanities course from approved list		3
ECON 101	Principles of Microeconomics	3
If H Sci student, select:		6
Additional Humanities course		
Additional Humanities or Social Science course		

Ethics and Environmental: 3-6 cr.

FS HN 342	World Food Issues: Past and Present	3
If AgLS student, select from:		2-3
ENV S 120	Introduction to Renewable Resources	
ENV S 201	Introduction to Environmental Issues	

Mathematical Sciences: 7-12 cr.
Food science and technology option:

Select from:		8
MATH 165 & MATH 166	Calculus I and Calculus II	
or		
MATH 181 & MATH 182	Calculus and Mathematical Modeling for the Life Sciences I and Calculus and Mathematical Modeling for the Life Sciences II	
Select at least 3 credits from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
STAT 105	Introduction to Statistics for Engineers	
Total Credits		11-12

Food science and industry option:

Select at least 4 credits from:		4
MATH 160	Survey of Calculus	
MATH 165	Calculus I	

MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Select at least 3 credits from:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
STAT 105	Introduction to Statistics for Engineers	
Total Credits		7-8

Physical Sciences: 13-25 cr.
Food science and technology option:

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
CHEM 332	Organic Chemistry II	3
PHYS 111	General Physics	5
PHYS 112	General Physics	5
Total Credits		25

Food science and industry option:

Select from:		5-8
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	
CHEM 177 & 177L & CHEM 178	General Chemistry I and Laboratory in General Chemistry I and General Chemistry II	
CHEM 231	Elementary Organic Chemistry	3
CHEM 231L	Laboratory in Elementary Organic Chemistry	1
PHYS 115	Physics for the Life Sciences	4-5
or PHYS 111	General Physics	
Total Credits		13-17

Biological Sciences: 12-13 cr.
Food science and technology option:

BBMB 301	Survey of Biochemistry	3
BIOL 211	Principles of Biology I	3
BIOL 212	Principles of Biology II	3
MICRO 302	Biology of Microorganisms	3
MICRO 302L	Microbiology Laboratory	1
Total Credits		13

Food science and industry option:

BBMB 301	Survey of Biochemistry	3
BIOL 211	Principles of Biology I	3
BIOL 212	Principles of Biology II	3
MICRO 201	Introduction to Microbiology	2-3
or MICRO 302	Biology of Microorganisms	
MICRO 201L	Introductory Microbiology Laboratory	1
or MICRO 302L	Microbiology Laboratory	
Total Credits		12-13

Food Science and Human Nutrition: 44 cr.

FS HN 101	Food and the Consumer	3
FS HN 110	Professional and Educational Preparation	1
FS HN 167	Introduction to Human Nutrition	3
FS HN 203	Contemporary Issues in Food Science and Human Nutrition	1
FS HN 311	Food Chemistry	3
FS HN 311L	Food Chemistry Laboratory	1
FS HN 351	Introduction to Food Engineering Concepts	3
FS HN 403	Food Laws and Regulations	2
FS HN 405	Food Quality Assurance	3
FS HN 406	Sensory Evaluation of Food	3
FS HN 410	Food Analysis	3
FS HN 411	Food Ingredient Interactions and Formulations	2
FS HN 412	Food Product Development	3
FS HN 420	Food Microbiology	3
FS HN 421	Food Microbiology Laboratory	3
FS HN 471	Food Processing I	3
FS HN 472	Food Processing II	3
FS HN 480	Professional Communication in Food Science and Human Nutrition	1
Total Credits		44

Food science and industry option:

Select 6 credits from the following business courses:		6
ACCT 215	Legal Environment of Business	
ACCT 284	Financial Accounting	
ACCT 285	Managerial Accounting	
ECON 301	Intermediate Microeconomics	
ECON 320	Labor Economics	
MGMT 310	Entrepreneurship and Innovation	
MGMT 370	Management of Organizations	
MGMT 371	Organizational Behavior	
MGMT 414	International Management	
MGMT 472	Management of Diversity	
MIS 301	Management Information Systems	
MKT 340	Principles of Marketing	
MKT 447	Consumer Behavior	

MKT 448	Global Marketing	
Total Credits		6

Electives: 0-23 cr. Select from any university coursework to earn at least 120 total credits.

Go to FS HN courses.

Food Science, B.S. - Food science & industry option

First Year

Fall	Credits	Spring	Credits
FS HN 101	3	FS HN 167	3
FS HN 110	1	CHEM 178 (if CHEM 177 was taken) or elective*	3
CHEM 163 or 177	4	BIOL 212	3
CHEM 163L or 177L	1	MATH 160, 165, or 181	4
BIOL 211	3	ECON 101	3
ENGL 150	3		
LIB 160	1		
	16		16

Second Year

Fall	Credits	Spring	Credits
CHEM 231	3	BBMB 301	3
CHEM 231L	1	FS HN 203	1
PHYS 115 (4cr) or 111 (5cr)	4-5	MICRO 201 or 302	2-3
ENGL 250	3	MICRO 201L or 302L	1
STAT 101 or 104 or 105	3-4	Humanities/Social Sci. (H Sci) or ENV S (AgLS)	2-3
		Humanities (H Sci) or elective (AgLS)*	3
	14-16		12-14

Third Year

Fall	Credits	Spring	Credits
FS HN 311	3	FS HN 342	3
FS HN 311L	1	FS HN 351	3
FS HN 420	3	FS HN 403	2
SP CM 212	3	FS HN 405	3
Humanities course	3	FS HN 421	3
Elective*	1	Elective*	2
	14		16

Fourth Year

Fall	Credits	Spring	Credits
FS HN 406	3	FS HN 412	3
FS HN 410	3	FS HN 472	3
FS HN 411	2	FS HN 480	1
FS HN 471	3	Business course	3
Business Course	3	U.S. Diversity (if not already taken) or Elective*	3
Elective*	2	Elective*	3
	16		16

* Choose elective courses to total equal to or greater than 120 credits.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point considerations.

Food Science, B.S. - Food science and technology option

First Year

Fall	Credits	Spring	Credits
FS HN 110	1	FS HN 101	3
CHEM 177	4	FS HN 167	3
CHEM 177L	1	CHEM 178	3
BIOL 211	3	BIOL 212	3
ENGL 150	3	MATH 166 or 182	4
LIB 160	1		
MATH 165 or 181	4		
	17		16

Second Year

Fall	Credits	Spring	Credits
CHEM 331	3	CHEM 332	3
CHEM 331L	1	FS HN 203	1
PHYS 111	5	PHYS 112	5
ENGL 250	3	MICRO 302	3
STAT 101, 104, or 105	3-4	MICRO 302L	1
		Elective*	2
	15-16		15

Third Year

Fall	Credits	Spring	Credits
BBMB 301	3	FS HN 351	3
FS HN 311	3	FS HN 403	2
FS HN 311L	1	FS HN 405	3
FS HN 420	3	FS HN 421	3
SP CM 212	3	ECON 101	3
Humanities course	3		
	16		14

Fourth Year

Fall	Credits	Spring	Credits
FS HN 406	3	FS HN 342	3
FS HN 410	3	FS HN 412	3
FS HN 411	2	FS HN 472	3
FS HN 471	3	FS HN 480	1
Humanities/Social Sci. (H Sci) or ENV S (AgLS)	2-3	US Diversity (if not already taken) or elective*	3
Humanities (H Sci) or elective (AgLS)*	1-3		
	14-17		13

* Choose elective courses to total equal to or greater than 120 credits.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

Food Science and Human Nutrition

The Department of Food Science and Human Nutrition is jointly administered by the College of Agriculture and Life Sciences and the College of Human Sciences. All curricula offered by the department are available to students in either college. These majors include:

- Culinary food science
- Dietetics
- Diet and exercise
- Food science
- Nutritional science

Visit the department web site at: www.fshn.hs.iastate.edu (http://www.fshn.hs.iastate.edu).

Undergraduate Study

Culinary Food Science

Culinary food science is an interdisciplinary degree combining a strong food science foundation with acquisition of culinary skills. The program includes chemistry, organic chemistry, biology, microbiology, and biochemistry as well as quantity food production, fine dining management, and food safety and sanitation. Internship experience in the food industry or culinary business is required. Culinary food science graduates are qualified to work as managers and specialists in food research, product development, culinary applications, and food marketing and sales. For more information: http://www.fshn.hs.iastate.edu/undergraduate-programs/culinary-science/

Dietetics

The Didactic Program in Dietetics (DPD) is accredited by the Accreditation Council for Education in Nutrition and Dietetics, the accrediting agency of the Academy of Nutrition and Dietetics. The dietetics undergraduate curriculum meets the academic requirements as the DPD. Additionally, the curriculum for concurrent Bachelor's and Master's degrees in diet and exercise meets the academic requirements of the DPD. Graduates of the program are eligible to apply for admission to accredited dietetics internships/supervised practice programs. Upon successful completion of the experience program, graduates are eligible to take the national examination administered by the Commission on Dietetic Registration to become a Registered Dietitian (RD) / Registered Dietitian Nutritionist (RDN) and to practice in the field of dietetics. There is a $30 fee for a statement of verification of completion of the DPD. For information about verification statements policies, see the dietetics program website: http://www.fshn.hs.iastate.edu/undergraduate-programs/dietetics/.

Students interested in pursuing the dietetics program enter the university designated as pre-dietetics students. During spring semester of the second year, interested students apply to the Didactic Program in Dietetics. Admission to the program is based on overall GPA (3.0 or above required), completion of required coursework, completion of application and demonstrated interest in becoming a registered dietitian. Upon admission, students progress toward earning a Bachelor of Science degree in dietetics and receive a Verification Statement upon graduation, which is needed to enter an accredited dietetics internship. The dietetics program includes study in basic sciences, nutrition, and food science with applications to medical dietetics, nutrition counseling and education, and community nutrition. Foodservice management is also an important aspect of the program. Graduates work in clinical settings, consulting, food companies, food services, sports or athletic programs, corporate wellness programs, care facilities for patients from neonatal to geriatric, and community or school health programs.

Diet and Exercise

A program for concurrent Bachelor of Science and Master of Science (BS/MS) degrees in diet and exercise (http://www.fshn.hs.iastate.edu/undergraduate-programs/diet-exercise) is available. The program is jointly administered by the Department of Food Science and Human Nutrition (FS HN), within the College of Agriculture and Life Sciences and College of Human Sciences, and the Department of Kinesiology within the College of Human Sciences. Students interested in this program enroll as pre-diet and exercise students. In the fall of the third year, students apply for admission to the BS/MS program. Students not accepted into the program can continue toward completion of the BS degree in dietetics or kinesiology and health. Coursework has been designed to facilitate a 4-year graduation date for those students not accepted into the program and electing to complete a single undergraduate degree.

Students accepted into the program will progress toward completion of BS/MS degrees in diet and exercise.

Food Science

Food science is a discipline in which the principles of biological and physical sciences are used to study the nature of foods, the causes of their deterioration, and the principles underlying the processing and preparation of food. It is the application of science and technology to the provision of a safe, wholesome, and nutritious food supply. Biotechnology and toxicology interrelate with food science in the area of food safety. In the food industry, food scientists work in research and development of products or processes, production supervision, quality control, marketing and sales, test kitchens and recipe development, product promotion and communication. Food scientists also work in government regulatory agencies and academic institutions.

Two options are available in food science: food science and technology and food science and industry. Both options are approved by the Institute of Food Technologists, the national professional organization of food science. Career options include quality control/assurance; production supervision; management and sales; research careers in the food industry, government, or academia; business; journalism; food product formulation and recipe development; food promotion and communication; and consumer services in government and industry. Students who have an interest in graduate study or research are encouraged to select the food science and technology option. Students who wish to combine education in engineering with food science may select additional courses in chemical or agricultural engineering. Double majors are available and may require an additional year. For more information: http://www.fshn.hs.iastate.edu/undergraduate-programs/food-science/

Students in food science have the opportunity to pursue a Master of Business Administration (http://www.fshn.hs.iastate.edu/undergraduate-programs/food-science) (MBA) concurrently with the Bachelor of Science (BS) degree in food science. The program is designed so students can earn both the BS in food science and MBA in five years, to meet the needs of students who are interested in management careers in the food industry. Students apply for admission to the MBA program in the spring of the third year. The program for concurrent BS in food science/MBA degrees is a rigorous 5-year program, and admission is very selective.

Nutritional Science

Nutritional science looks at the connection between diet and health. Students learn how diet can play a crucial role in the cause, treatment, and prevention of many diseases. There are degree program options within nutritional science. The pre-health professional and research option coursework prepares students for work in research laboratories, graduate study in nutrition or biological sciences, or entrance into health professional programs, such as medical, dental, physician assistant, and pharmacy schools. Students gain a strong science education along with human nutrition expertise. Additional options in family health, global health and policy, health coach, and nutrition and wellness prepare students for work positions in program planning and evaluation for community, public health, non-profit, and corporate wellness programs addressing the growing public interest in nutrition, wellness, and preventative health. Students learn about the role of nutrition and healthy eating for disease prevention and wellness. The food service option prepares students for school nutrition and food service management positions. For more information: http://www.fshn.hs.iastate.edu/undergraduate-programs/nutritional-science/

Departmental Learning Outcomes

Students graduating with degrees in culinary science, dietetics, diet and exercise, food science, or nutritional science will be able to: 1) demonstrate a high level of technical competence in their chosen field, perform successfully in a graduate program, supervised practice program or entry-level professional position; 2) communicate effectively as professionals; 3) successfully solve complex problems on their own and as members of a team; 4) correctly interpret and critically evaluate research literature as well as data from professional practice; 5) critically evaluate information related to food science and nutrition issues appearing in the popular press; 6) prepare and deliver effective presentations, orally and in writing, of technical information to professionals and to the general public; 7) thoughtfully discuss ethical, social, multicultural, and environmental dimensions of issues facing professionals in their chosen field. For more information: http://www.fshn.hs.iastate.edu/undergraduate-programs/outcomes/

Communication Proficiency is certified by a grade of C or better in 6 credits of coursework in composition (ENGL 150 Critical Thinking and Communication and ENGL 250 Written, Oral, Visual, and Electronic Composition or other communication-intensive courses) and a grade of C or better in 3 credits of coursework in oral communication.

Minors - Undergraduate

The department offers coursework for a variety of minors (http://www.fshn.hs.iastate.edu/undergraduate-programs/minors). Minors available include:

- culinary food science
- food safety (interdepartmental minor)
- food science
- nutrition
- food and society

All minors have the following requirements:

- At least 15 credits must be taken, including at least 6 credits taken at Iowa State University in courses numbered 300 or above.

- The minor must include at least 9 credits that are not used to meet any other college or university requirement.
- The same courses may not be applied to two different minors.

Prerequisites: Students must complete prerequisite requirements for courses included in the minor.

Graduate Study

The Food Science and Human Nutrition (FSHN) Department offers coursework for the degrees master of science and doctor of philosophy with majors in food science and technology and in nutritional sciences, and minors in food science and technology and in nutrition. Graduate work in meat science is offered as a co-major in animal science and food science and technology.

Prerequisite to major work is a baccalaureate degree in food science, nutrition, or other physical or biological sciences or engineering that is substantially equivalent to those at Iowa State University.

Students taking major work for the degree doctor of philosophy either in food science and technology or in nutritional sciences may choose minors from other fields including anthropology, biorenewable resources and technology, chemistry, biochemistry, economics, education, journalism, microbiology, psychology, physiology, statistics, toxicology, or other related fields.

The Food Science and Technology (FST) graduate program offers MS and PhD degrees in the general areas of Food Chemistry and Functionality, Food Safety and Microbiology, and Food Processing. The FST core curriculum and interdisciplinary faculty team provides holistic graduate student training. Individuals with an undergraduate or graduate degree from a variety of academic training backgrounds, such as food sciences and the various disciplines of biology, chemistry, and agricultural sciences, may enter the FST program.

The interdepartmental graduate program in nutritional sciences, administered through the Graduate College, under the auspices of the Chairs of FSHN and Animal Science, will provide the structure for coordinating and enhancing interdisciplinary nutrition research and graduate education. Graduate students will be able to select from three specializations: animal nutrition, human nutrition, or molecular/biochemical nutrition. The three main departments are FSHN, Animal Science, and Kinesiology, whereas other departments (such as; Biochemistry, Biophysics, and Molecular Biology; Agronomy; and Statistics) may also be involved. (See Nutritional Sciences interdepartmental graduate major).

The department participates in an online Master of Family and Consumer Sciences/Dietetics in conjunction with Colorado State University, Kansas State University, North Dakota State University, Oklahoma State University, South Dakota State University, University of Kansas Medical Center, and University of Nebraska through the Great Plains Interactive Distance Education Alliance. Students who are registered dietitians and are eligible for admission to the FSHN Master's degree program may be admitted.

The department also offers an online 12-13 credit Graduate Certificate in Food Safety and Defense, in conjunction with the University of Nebraska, Lincoln, Kansas State University and the University of Missouri through the Great Plains Interactive Distance Education Alliance. Course topics include food microbiology, food defense, food toxicology, HACCP, and additional topics related to food safety. Students may be admitted if qualified for admission to the food science master's degree program.

The department offers work for concurrent B.S. and M.S. degree programs that allow students to obtain both the B.S. and M.S. degrees in 5 years. The programs are available to students majoring in nutritional science or pre-diet and exercise, and students progress toward M.S. degrees in nutritional sciences or diet and exercise, respectively. Students interested in these programs should contact the department for details. Application for admission to the Graduate College should be made during the junior year. Students begin research for the M.S. thesis or creative component during the summer after their junior year and are eligible for research assistantships.

Students graduating with advanced degrees in nutritional sciences and in food science and technology will demonstrate competency in their chosen discipline. Measurable outcomes will include the ability to:

- Apply scientific thinking to the analysis, synthesis and evaluation of knowledge within the discipline of food science, nutritional sciences, or dietetics
- Apply ethical reasoning within the discipline of food science, nutritional sciences or dietetics
- Effectively communicate discipline-specific information in written and oral forms to scientific audiences
- Effectively interact within scientific teams
- Facilitate learning within FSHN courses

Minors - Graduate

The department offers coursework for graduate minors in:

- food science/technology (http://www.fshn.hs.iastate.edu/graduate-program/food-science-technology/#minor-in-food-science-and-technology)
- nutritional sciences (http://www.fshn.hs.iastate.edu/graduate-program/nutritional-sciences/#minor-in-nutritional-sciences)

Food Science and Technology Graduate Minor students must complete the following:

- 9 to 12 credits. Students without a background in food chemistry, food engineering/processing, and/or food microbiology are required to take FSHN 511, 513, and/or 514, respectively, in which case the graduate minor will constitute up to 12 credits.
- 9 credits of graduate level food science coursework as approved by the POS committee.
- Maximum of 3 credits at the 400 level.

Nutritional Sciences Graduate Minor students must complete the following:

- 9 to 12 credits are required. Students who have not taken FSHN 360 or its equivalent (advanced nutrition with a biochemistry perquisite) will need to take FSHN 360, in which case the Nutrition Graduate minor will constitute 12 credits.
- 9 credits of graduate level nutrition courses as approved by the POS Committee.
- NUTRS 501

Certificate - Undergraduate

Health Coach (http://www.fshn.hs.iastate.edu/undergraduate-programs/health-coach-certificate)

The undergraduate health coach certificate provides a rigorous academic and theoretical background in three components of health (nutrition, exercise and motivational coaching) required to prepare workers for the challenges of being a health coach.

Certificates - Graduate

Food Safety and Defense (http://www.fshn.hs.iastate.edu/graduate-program/food-safety-defense)

The department offers an online 12-13 credit Graduate Certificate in Food Safety and Defense, in conjunction with the University of Nebraska, Lincoln, Kansas State University and the University of Missouri through the Great Plains Interactive Distance Education Alliance. Students may be admitted if qualified for admission to the food science master's degree program .

Dietetics Internship (http://www.dietetics.iastate.edu)

The Iowa State University Dietetics Internship (DI) began as an AP4 program in 1989. It meets the performance requirements for supervised practice programs for students who have completed the academic requirements of the Academy of Nutrition and Dietetics. The internship is administered through the Department of Food Science and Human Nutrition. Interns are admitted to Iowa State University as graduate students seeking a "Graduate Certificate in Dietetics Internship" which will be indicated on the final transcript. Successful completion of this program will result in the receipt of the DI Verification Statement which establishes eligibility to sit for the national standardized exam administered by the Commission on Dietetic Registration (CDR). Successful completion of the exam results in the Registered Dietitian (RD) / Registered Dietitian Nutritionist (RDN) credential. There is a nonrefundable application fee of $75.

Courses primarily for undergraduates:

FS HN 101: Food and the Consumer
(3-0) Cr. 3. F.S.
Prereq: High school biology and chemistry or 3 credits each of biology and chemistry
The food system from point of harvest to the consumption of the food by the consumer. Properties of food constituents. Protection of food against deterioration and microbial contamination. Introduction of foods into the marketplace. Processes for making various foods. Government regulations. Use of food additives. Current and controversial topics. Electronic communication from web emphasized for class reports, notes and assignments.

FS HN 102: Nutrition for Sport Performance
(1-0) Cr. 1. F.S.
Analysis of how the body uses nutrients for energy and how to select a balanced diet to meet specific athletic performance needs. Lecture and activities specific to students' interest.

FS HN 104: Introduction to Professional Skills in Culinary Science
(0-6) Cr. 1. S.
Introduction to culinary science. Students will develop fundamental culinary skills by arranged on-campus work experience (100 hours). Sessions with instructor arranged.

FS HN 110: Professional and Educational Preparation
(1-0) Cr. 1. F.S.
Introduction to professional and educational development within the food science and human nutrition disciplines. Focus is on university and career acclimation as well as enhancement of communication skills. Offered on a satisfactory-fail basis only.

FS HN 111: Fundamentals of Food Preparation
(2-0) Cr. 2. F.S.
Prereq: FS HN 101 or FS HN 167; high school chemistry or CHEM 160; concurrent enrollment in FSHN 115.
Principles involved in preparation of food products of standard quality. Influence of composition and techniques on properties of food products.

FS HN 115: Food Preparation Laboratory
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in FS HN 111 or FS HN 214
Practice standard methods of food preparation with emphasis on quality, nutrient retention, and safety.

FS HN 120: The Biochemistry of Beer
(Cross-listed with BBMB). (2-0) Cr. 2. F.
An introduction to the major classes of biomolecules, basic biochemical concepts, enzymology, metabolism and genetic engineering as they apply to the production and flavor of beer. All aspects of the biochemistry of beer will be covered, including the malting of barley, starch conversion, yeast fermentation and the chemical changes that occur during the aging of beer. Intended for non-majors. Natural science majors are limited to elective credit only.

FS HN 167: Introduction to Human Nutrition
(3-0) Cr. 3. F.S.SS.
Prereq: High school biology or 3 credits of biology
Understanding and implementing present day knowledge of nutrition. The role of nutrition in the health and well being of the individual and family.

FS HN 203: Contemporary Issues in Food Science and Human Nutrition
(1-0) Cr. 1. F.S.
Introduction to published research and discussion of current issues in food science and human nutrition. Emphasis on sources of credible information, ethics, and communication.

FS HN 214: Scientific Study of Food
(3-0) Cr. 3. F.S.
Prereq: FS HN 167 or FS HN 265; CHEM 231 or CHEM 331; plus concurrent enrollment in FS HN 115 or 215
Composition and structure of foods. Principles of preparation of standard quality food products. Behavior and interactions of food constituents.

FS HN 215: Advanced Food Preparation Laboratory
(0-6) Cr. 2. F.S.
Prereq: Credit or enrollment in FS HN 214
Practice standard methods of food preparation with emphasis on quality, nutrient retention, and safety. Development of culinary skills and advanced food preparation.

FS HN 242: The US Food System
(3-0) Cr. 3. S.
Exploration of the components of our food system including food production, food processing, and food access and the social, political and ethical influences on these components. Controversial topics related to how food is produced, processed, marketed and consumed will be discussed.

FS HN 264: Fundamentals of Nutritional Biochemistry and Metabolism
(3-0) Cr. 3. F.
Prereq: FS HN 167; CHEM 163, CHEM 163L; BIOL 211
Digestion, absorption, metabolism, and biochemical functions of nutrients. Biochemical aspects of nutrient deficiencies.

FS HN 265: Nutrition for Active and Healthy Lifestyles
(3-0) Cr. 3. S.
Prereq: FS HN 167, plus credit or enrollment in BBMB 301 or credit in FS HN 264
Fundamentals of nutrient metabolism and nutrient requirements. Role of macronutrient metabolism in physical performance and disease prevention. Effect of manipulation of macronutrient metabolism on physical performance and disease prevention. Applications of nutrient metabolism principles to dietary recommendations and planning.

FS HN 276: Understanding Grape and Wine Science
(Cross-listed with HORT). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: High school biology and chemistry.
A scientific introduction to viticulture (grape-growing) and enology (wine-making). Topics include grape species and varieties, viticulture practices, fruit quality, geography, history, principles of fermentation and aging, wine classification, appreciation, evaluation, storage and service, regulations, wine as food. No wine tasting.

FS HN 308: Dairy Products: Current Issues and Controversies
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Course will address milk chemistry, microbiology, handling, processing, regulations, organic production, and nutrition; dispel myths about dairy foods; improve critical thinking and communication skills. Students will participate in structured controversies and debate.

FS HN 311: Food Chemistry
(3-0) Cr. 3. F.
Prereq: CHEM 231 and CHEM 231L or CHEM 331 and CHEM 331L; credit or enrollment in BBMB 301
The structure, properties, and chemistry of food constituents and animal and plant commodities.

FS HN 311L: Food Chemistry Laboratory
(0-3) Cr. 1. F.
Prereq: Credit or concurrent enrollment in FSHN 311.
The laboratory practices of structure, properties, and chemistry of food constituents.

FS HN 314: Foundations of Culinary Science
(1-0) Cr. 1. S.
Prereq: FSHN 104 or concurrent enrollment in FSHN 104.
Introduction to the roles culinary scientists hold within industry including product development, research, and quality assurance. Discussions focused on professional and educational development, enhancement of communication skills, ethics and emerging issues and trends in culinary science.

FS HN 340: Foundations of Dietetic Practice
(1-0) Cr. 1. F.
Prereq: DIET or PDEX classification
Introduction to the profession of dietetics and responsibilities associated with dietetic professional practice. Emphasis on exploring career options in dietetics and preparation for a dietetic internship. Leadership and professional career development for the dietitian is addressed through self reflection, creation of materials for post-baccalaureate programs and job shadowing experience. Professional issues related to dietetic practice include Code of Ethics, legal credentialing and standards of professional practice, leadership and future trends in the profession. Offered on a satisfactory-fail basis only.

FS HN 342: World Food Issues: Past and Present
(Cross-listed with AGRON, ENV S, T SC). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

FS HN 351: Introduction to Food Engineering Concepts
(3-0) Cr. 3. S.
Prereq: A course in calculus and physics (PHYS 111 or PHYS 115)
Methodology for solving problems in food processing and introduction to food engineering concepts including food properties, material and energy balances, sources of energy, thermodynamics, fluid flow, heat transfer, and mass transfer.

FS HN 360: Advanced Human Nutrition and Metabolism
(3-0) Cr. 3. F.
Prereq: FS HN 265, 3 credits in biochemistry; 3 credits in physiology recommended
Physiological and biochemical basis for nutrient needs; assessment of nutrient deficiency and toxicity; examination of nutrient functions and regulation of metabolism; nutrient-gene interactions.

FS HN 361: Nutrition and Health Assessment
(1-3) Cr. 2. S.
Prereq: FS HN 265; 3 credits in statistics; 3 credits in physiology recommended
The assessment of nutritional status in healthy individuals. Laboratory experiences in food composition and assessment of dietary intake, body composition, and biochemical indices of nutritional status.

FS HN 362: Nutrition in Growth and Development
(3-0) Cr. 3. S.
Prereq: FS HN 360; credit or enrollment in a course in physiology
Nutrient needs throughout the life cycle. Interrelationships of genes, gene expression and nutrients with physiological outcomes during human development and aging.

FS HN 364: Nutrition and Prevention of Chronic Disease
(3-0) Cr. 3. F.
Prereq: BIOL 256, BIOL 256L or BIOL 306
Overview of nutrients, their functions, metabolism, food sources and optimal choices for the promotion of health and wellness. Nutrition strategies for the prevention of chronic disease, including cancer, diabetes and obesity, as they apply to individuals or the wider population will be discussed.

FS HN 365: Obesity and Weight Management
(3-0) Cr. 3. S.
Prereq: BIOL 256 and BIOL 256L, or BIOL 306
Multifactorial aspects of obesity, maintenance of healthy weight, and the relationship of weight status and chronic disease prevention. Traditional and novel nutrition and exercise theories as well as current popular diet and exercise trends will be discussed.

FS HN 366: Communicating Nutrition Messages
(3-0) Cr. 3. S.
Prereq: FS HN 264 or FS HN 265
Theory and application of adult learning and behavior change as it relates to the role of nutrition in health promotion and disease prevention. Discussion of nutrition education and interventions relative to various models. Factors to consider in developing the nutrition education/intervention practicum experience. Focus on communication strategies for providing nutrition messages to diverse community audiences using various forms of media and outreach (print, radio, TV, newspaper, consumer publications, websites, community venues). Development of nutrition messages using various forms of media for a target population.

FS HN 367: Medical Terminology for Health Professionals
(1-0) Cr. 1. F.S.SS.
An independent course focused on medical terminology, abbreviations, and simple clinical mathematical calculations. (offered online only).

FS HN 403: Food Laws and Regulations
(2-0) Cr. 2. S.SS.
Prereq: 3 credits in food science coursework at 200 level or above
History of food law in the US and the world. Relationship between policy, legislation and regulation. Introduction to primary US regulatory agencies and enforcement principles. Discussion of key laws related to food safety and nutrition. Overview of federal and independent research tools and sources of food law.

FS HN 405: Food Quality Assurance
(Dual-listed with FS HN 505). (2-3) Cr. 3.
Prereq: FS HN 214 or FS HN 311; STAT 101 or STAT 104
Basis of food quality control/assurance programs and establishment of decision-making processes using official (government and industry) instrumental, chemical, and sensory procedures. Statistical process and quality control procedures and their applications to various food systems. Development of hazard analysis procedures, specifications, grades, standards, and the procedures and processes which can affect the overall microbiological safety of the food. Successful completion of the course will result in certification in Preventive Controls for Human Food (FSMA).

FS HN 406: Sensory Evaluation of Food
(Dual-listed with FS HN 506). (2-3) Cr. 3. F.
Prereq: FS HN 214 or FS HN 311 or AN S 360; 3 credits in statistics
Sensory evaluation techniques used to evaluate the appearance, aroma, flavor, texture and acceptability of foods. Relationships between sensory and instrumental measurements of color and texture. Work independently and cooperatively (in a team) to identify sensory evaluation objectives, write hypotheses, design and conduct experiments, and analyze and interpret data.

FS HN 407: Microbiological Safety of Foods of Animal Origins
(Dual-listed with FS HN 507). (Cross-listed with MICRO). (3-0) Cr. 3. S.
Prereq: MICRO 420
Examination of the various factors in the production of foods of animal origin, from animal production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. The two modules of this course will be 1) the procedures and processes which can affect the overall microbiological safety of the food, and 2) the Hazard Analysis Critical Control Point (HACCP) system.

FS HN 408: Dairy Products Evaluation
(0-3) Cr. 1. S.
Prereq: Permission of instructor
Gain experience in identifying quality defects in dairy products including milk, cottage cheese, cheddar cheese, strawberry yogurt, butter, and vanilla ice cream. Intensive training for the National Collegiate Dairy Products Evaluation competition and for dairy product evaluation in the food industry.

FS HN 410: Food Analysis
(2-3) Cr. 3. F.
Prereq: FS HN 214 or FS HN 311 or CHEM 211
An introduction to the theory and application of chemical and instrumental methods for determining the constituents of food. Use of standard procedures for food analysis and food composition data bases.

FS HN 411: Food Ingredient Interactions and Formulations
(1-3) Cr. 2. F.S.
Prereq: FSHN 214 or FS HN 311 and FS HN 115, FS HN 215 or FS HN 311L.
Application of food science principles to ingredient substitutions in food products. Laboratory procedures for standard formulations and instrumental evaluation, with emphasis on problem-solving and critical thinking.

FS HN 412: Food Product Development
(Dual-listed with FS HN 512). (1-6) Cr. 3. F.S.
Prereq: FS HN 311 or FS HN 411
Principles of developing consumer packaged food products. Application of skills gained in food chemistry, formulation, microbiology, and processing. Some pilot plant experiences. Electronic communication from web emphasized for class reports, notes and assignments.

FS HN 419: Foodborne Hazards
(Cross-listed with MICRO, TOX). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MICRO 201 or MICRO 302, a course in biochemistry
Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

FS HN 420: Food Microbiology
(Cross-listed with MICRO, TOX). (3-0) Cr. 3.
Prereq: MICRO 201 or MICRO 302
Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications.

FS HN 421: Food Microbiology Laboratory
(Cross-listed with MICRO). (0-6) Cr. 3.
Prereq: MICRO 201 or MICRO 302; MICRO 201L or MICRO 302L. Credit or enrollment in FS HN/MICRO 420
Standard techniques used for the microbiological examination of foods. Independent and group projects on student-generated questions in food microbiology. Emphasis on oral and written communication and group interaction.

FS HN 440: Bioprocessing and Bioproducts
(Dual-listed with FS HN 540). (Cross-listed with C E). (3-0) Cr. 3. F.
Prereq: C E 326 or equivalent, MATH 160 or MATH 165, CHEM 167 or higher, BIOL 173 or BIOL 211 or higher, senior or graduate classification
Sustainability, cleaner production. Taxonomy, kinetics, metabolism, microbial cultivation, aerobic and anaerobic fermentation. Antibiotics, food supplements, fermented foods, vitamin production. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis.

FS HN 442: Issues in Food and Society
(2-0) Cr. 2. F.
Prereq: FS HN 242, FS HN 342
In-depth discussion, synthesis, and analysis of domestic and international food issues including: food systems from farm to fork, poverty and world hunger, overnutrition, population, agriculture and the environment, ethics, biotechnology, and policy.

FS HN 460: Global Nutrition
(Dual-listed with NUTRS 560 FS HN 560). (3-0) Cr. 3.
Prereq: FS HN 361 or equivalent; senior or graduate standing
An overview of global nutrition issues, including the sociocultural, biological, economic, and environmental context of nutrition related topics. The etiology, epidemiology, and program/policy responses to issues will be presented. Areas to be covered include childhood malnutrition, growth stunting, micronutrient deficiencies, parasites and nutrition, sanitation, and obesity and chronic disease incidence in developing countries. Participatory course, students will engage in a series of class activities, discussions, and presentations.

FS HN 461: Medical Nutrition and Disease I
(4-0) Cr. 4. F.
Prereq: FS HN 360, FS HN 361, FS HN 367; plus BIOL 256 and 256L or BIOL 306 or BIOL 335
(Dual-listed with NutrS 561) Pathophysiology of selected chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state.

FS HN 463: Community Nutrition
(3-0) Cr. 3. F.
Prereq: FS HN 265 or FS HN 360; FS HN 366 recommended
Dual-listed with NutrS 563. Survey of current public health nutrition problems among nutritionally vulnerable individuals and groups. Discussion of the multidimensional nature of those problems and of community programs addressing them. Grant writing as a means for funding community nutrition program development. Significant emphasis on written and oral communication at the lay and professional level. Field trip.
Meets U.S. Diversity Requirement

FS HN 464: Medical Nutrition and Disease II
(3-0) Cr. 3. S.
Prereq: FS HN 360, FS HN 461; plus BIOL 256 and BIOL 256L or BIOL 306 or BIOL 335
(Dual-listed with NutrS 564) Pathophysiology of selected acute and chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state.

FS HN 466: Nutrition Counseling and Education Methods
(Dual-listed with FS HN 566). (2-2) Cr. 3. F.
Prereq: FS HN 361 and FS HN 362
Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories.

FS HN 467: Molecular Basis of Nutrition in Disease Prevention
(3-0) Cr. 3. S.
Prereq: FS HN 360 or equivalent
Understanding the molecular basis for the role of diet in the development and prevention of common diseases such as diabetes, cancer, and vascular diseases. Translating this understanding into practical approaches for improving the health of individuals and populations.

FS HN 471: Food Processing I
(2-3) Cr. 3. F.
Prereq: FS HN 351 or A E 451 or CH E 357; MICRO 201 or 302; CHEM 163 or 177.
Principles and applications of food processing by application of heat (blanching, pasteurization, canning, extrusion, evaporation and distillation, extrusion and dehydration) and by removal of heat (refrigeration and freezing). Emphasis on solving problems in laboratory and recitation sessions.

FS HN 472: Food Processing II
(2-3) Cr. 3. S.
Prereq: FS HN 351 or A E 451 or CH E 357.
Principles and applications of food processing by biological 9fermentation, enzymes) and nontraditional (high pressure, irradiation, pulsed electric field) preservation methods. Includes packaging, waste water treatment, and sanitation. Emphasis on solving problems in laboratory and recitation sessions.

FS HN 480: Professional Communication in Food Science and Human Nutrition
(1-0) Cr. 1. F.S.
Prereq: FS HN 203, senior classification in the department
Presentation of current topics using written and oral communication to a lay audience. Emphasis on communication skills for the profession.

FS HN 489: Issues in Food Safety
(Cross-listed with AN S, HSP M, VDPAM). (1-0) Cr. 1. S.
Prereq: Credit or enrollment in FS HN 101 or FS HN 272 or HSP M 233; FS HN 419 or FS HN 420; FS HN 403
Capstone seminar for the food safety minor. Case discussions and independent projects about safety issues in the food system from a multidisciplinary perspective.

FS HN 490: Independent Study
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490A: Independent Study: Dietetics
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490B: Independent Study: Food Science
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490C: Independent Study: Nutrition
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490D: Independent Study: International Experience
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490E: Independent Study: Entrepreneurship
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 490H: Independent Study: Honors
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of instructor
Independent work in food science, nutrition, or dietetics. A maximum of 6 credits of FS HN 490 may be used toward graduation.

FS HN 491: Supervised Work Experience
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 491A: Supervised Work Experience: Dietetics
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 491B: Supervised Work Experience: Food Science
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 491C: Supervised Work Experience: Nutrition
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 491D: Supervised Work Experience: Culinary Science
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Advance approval of instructor and adviser
Supervised off-campus work experience relevant to the academic major. Offered on a satisfactory-fail basis only. A maximum of 4 credits of FS HN 491 may be used toward graduation.

FS HN 492: Research Concepts in Human Nutrition
(1-3) Cr. 2. F.
Prereq: senior classification or permission of instructor; FS HN 360
Students will develop and implement research projects with faculty supervision, based on knowledge gained from nutrition, biology and chemistry courses. Students will prepare a research proposal, conduct research and report results. Students will gain appreciation for independent research and experience creative and innovative aspects of nutrition research.

FS HN 493: Food Preparation Workshop
(1-3) Cr. 1-3.
Selected topics in food preparation including scientific principles, culture and culinary techniques. Variable format may include laboratory, recitation, and lecture. Offered on a satisfactory-fail basis only.

FS HN 495: Practicum
(1-3) Cr. 2. F.S.
Prereq: Senior classification in Nutritional Science-Nutrition and Wellness option or permission of instructor; FS HN 366; credit or enrollment in FS HN 463.
Students will develop, implement and assess a community-based project that engages groups in learning and practicing concepts related to nutrition and wellness. Assessed service learning component.

FS HN 496: Food Science and Human Nutrition Travel Course
(Dual-listed with FS HN 596). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled and 1 credit for pre-departure class, if offered.) Limited enrollment. Tour and study of food industry, culinary science, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

FS HN 496A: Food Science and Human Nutrition Travel Course: International travel
(Dual-listed with FS HN 596A). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.
Meets International Perspectives Requirement.

FS HN 496B: Food Science and Human Nutrition Travel Course: Domestic travel
(Dual-listed with FS HN 596B). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

FS HN 498: Cooperative Education
Cr. R. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Permission of department chair.
Required for students completing professional work periods in a cooperative education program. Students must register prior to commencing each work period. Offered on a satisfactory-fail basis only.

FS HN 499: Undergraduate Research
Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Permission of staff member with whom student proposes to work
Research under staff guidance. A maximum of 6 credits of FS HN 499 may be used toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

FS HN 505: Food Quality Assurance
(Dual-listed with FS HN 405). (2-3) Cr. 3.
Prereq: FS HN 214 or FS HN 311; STAT 101 or STAT 104
Basis of food quality control/assurance programs and establishment of decision-making processes using official (government and industry) instrumental, chemical, and sensory procedures. Statistical process and quality control procedures and their applications to various food systems. Development of hazard analysis procedures, specifications, grades, standards, and the procedures and processes which can affect the overall microbiological safety of the food. Successful completion of the course will result in certification in Preventive Controls for Human Food (FSMA).

FS HN 506: Sensory Evaluation of Food
(Dual-listed with FS HN 406). (2-3) Cr. 3. F.
Prereq: FS HN 214 or FS HN 311 or AN S 360; 3 credits in statistics
Sensory evaluation techniques used to evaluate the appearance, aroma, flavor, texture and acceptability of foods. Relationships between sensory and instrumental measurements of color and texture. Work independently and cooperatively (in a team) to identify sensory evaluation objectives, write hypotheses, design and conduct experiments, and analyze and interpret data.

FS HN 507: Microbiological Safety of Foods of Animal Origins
(Dual-listed with FS HN 407). (Cross-listed with MICRO). (3-0) Cr. 3. S.
Prereq: MICRO 420
Examination of the various factors in the production of foods of animal origin, from animal production through processing, distribution and final consumption which contribute to the overall microbiological safety of the food. The two modules of this course will be 1) the procedures and processes which can affect the overall microbiological safety of the food, and 2) the Hazard Analysis Critical Control Point (HACCP) system.

FS HN 511: Integrated Food Science
(3-0) Cr. 3. F.
Prereq: 3 credits in each of organic chemistry, physics, mathematics, and microbiology.
Critical review of the key principles of food science and applications in the chemistry, microbiology, and processing of food. Understanding of the impact of processing on the quality of foods with respect to composition, quality and safety.

FS HN 512: Food Product Development
(Dual-listed with FS HN 412). (1-6) Cr. 3. F.S.
Prereq: FS HN 311 or FS HN 411
Principles of developing consumer packaged food products. Application of skills gained in food chemistry, formulation, microbiology, and processing. Some pilot plant experiences. Electronic communication from web emphasized for class reports, notes and assignments.

FS HN 519: Food Toxicology
(Cross-listed with NUTRS, TOX). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A course in biochemistry
Basic principles of toxicology. Toxicants in the food supply: modes of action, toxicant defense systems, toxicant and nutrient interactions, risk assessment. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

FS HN 521: Microbiology of Food
(2-0) Cr. 2. S.SS.
Prereq: A course in microbiology with laboratory; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
This course deals with the identification, enumeration, and characterization of bacteria, yeasts, and mold associated with foods and food processing. Effects of physical and chemical agents on micro-organisms will be studied. Microbiological problems in food spoilage, food preservation, food fermentation, and food-borne disease will be discussed. Offered online only.

FS HN 522: Advanced Food Microbiology and Biotechnology
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Food microbiology, a course in biochemistry; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
This course will cover basic principles in biotechnology and applied food microbiology, including current topics of interest in food biotechnology. Students will be introduced to recombinant DNA techniques and how they are applied to genetically modify microorganisms, the use of nucleic acids as tools of rapid detection of microorganisms in foods, basic enzyme immobilization and down-stream processing techniques, and regulatory aspects of food biotechnology. Offered online only.

FS HN 523: A Multidisciplinary Overview of Food Safety and Security
(2-0) Cr. 2. F.SS.
Prereq: A course in biology or chemistry; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Multidisciplinary food safety and security perspectives provided by numerous subject matter experts. Topics include food safety policy, ag bioterrorism, border security, animal ID, food defense and site security, risk analysis, crisis communication, epidemiology, HACCP, and more. Offered online only.

FS HN 524: Food Microbiology
(3-0) Cr. 3. F.
Prereq: A course in microbiology with laboratory; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Food Microbiology looks at the nature, physiology, and interactions of microorganisms in foods. The course is an introduction to food-borne diseases, the effect of food processing systems on the microflora of foods, principles of food preservation, food spoilage, and foods produced by microorganisms. Additionally, the course looks at food plant sanitation and criteria for establishing microbial standards for food products. Offered online only.

FS HN 525: Principles of HACCP
(2-0) Cr. 2. F.
Prereq: Undergraduate biology and chemistry courses;enrollment in GP-IDEA Food Safety and Defense Certificate or permission of instructor.
A comprehensive study of the Hazard Analysis and Critical Control Point System and its application in the food industry. Offered online only.

FS HN 526: Ethnic Foods: Food Safety, Food Protection and Defense
(2-0) Cr. 2. SS.
Prereq: Graduate standing; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Understanding of the various factors that impact safety of ethnic and imported ethnic foods; knowledge about the handling, preparation, processing and storage of ethnic and imported foods and food products; science-based characterization of representative ethnic foods. Offered online only.

FS HN 527: Microbiology of Fermented Foods
(2-0) Cr. 2. SS.
Prereq: Food microbiology; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Microbiology of fermented foods covers the physiology, biochemistry, and genetics of microorganisms important in food fermentations. The course looks at how microorganisms are used in fermentations and the effects of processing and manufacturing conditions on production of fermented foods. Offered online only.

FS HN 528: Food Protection and Defense-Essential Concepts
(2-0) Cr. 2. S.
Prereq: Enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
This course will provide students with an understanding of the principles required in a food defense program for a food manufacturing, warehousing or distribution center. The topics covered include: defining threats and aggressors; the Bioterrorism Act; food defense teams; vulnerability assessments; security programs; recall and traceability basics; security inspections; crisis management; emergency preparedness; and workplace violence. Offered online only.

FS HN 529: Foodborne Toxicants
(Cross-listed with TOX). (2-0) Cr. 2. F.
Prereq: A course in biochemistry; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Mechanisms of action, metabolism, sources, remediation/detoxification, risk assessment of major foodborne toxicants of current interest, design of HAACP plans for use in food industries targeting foodborne toxicants, discussion of toxicants from a food defense perspective. Offered online only.

FS HN 540: Bioprocessing and Bioproducts
(Dual-listed with FS HN 440). (Cross-listed with BRT, C E). (3-0) Cr. 3. F.
Prereq: C E 326 or equivalent, MATH 160 or MATH 165, CHEM 167 or higher, BIOL 173 or BIOL 211 or higher, senior or graduate classification
Sustainability, cleaner production. Taxonomy, kinetics, metabolism, microbial cultivation, aerobic and anaerobic fermentation. Antibiotics, food supplements, fermented foods, vitamin production. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis.

FS HN 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

FS HN 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

FS HN 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

FS HN 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

FS HN 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

FS HN 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

FS HN 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

FS HN 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

FS HN 554: Dietetic Internship I
(0-22) Cr. 5. S.SS.
For students enrolled in the Dietetic Internship program only. Supervised practice experience in operational management, medical nutrition therapy and community nutrition. Capstone research project: Technology in Health Promotion. Experiences and activities designed to meet accreditation standards.

FS HN 555: Dietetic Internship II
(0-18) Cr. 4. F.S.
Prereq: Concurrent enrollment or successful completion of FS HN 554
For students enrolled in the Dietetic Internship program only. Supervised practice experience in operational management, medical nutrition therapy and community nutrition. Capstone research project: Leadership Challenge. Experiences and activities designed to meet accreditation standards.

FS HN 556: Dietetic Internship III
(0-22) Cr. 5. F.SS.
Prereq: Concurrent enrollment or successful completion of FS HN 554 and FS HN 555
For students enrolled in the Dietetic Internship program only. Supervised practice experience in operational management, medical nutrition therapy and community nutrition. Capstone research project: Evidenced Analysis Based Clinical Presentation. Experiences and activities designed to meet accreditation standards.

FS HN 560: Global Nutrition
(Dual-listed with FS HN 460). (Cross-listed with NUTRS). (3-0) Cr. 3.
Prereq: FS HN 361 or equivalent; senior or graduate standing
An overview of global nutrition issues, including the sociocultural, biological, economic, and environmental context of nutrition related topics. The etiology, epidemiology, and program/policy responses to issues will be presented. Areas to be covered include childhood malnutrition, growth stunting, micronutrient deficiencies, parasites and nutrition, sanitation, and obesity and chronic disease incidence in developing countries. Participatory course, students will engage in a series of class activities, discussions, and presentations.

FS HN 566: Nutrition Counseling and Education Methods
(Dual-listed with FS HN 466). (Cross-listed with DIET). (2-2) Cr. 3. F.
Prereq: FS HN 361 and FS HN 362
Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories.

FS HN 575: Processed Foods
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: FS HN 214 or FS HN 311; a course in nutrition
This course will examine effect of industrial and domestic food processing on the nutrient content of food and risk of developing chronic disease.

FS HN 580: Orientation to Food Science and Nutrition Research
(1-0) Cr. 1. F.
Orientation to and discussion of research interests in food science and nutrition. Discussion of policy and ethical issues in the conduct of research. Intended for entering students in FS HN. Offered on a satisfactory-fail basis only.

FS HN 581: Seminar
(1-0) Cr. 1. S.
Discussion and practice of oral presentation of scientific data in a professional setting. Discussion of issues related to data presentation. Intended for graduate students in their first or second semester in FS HN.

FS HN 590: Special Topics
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

FS HN 590A: Special Topics: Nutrition
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

FS HN 590B: Special Topics: Food Science
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

FS HN 590C: Special Topics: Teaching
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.

FS HN 596A: Food Science and Human Nutrition Travel Course: International travel
(Dual-listed with FS HN 496A). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.
Meets International Perspectives Requirement.

FS HN 596B: Food Science and Human Nutrition Travel Course: Domestic travel
(Dual-listed with FS HN 496B). Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor
(One credit per week traveled.) Limited enrollment. Tour and study of food industry, dietetic and nutritional agencies in different regions of the world. Pre-travel session arranged. Travel expenses paid by students.

FS HN 597: Nutritional Aspects of Oncology
(Cross-listed with DIET, NUTRS). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: B.S. in nutrition, dietetics, biology, or related discipline.
Understanding of basic cancer biology and methodology used to study nutrition and cancer relationships. Using current research as a basis, the role of nutrition in specific cancers will be explored. Students will learn about sources of information for cancer prevention programs, and how to apply this information to clinical patient management.

FS HN 599: Creative Component
Cr. arr.
Nonthesis option only.

Courses for graduate students:

FS HN 606: Advanced Food Analysis and Instrumentation
(3-3) Cr. 4. Alt. S., offered odd-numbered years.
Prereq: FS HN 311, or FS HN 410, or FS HN 511 or equivalent.
Instrumental methods for measuring chemical and physical properties of foods, food quality and functionality. Techniques for methods development, sample preparation, optimization of operating conditions, and data analysis needed to obtain accurate, reproducible results by means of instrumentation.

FS HN 611: Advanced Food Processing
(Cross-listed with BRT). (3-0) Cr. 3. F.
Prereq: FS HN 311, or FS HN 471/472 or equivalent, or FS HN 511.
Recent advances in the science and technology of food processing and preservation; examples include both thermal and non-thermal processes, including cold plasma, nanotechnology, food packaging, and extrusion. Advances in extraction and separation technologies, waste management, by-product utilization, biorenewables and sustainability in food processing industry will also be discussed. Students to research on select topics and present.

FS HN 612: Advanced Food Chemistry
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: FS HN 311, or FS HN 411, or FS HN 511, or BBMB 404, or equivalent.
Structure, chemical and physical properties of lipids, proteins and carbohydrates, and their food and industrial applications. Changes in functionalities during processing and storage.

FS HN 626: Advanced Food Microbiology
(Cross-listed with MICRO, TOX). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials.

FS HN 627: Rapid Methods in Food Microbiology
(Cross-listed with MICRO, TOX). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Provides an overview of rapid microbial detection methods for use in foods. Topics include historical aspects of rapid microbial detection, basic categories of rapid tests (phenotypic, genotypic, whole cell, etc.), existing commercial test formats and kits, automation in testing, sample preparation and "next generation" testing formats now in development.

FS HN 681: Seminar
(1-0) Cr. 1. F.S.SS.
Presentation of thesis or dissertation research. May be taken once for M.S. program and twice for the Ph.D. program.

FS HN 682: Seminar Reflection
Cr. R. Repeatable. F.S.
Active listening and critical thinking activities related to research seminars in food science and human nutrition. Required each semester for all FSHN graduate students. Electronic documentation.

FS HN 690: Special Problems
Cr. arr. Repeatable. F.S.SS.
Prereq: FS HN 502 or FS HN 503 or FS HN 504 or FS HN 553 or FS HN 554

FS HN 695: Grant Proposal Writing
(Cross-listed with NUTRS). (1-0) Cr. 1. F.
Prereq: 3 credits of graduate course work in food science and/or nutrition
Grant proposal preparation experiences including writing and critiquing of proposals and budget planning. Formation of grant writing teams in food science and/or nutrition. Offered on a satisfactory-fail basis only.

FS HN 699: Research in Food Science and Technology
Cr. arr. Repeatable. F.S.SS.
Offered on a satisfactory-fail basis only.

Gerontology

Interdepartmental Minor and Interinstitutional Program

The gerontology program is designed for students desiring careers in aging-related fields and for students interested in improving their understanding of aging persons in American society. Students are

expected to take courses to develop the necessary interdisciplinary breadth which, in combination with other disciplinary training, can prepare them to work with older adults.

Graduates understand the ways in which individual and societal aging influence, and are impacted by, developments in their major field of study. They have an appreciation and understanding of the cross-disciplinary aspects of human aging.

Gerontology courses are offered in the interdepartmental gerontology program in the following participating departments and programs: Architecture; Biochemistry, Biophysics, and Molecular Biology; Economics; Apparel, Educational Studies, and Hospitality Management, Food Science and Human Nutrition; Kinesiology; Human Development and Family Studies; Political Science; Psychology; and Sociology.

Undergraduate Study

Undergraduate study in this program provides the student with an opportunity to develop a minor in gerontology. A balanced grouping of courses assists the student in developing both a sensitivity to the issues and the ability to synthesize ideas from the variety of disciplines important to the study of the aging process.

Minor

Undergraduate students may minor in gerontology by taking 16 semester hours of gerontology related courses. Nine of these credits must come from the following courses:

GERON 373	Death as a Part of Living	3
GERON 377	Aging and the Family	3
GERON 378	Retirement Planning and Employee Benefits	3
GERON 463	Environments for the Aging	3

Students will participate in a prepracticum seminar, GERON 466 Gerontology Prepracticum Seminar, and will complete a supervised field practicum after all gerontology coursework is completed (GERON 467 Gerontology Practicum). A minimum of 3 semester credits must be selected from a list of supportive gerontology related courses. Supportive courses include units or topics related to aging and can be used to complement the student's major interests. The student's minor program must be approved by the undergraduate gerontology coordinator.

Graduate Study

A declared graduate minor in gerontology consists of a minimum of 12 credits taken from a list of acceptable courses, and from at least two departments. Nine of the 12 credits must be in courses that are focused specifically on aging. One 590 course (3 credits maximum) can be taken as part of the 12 credits. GERON 510 Survey of Gerontology is required for all minor students. At least one member of the gerontology faculty will be on a student's advisory committee; this person must be a member of the Graduate Faculty. Contact the coordinator to determine whether courses other than those listed below are available.

Interinstitutional Program

Iowa State University offers a Master's degree in Family and Consumer Sciences with specialization in gerontology. This is an interinstitutional distance education program offered through the Web. The student selects the home institution, which grants the degree. After admission at the home institution, the student takes courses from each of the seven institutions: Iowa State University, Kansas State University, North Dakota State University, Oklahoma State University, Texas Tech University, the University of Arkansas, and the University of Missouri.

The master's degree consists of 36 semester hours, 24 of these hours are from the following courses:

GERON 530	Perspectives in Gerontology	3
GERON 534	Adult Development	3
GERON 540	Nutrition and Physical Activity in Aging	3
GERON 545	Economics, Public Policy, and Aging	3
GERON 563	Environments for the Aging	3
GERON 577	Aging in the Family Setting	3
GERON 584	Program Evaluation and Research Methods in Gerontology	3
GERON 594	Professional Seminar in Gerontology	3

The remaining 12 credits will include electives and specific courses needed to meet the requirements of the institution awarding the degree. Neither a thesis nor a creative component is required.

Gerontology Graduate Certificate Program

The 21-credit Graduate Certificate Program in Gerontology includes the following courses from the list of core courses:

GERON 530	Perspectives in Gerontology	3
GERON 534	Adult Development	3
GERON 540	Nutrition and Physical Activity in Aging	3
GERON 594	Professional Seminar in Gerontology	3

The additional six credits required for the certificate can be chosen from the remaining core courses or from other approved elective courses. A maximum of three credits of practicum also can be included in the elective credits.

Admission Procedures: Admission to the Gerontology Certificate Program requires exactly the same procedures as admission to the Graduate College. See Graduate College section of the catalog.

Registration: Students choosing to receive their degree from Iowa State University complete all the admissions, registration, and fee payment processes through ISU.

Courses primarily for undergraduates:

GERON 234: Adult Development
(Cross-listed with HD FS). (3-0) Cr. 3. S.
Prereq: HD FS 102
Introductory exploration of the health, individual and social factors associated with adult development including young adulthood, middle age and older adulthood. Information is presented from a life-span developmental framework.

GERON 373: Death as a Part of Living
(Cross-listed with HD FS). (3-0) Cr. 3. F.S.Alt. SS., offered even-numbered years.
Prereq: HD FS 102
Consideration of death in the life span of the individual and the family with opportunity for exploration of personal and societal attitudes.

GERON 377: Aging and the Family
(Cross-listed with HD FS). (3-0) Cr. 3. F.Alt. SS., offered odd-numbered years.
Prereq: HD FS 102
Interchanges of the aged and their families. Emphasis on role changes, social interaction, and independence as influenced by health, finances, life styles, and community development.
Meets U.S. Diversity Requirement

GERON 378: Retirement Planning and Employee Benefits
(Cross-listed with ECON, HD FS). (3-0) Cr. 3. S.
Prereq: 3 credits in Principles of Economics and 3 credits in Human Development and Family Studies
Economic well-being in the context of demographic change, the present and future of Social Security, family retirement needs analysis, investment strategies and characteristics of retirement plans, helping others to work towards financial security, family economic issues for retired persons. Overview of employee and retirement benefits.
Meets U.S. Diversity Requirement

GERON 414: Gerontechnology in Smart Home Environments
(3-0) Cr. 3. F.
Prereq: Com S 227 or (Com S 207 or Geron 377 or ArtGr 271) or equivalent.
An interdisciplinary course designed for students who are interested in assistive technology, pervasive computing, mobile computing and principles of universal and inclusive design for end users, in particular, the elderly population. Students will work in semester-long projects as interdisciplinary teams to apply knowledge obtained from lectures and mutual presentations. For graduate credit students are required to submit a research report and give an oral presentation.

GERON 415: Gerontechnology in Smart Home Environments
(3-0) Cr. 3. F.
Prereq: Com S 227 or (Com S 207 or Geron 377)
An interdisciplinary course designed for students who are interested in assistive technology, pervasive computing, mobile computing and principles of universal software design for end users, in particular the elderly population. Students will have the chance to learn both about the theories and principles about aging and assistive technology, as well as to engage in the practical semester-long project while working with students from other disciplines.

GERON 463: Environments for the Aging
(Dual-listed with GERON 563). (Cross-listed with ARTID, HD FS). (3-0) Cr. 3. S.
Prereq: HD FS 360 or 3 credits in housing, architecture, interior design, rehabilitation, psychology, or human development and family studies or permission of instructor
Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (on-line course offering via Distance Education).
Meets U.S. Diversity Requirement

GERON 466: Gerontology Prepracticum Seminar
(1-0) Cr. 1. F.S.SS.
Prereq: 9 credits in core courses for the gerontology minor and approval of the gerontology undergraduate coordinator
Prepracticum training for students planning a gerontology practicum. Exploration of possible agencies for the practicum, in-depth study of a selected agency, and development of goals and objectives for the practicum.

GERON 467: Gerontology Practicum
Cr. 3-6. Repeatable. F.S.SS.
Prereq: GERON 466, advance reservation
Supervised field experience related to aging. Offered on a satisfactory-fail basis only.

GERON 490: Independent Study
Cr. arr.
Consult program coordinator for procedure.

Courses primarily for graduate students, open to qualified undergraduates:

GERON 501: Seminar
Cr. arr. Repeatable. F.S.SS.

GERON 510: Survey of Gerontology
Cr. 1-3. Repeatable. S.
Provides an overview of important gerontological issues.

GERON 514: Gerontechnology in Smart Home Environments
(3-0) Cr. 3. F.
Prereq: COM S 227 or (COM S 207 or GERON 377 or ARTGR 271) or equivalent.
An interdisciplinary course designed for students who are interested in assistive technology, pervasive computing, mobile computing and principles of universal and inclusive design for end users, in particular, the elderly population. Students will work in semester-long projects as interdisciplinary teams to apply knowledge obtained from lectures and mutual presentations. For graduate credit students are required to submit a research report and give an oral presentation.

GERON 520: Women and Aging
(3-0) Cr. 3. SS.
Women and Aging is the study of theory, research and application of issues related to women and the aging experience. This course will examine gender differences in areas such as health, mental health, income security, crime, and public policy. Attention will be given to ways in which younger women can prepare to meet the challenges and opportunities awaiting them as they age.

GERON 521: Biological Principles of Aging
(3-0) Cr. 3. SS.
Basic biological principles of aging. Course modules include an introduction to the aging process, body systems and normal aging, and environment and the biology of aging. In addition, disorders and diseases of aging, prevention and treatment and exercise and aging topics will be covered.

GERON 522: Long-Term Care
(3-0) Cr. 3. F.
Administration principles involved in the planning, organizing and directing of long-term care agencies. Includes an in-depth exposure to federal and state standards and regulations governing long-term care.

GERON 523: Mental Health and Aging
(3-0) Cr. 3. S.
Introduction to the range of issues involved in aging and mental health. From a systems framework the major emotional and psychiatric problems encountered in old age will be examined including mood, anxiety, adjustment and personality disorders, dementia, cognitive problems, substance abuse, and suicide. Barriers to treatment and cohort and cultural issues will be explored.

GERON 524: Cognitive Health
(3-0) Cr. 3. SS.
Cognitive skills form the foundation for functioning in everyday life and these skills take on added importance in older adulthood. This course focuses on selected theoretical approaches and current research related to cognitive aging. We will review normative and non-normative cognitive changes, assessment techniques, and prevention/intervention efforts. Throughout the course we will keep the role of environment and life-span implications in the forefront of our discussion.

GERON 530: Perspectives in Gerontology
(Cross-listed with HD FS). (3-0) Cr. 3. F.
Overview of current aging issues including theory and research, critical social and political issues in aging, the interdisciplinary focus of gerontology, career opportunities, and aging in the future. (on-line course offering via Distance Education).

GERON 534: Adult Development
(Cross-listed with HD FS). (3-0) Cr. 3. S.
Exploration of the biological, psychological and social factors associated with aging. Although the focus is on the later years, information is presented from a life-span developmental framework. Empirical studies are reviewed and their strengths, limitations and implications for normative and optimal functioning are discussed. (on-line course offering via Distance Education).

GERON 540: Nutrition and Physical Activity in Aging
(Cross-listed with DIET). (3-0) Cr. 3. F.
WWW only. Basic physiologic changes during aging and their impacts in health and disease. The focus will be on successful aging with special emphasis on physical activity and nutrition. Practical application to community settings is addressed.

GERON 545: Economics, Public Policy, and Aging
(Cross-listed with HD FS). (3-0) Cr. 3. F.
Policy development in the context of the economic status of the older adult population. Retirement planning and the retirement decisions; social security and public transfer programs; intra-family transfers to/from the aged; private pensions; financing medical care; prospects and issues for the future.

GERON 563: Environments for the Aging

(Dual-listed with GERON 463). (Cross-listed with ARTID, HD FS). (3-0) Cr. 3. S.

Prereq: HD FS 360 or 3 credits in housing, architecture, interior design, rehabilitation, psychology, or human development and family studies or permission of instructor

Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (on-line course offering via Distance Education).

Meets U.S. Diversity Requirement

GERON 571: Design for All People

(Cross-listed with ARCH). (3-0) Cr. 3. S.

Prereq: Graduate or Senior classification

Principles and procedures of universal design in response to the varying ability level of users. Assessment and analysis of existing buildings and sites with respect to standards and details of accessibility for all people, including visually impaired, mentally impaired, and mobility restricted users. Design is neither a prerequisite nor a required part of the course. Enrollment open to students majoring in related disciplines. Credit counts toward fulfillment of History, Theory, Culture requirements.

Meets U.S. Diversity Requirement

GERON 577: Aging in the Family Setting

(Cross-listed with HD FS). (3-0) Cr. 3. S.

Prereq: 9 credits in social sciences or permission of instructor

Theories and research related to personal and family adjustments in later life affecting older persons and their intergenerational relationships. Related issues including demographics also are examined through the use of current literature. (on-line course offering via Distance Education).

GERON 584: Program Evaluation and Research Methods in Gerontology

(Cross-listed with HD FS). (3-0) Cr. 3. S.

Overview of program evaluation, research methods, and grant writing in gerontology. Includes application of quantitative and qualitative methods in professional settings. (on-line course offering via Distance Education).

GERON 590: Special Topics

Cr. arr. Repeatable.

Consult program coordinator for procedure.

GERON 591: Internship

Cr. 1-9. Repeatable, maximum of 9 credits. F.S.SS.

Supervised experience in an area of gerontology.

GERON 594: Professional Seminar in Gerontology

(Cross-listed with HD FS). (3-0) Cr. 3. SS.

An integrative experience for gerontology students designed to be taken near the end of the degree program. By applying knowledge gained in earlier coursework, students will strengthen skills in ethical decision-making behavior, applying these skills in gerontology-related areas such as advocacy, professionalism, family and workplace issues. Students from a variety of professions will bring their unique perspectives to bear on topics of common interest. (on-line course offering via Distance Education).

GERON 599: Creative Component

Cr. arr. Repeatable. F.S.SS.

Courses for graduate students:

GERON 635: Adult Development, Aging, and Health

(Cross-listed with HD FS). (3-0) Cr. 3. Alt. F., offered odd-numbered years.

Prereq: HD FS 510 or permission of instructor

Review of the impact of the growing older adult population as well as individual development and aging on individuals, families, and society. Exploration of theoretical perspectives applied to adult development and aging and distinction of normative and non-normative changes in adulthood. Discussion of methods to assess development across adulthood and consideration of the role of individual and environmental factors impacting efforts to optimize adult development.(on-line course offering via Distance Education).

GERON 699: Research

Cr. arr. Repeatable. F.S.SS.

Hospitality Management

Administered by the Department of Apparel, Events, and Hospitality Management

The Hospitality Management program strives for excellence in professional and leadership development for the hospitality industry through education, research, and outreach. Our mission is to create, share, and apply knowledge to provide hospitality consumers with products, services, and experiences to enhance overall well-being. Educational experiences are planned to contribute to the graduate's effectiveness as a career professional and as a person, family member, and citizen. Research along with Extension and Outreach efforts are conducted with the purpose of improving management effectiveness and quality of services within hospitality organizations. Finally, the program is committed to serving the respective missions of Iowa State University and the College of Human Sciences and to serving the needs of the citizens of Iowa.

Undergraduate Study

The program offers a Bachelor of Science degree in hospitality management. Coursework is planned to provide students with a general education plus professional preparation for supervisory and executive positions in hospitality organizations. Principles of business management are presented, as well as fundamentals of hospitality operations.

Graduates demonstrate leadership characteristics and make decisions based on integrating knowledge of financial, human resources, marketing, and operational principles for managing hospitality operations. They demonstrate best practices in meeting customer expectations and use of technology to achieve operational efficiency and effectiveness.

Learning experiences are provided in the quantity food production and service facility of the Hospitality Management program and other approved establishments. Students are required to have a total of at least 600 hours of relevant work experience prior to graduation. Of the 600 hours, 200 hours are required prior to completing one year in the program.

The program offers a concurrent B.S. and M.S. degree that allows students to obtain a B.S. and M.S. degree in hospitality management in 5 years. Application for admission to the Graduate College should be made in the junior year.

Minor

A minor in Hospitality Management may be earned by successfully completing at least 15 credits of AESHM/HSP M courses. The minor must include at least six (6) credits in courses numbered 300 or above taken at ISU. All course prerequisites must be completed prior to taking the course. All minor courses must be taken for a grade.

The Hospitality Minor requires students to complete HSP M 101 and HSP M 233. The remaining 9 credits may be selected from any HSP M designated course, as well as AESHM 287, AESHM 438, AESHM 474, and A M D 477.

Curriculum in Hospitality Management

Administered by the Apparel, Events, and Hospitality Management Department. Leading to the Bachelor of Science degree.

The curriculum in Hospitality Management develops students as leaders for the hospitality professions.

A minor in Hospitality Management is available; see requirements under Hospitality Management, Courses and Programs.

Students majoring in Hospitality Management are required to earn C- or better in all AESHM and HSP M courses. Communication Proficiency Requirement: Grade of C or better in ENGL 150 Critical Thinking and Communication, and ENGL 250 Written, Oral, Visual, and Electronic Composition.

Degree Requirements

10 Communications and Library

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
Select one from the following:		3
COMST 102	Introduction to Interpersonal Communication	
COMST 214	Professional Communication	
SP CM 212	Fundamentals of Public Speaking	
Total Credits		10

9-10 Natural Sciences and Mathematical Disciplines

Select one MATH course from:		3
MATH 104	Introduction to Probability	
MATH 105	Introduction to Mathematical Ideas	
MATH 140	College Algebra	
MATH 150	Discrete Mathematics for Business and Social Sciences	
MATH 160	Survey of Calculus	
STAT 101	Principles of Statistics	3-4
or STAT 104	Introduction to Statistics	
Natural Sciences (see approved list)		3
Total Credits		9-10

9 Social Sciences

ECON 101	Principles of Microeconomics	3
HD FS 102	Individual and Family Development, Health, and Well-being	3
Select from:		3
PSYCH 101	Introduction to Psychology	
PSYCH 280	Social Psychology	
SOC 134	Introduction to Sociology	
Total Credits		9

6 Humanities

AESHM 342	Aesthetics of Consumer Experience	3
Approved courses		3
Total Credits		6

49-53 Hospitality Management Professional Core Courses

AESHM 170	Supervised Work Experience I	1
AESHM 175D	Financial Applications for Retail and Hospitality Industries: Hospitality Management	2
AESHM 270D	Supervised Work Experience II: Hospitality	2

or AESHM 270P	Supervised Work Experience II: ISU Dining	
AESHM 287	Principles of Management in Human Sciences	3
AESHM 340	Hospitality and Apparel Marketing Strategies	3
AESHM 411E	Seminar on Current Issues: Events and Hospitality	1
AESHM 438	Human Resource Management	3
AESHM 470D	Supervised Professional Internship: Hospitality	3-6
or AESHM 470F	Supervised Professional Internship: ISU Dining	
HSP M 101	Introduction to the Hospitality Industry	3
HSP M 233	Hospitality Sanitation and Safety	3
HSP M 315	Hospitality Law	3
HSP M 333	Hospitality Operations Cost Controls	3
HSP M 352	Lodging Operations Management I	3
HSP M 380	Quantity Food Production Management	3
HSP M 380L	Quantity Food Production and Service Management Experience	2
HSP M 433	Hospitality Financial Management	3
HSP M 439	Advanced Hospitality Human Resource Management	3
HSP M 455	Introduction to Strategic Management in Foodservice and Lodging	3
Total Credits		47-50

13-15 Hospitality Management electives

Select from:

A M D 275	Retail Merchandising	3
A M D 477	Omni-channel Retailing	3
AESHM 211	Leadership Experiences and Development (LEAD)	3
AESHM 222	Creativity on Demand	3
AESHM 474	Entrepreneurship in Human Sciences	3
EVENT 271	Introduction to Event Management Only 6 credits of EVENT courses may apply for Hospitality elective credits	3
EVENT 371	Conference and Meeting Planning	3
EVENT 471	Special Events Coordination	3
HSP M 189	Introduction to University Dining Services Management	1
HSP M 201	Introduction to Casino Management	3
HSP M 230	Introduction to Hospitality Performance Analysis	3
HSP M 260	Global Tourism Management	3
HSP M 289	Contemporary Club Management	3
HSP M 301X	Hospitality Revenue Management	
HSP M 320	Attractions and Amusement Park Administration	3
HSP M 383	Introduction to Wine, Beer, and Spirits	2
HSP M 383L	Introduction to Wine, Beer and Spirits Laboratory	1
HSP M 437	Hospitality Information Technology	3
HSP M 452	Lodging Operations Management II	3
HSP M 487	Fine Dining Event Management	3

13 Supporting courses

ACCT 284	Financial Accounting	3
AESHM 112	Orientation for AESHM	1
AESHM 113E	Professional Development for AESHM: Event Management and Hospitality Management	1
AESHM 311E	Seminar on Careers and Internships: Event Management and Hospitality Management	1
FS HN 111	Fundamentals of Food Preparation *	2
FS HN 115	Food Preparation Laboratory	1
FS HN 167	Introduction to Human Nutrition *	3

* A student who has not had high school chemistry is required to take CHEM 160 Chemistry in Modern Society

16-18 Electives

123.0 Total credits

**A student who has not had high school biology is required to take BIOL 101 Introductory Biology.

Hospitality Management, B.S.

Freshman

Fall	Credits	Spring	Credits
AESHM 112	1	AESHM 175D	2
AESHM 113E	1	AESHM 287	3
AESHM 170D	1	ECON 101	3
ENGL 150	3	HSP M or General Elective	2-3
FS HN 167	3	PSYCH or SOC	3
HSP M 101	3	LIB 160	1
HD FS 102	3		
	15		14-15

Sophomore

Fall	Credits	Spring	Credits
AESHM 270D	2	ACCT 284	3
ENGL 250	3	AESHM 311E	1
HSP M 233	3	FS HN 111	2
HSP M or General Elective[2]	4	FS HN 115	1

Natural Sciences or Chemistry[3]	3 STAT 101 or 104	3-4	
	HSP M or General Electives[3]	5	
	15	15-16	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
AESHM 340	3	AESHM 438	3	AESHM 470N	3-6
HSP M 352	3	HSP M 315	3		
SP CM 212	3	HSP M or General Electives[2]	4-7		
HSP M or General Electives[3]	8-9	Humanities	3		
		Math	3		
	17-18		16-19		3-6

Senior

Fall	Credits	Spring	Credits
AESHM 411E	1	AESHM 342	3
HSP M 333	3	HSP M 433	3
HSP M 380	3	HSP M 455	3
HSP M 380L	2	HSP M or General Electives[2]	3-6
HSP M 439	3		
	12		12-15

US Diversity and International Perspectives Requirement: Students in HSP M fulfill the US Diversity and International Perspectives Requirements by choosing 3 credits of coursework from each of the University-approved lists.

Note: This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

1 BIOL 101 required if student has not completed high school biology

2 When the 4-year plan indicates HSP M Group or General Electives, choice depends on courses available. However, you must have a total of 13-15 credits of HSP M electives and 11-17 credits of General Electives (HSP M courses may be taken to meet General Electives requirements).

3 CHEM 160 required if student has not completed high school chemistry

Graduate Study

The Hospitality Management program offers work for the Master of Science and Doctor of Philosophy degrees in hospitality management. Graduates of the program are able to interpret trends and adapt operating practices of hospitality organizations to changing economic, social, political, technological, and environmental conditions. The Master's degree program is designed to prepare individuals for managerial and leadership positions in industry, business, and non-profit organization; teaching careers; and continued graduate study.

The doctoral program is designed to prepare individuals to teach in programs at the university lefel; provide leadership in non-profit organizations; and/or conduct advanced research at the corporate level or with research firms.

A degree in hospitality management is the usual background for graduate study; however, applicants with preparation in dietetics, business, or closely related fields are encouraged to apply. PhD applicants must have two (2) years of professional work experience in the field.

The Master of Science degree requires either a thesis or non-thesis (creative component) project. Students also are required to take three core courses out of the four offered in the core areas (human resources, financial management, marketing, and strategic management).

The PhD program requires a minimum of 72 credits, up to 30 of which may be applied from the Master's degree. All PhD students take a minimum of 15 research/dissertation credits.

Courses primarily for undergraduates:

HSP M 101: Introduction to the Hospitality Industry
(3-0) Cr. 3. F.S.SS.
Introduction to the foodservice, lodging, and tourism components of the hospitality industry. Background information, current issues, and future challenges in various segments of the industry.

HSP M 189: Introduction to University Dining Services Management
(1-0) Cr. 1. Alt. S., offered even-numbered years.
Overview of management concepts and distinct features of university dining services.

HSP M 201: Introduction to Casino Management
(3-0) Cr. 3. F.
An overview of the gaming industry. History and development of gaming, casino operations, casino games, marketing of the core gaming products, and social and economic impacts of the gaming industry.

HSP M 230: Introduction to Hospitality Performance Analysis
(3-0) Cr. 3. F.S.
Introduction to Uniform Systems of Accounts for hospitality industry, profitability, income statements, budgeting, managing cash, accounts receivable and payable, costs control, pricing, and evaluation related to restaurant, lodging, and club industry. Preparation for a hospitality accounting certification exam.

HSP M 233: Hospitality Sanitation and Safety
(3-0) Cr. 3. F.S.
Sanitation and safety principles in hospitality operations. Issues impacting consumers and operators. Characteristics of food, supplies, and equipment as related to quality, sanitation and safety. Application of HACCP. Preparation for national foodservice sanitation certification examination.

HSP M 260: Global Tourism Management
(3-0) Cr. 3. F.S.
Overview of the global tourism industry: hospitality and related services, destination/ attractions, tourist behaviors, and destination marketing. Introduction to destination mix, socio-economic and cultural impacts of tourism, destination organizations, tourist motivations, destination image, marketing, promotions, tourism distribution system, and the future of tourism.
Meets International Perspectives Requirement.

HSP M 289: Contemporary Club Management
(Cross-listed with EVENT). (3-0) Cr. 3. F.S.
Prereq: HSP M 101
Organization and management of private clubs including city, country, and other recreational and social clubs. Field trip may be required.

HSP M 290: Independent Study
Cr. 1-2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Freshman or Sophomore classification. Permission of instructor, adviser, and department chair.
Independent study on topics of special interest to the student, facilitated by approved faculty member. Maximum of 9 credits combined of HSP M 290 and HSP M 490 can be applied to graduation.

HSP M 315: Hospitality Law
(3-0) Cr. 3. S.
Prereq: HSP M 101
Laws relating to ownership and operation of hospitality organizations. The duties and rights of both hospitality business operators and customers. Legal implications of various managerial decisions.

HSP M 320: Attractions and Amusement Park Administration
(Cross-listed with EVENT). (3-0) Cr. 3. S.
Prereq: HSP M 101 or permission of instructor
Examination of current issues in the attractions and amusement park industry. Emphasis will be placed on development and design along with the functional departments of modern amusement parks and themed attractions.

HSP M 333: Hospitality Operations Cost Controls
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in HSP M 380, HSP M 380L; 3 credits MATH
Introduction to revenue and cost systems in the hospitality industry. Application of principles related to procurement, production, and inventory controls.

HSP M 352: Lodging Operations Management I
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in HSP M 101, AESHM 287
Introduction to functional department activities and current issues of lodging organizations with emphasis on front office and housekeeping. Reservation activities and night audit exercises. Case studies.

HSP M 380: Quantity Food Production Management
(3-0) Cr. 3. F.S.
Prereq: HSP M 233 or 2 cr MICRO; FS HN 111 or FS HN 214; FS HN 115 or FS HN 215; at least junior classification; enrollment in HSP M 380L
Principles of and procedures used in quantity food production management including menu planning, food costing, work methods, food production systems, quality control, and service.

HSP M 380L: Quantity Food Production and Service Management Experience
(0-6) Cr. 2. F.S.
Prereq: HSP M 233 or 2 cr MICRO; FS HN 111 or FS HN 214; FS HN 115 or FS HN 215; at least junior classification; enrollment in HSP M 380
Application of quantity food production and service management principles and procedures in the program's foodservice operation.

HSP M 383: Introduction to Wine, Beer, and Spirits
(2-0) Cr. 2. F.S.
Prereq: Must be at least 21 years old
Introduction to history and methods of production for a variety of wines, beers, spirits, and other beverages. Beverage tasting and sensory analysis; product knowledge; service techniques; sales; and alcohol service related to the hospitality industry.

HSP M 383L: Introduction to Wine, Beer and Spirits Laboratory
(0-2) Cr. 1. F.S.
Prereq: HSP M 383 or concurrent enrollment. Must be at least 21 years old
The application of the management principles and procedures related to the sale and service of alcohol and specialty beverages served in the beverage and hospitality industry. Beverage tasting and sensory analysis of products commonly served in the beverage industry.

HSP M 391: Foodservice Systems Management I
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in HSP M 380, HSP M 380L
Principles and techniques related to basic management, leadership, and human resource management of foodservices in health care and other on-site foodservice settings. Food safety and sanitation for on-site foodservice operations. Credit for either HSP M 391 or AESHM 287 and AESHM 438 may count toward graduation. Not accepted for credit toward a major in Hospitality Management.

HSP M 392: Foodservice Systems Management II
(3-0) Cr. 3. S.
Prereq: HSP M 391
Introduction to cost control in foodservice departments: procedures for controlling food, labor, and other variable costs. Application of principles related to food product selection, specification, purchase, and storage in health care and other onsite operations. Credit for either HSP M 392 or HSP M 233 and HSP M 333 may count toward graduation. Not accepted for credit toward a major in Hospitality Management.

HSP M 393: Hospitality Management Industry Workshop
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: HSP M Junior or Senior Classification and Permission of Instructor.
Intensive 2 to 8 week workshop exploration. Topics vary each time offered. Maximum of 6 credits of HSPM 393 can be applied toward graduation.

HSP M 433: Hospitality Financial Management
(3-0) Cr. 3. S.
Prereq: HSP M 333; ACCT 284; ECON 101; credit or enrollment in STAT 101
Use of common financial statements, accounting ratios, and financial techniques to impact management decisions.

HSP M 437: Hospitality Information Technology
(3-0) Cr. 3. F.
Prereq: HSP M 352
Introduction to hospitality information technology. Property management and point-of-sales system interfaces: customer relationship management, selecting and purchasing computer systems, electronic distribution systems, internet and its related application systems, managing internal and external communication networks. Case studies.

HSP M 439: Advanced Hospitality Human Resource Management
(3-0) Cr. 3. F.
Prereq: AESHM 438
Emphasis on development of management personnel in hospitality organizations. Case studies.

HSP M 452: Lodging Operations Management II
(3-0) Cr. 3. S.
Prereq: HSP M 352; credit or enrollment in HSP M 333
Development of business plan and evaluation of business performance in a simulated environment. Operational decision making practices by applying concepts of management, operations, marketing, and finance for a computer-mediated environment.

HSP M 455: Introduction to Strategic Management in Foodservice and Lodging
(3-0) Cr. 3. S.
Prereq: AESHM 340; credit or enrollment in HSP M 433 and AESHM 438
Introduction to strategic management principles and practices with an application of human resources, operations, marketing, and financial management concepts. Case studies.

HSP M 487: Fine Dining Event Management
(Dual-listed with HSP M 587). (2-3) Cr. 3. F.
Prereq: HSP M 380, HSP M 380L
Exploration of the historical and cultural development of the world food table. Creative experiences with U.S. regional and international foods. Application of management and financial principles in food preparation and service in fine dining settings. Individual special problems.
Meets International Perspectives Requirement.

HSP M 489: Issues in Food Safety
(Cross-listed with AN S, FS HN, VDPAM). (1-0) Cr. 1. S.
Prereq: Credit or enrollment in FS HN 101 or FS HN 272 or HSP M 233; FS HN 419 or FS HN 420; FS HN 403
Capstone seminar for the food safety minor. Case discussions and independent projects about safety issues in the food system from a multidisciplinary perspective.

HSP M 490: Independent Study
Cr. arr. Repeatable.
Prereq: Sections B-E: Program approval; Section H: Full membership in Honors Program

HSP M 490B: Independent Study: Hospitality Management
Cr. arr. Repeatable.
Prereq: Sections B-E: Program approval
Independent Study in Hospitality Management.

HSP M 490D: Independent Study: Lodging Operations
Cr. arr. Repeatable.
Prereq: Sections B-E: Program approval; Section H: Full membership in Honors Program

HSP M 490E: Independent Study: Foodservice Operations
Cr. arr. Repeatable.
Prereq: Sections B-E: Program approval; Section H: Full membership in Honors Program

HSP M 490H: Independent Study: Honors
Cr. arr. Repeatable.
Prereq: Sections B-E: Program approval; Section H: Full membership in Honors Program

Courses primarily for graduate students, open to qualified undergraduates:

HSP M 505: Hospitality Management Scholarship and Applications
(0-1) Cr. 1. F.SS.
Focus on teaching and research scholarship involving the hospitality industry.

HSP M 506: Current Issues in Hospitality Management
(0-1) Cr. 1. Repeatable. S.SS.
Focus on current issues related to the hospitality industry.

HSP M 533: Financial Decision Making in Hospitality Organizations
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: HSP M 433
Concepts of financial management applied to strategic decision making.

HSP M 538: Human Resources Development in Hospitality Organizations
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: AESHM 438
Theories of human resources management. Practices and principles related to development of management personnel.

HSP M 540: Strategic Marketing
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: AESHM 340
Application of marketing principles in developing effective marketing strategies for hospitality, apparel, and retail organizations. Evaluation of multi-dimensional marketing functions in hospitality organizations.

HSP M 555: Strategic Management in Hospitality Organizations
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Courses in MKT, FIN, MGMT, and HSP M. Permission of instructor
Strategic management process as a planning and decision-making framework; integration of human resources, operations, marketing, and financial management concepts.

HSP M 587: Fine Dining Event Management
(Dual-listed with HSP M 487). (2-3) Cr. 3. F.
Prereq: HSP M 380, HSP M 380L
Exploration of the historical and cultural development of the world food table. Creative experiences with U.S. regional and international foods. Application of management and financial principles in food preparation and service in fine dining settings. Individual special problems. Meets International Perspectives Requirement.

HSP M 590: Special Topics
Cr. arr. Repeatable, maximum of 3 credits.
Prereq: 9 credits in HRI at 400 level or above; application process
Topics in hospitality management.

HSP M 590B: Special Topics: Hospitality Management
Cr. arr. Repeatable, maximum of 3 credits.
Prereq: 9 credits in HSP M at 400 level or above; application process.

HSP M 590C: Special Topics: Tourism
Cr. arr. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: 9 credits in HSP M at 400 level or above; application process
Special topics in tourism.

HSP M 590D: Special Topics: Lodging Operations
Cr. arr. Repeatable, maximum of 3 credits.
Prereq: 9 credits in HSP M at 400 level or above; application process.

HSP M 590E: Special Topics: Commercial/Retail Foodservice Operations
Cr. arr. Repeatable, maximum of 3 credits.
Prereq: 9 credits in HSP M at 400 level or above; application process.

HSP M 590F: Special Topics: Onsite Foodservice Operations
Cr. arr. Repeatable, maximum of 3 credits.
Prereq: 9 credits in HSP M at 400 level or above; application process.

HSP M 599: Creative Component
Cr. arr.
Creative component as arranged with instructor.

Courses for graduate students:

HSP M 604: Professional Writing
(2-0) Cr. 2. S.SS.
Prereq: Enrollment in PhD program
Development of professional written communication with emphasis on abstracts, proposals, manuscripts, and technical reports.

HSP M 608: Administrative Problems
Cr. arr. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Permission of instructor; enrollment in PhD program
Advanced administrative problems; case studies in foodservice and lodging organizations.

HSP M 633: Advanced Hospitality Financial Management
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HSP M 433; Enrollment in PhD program
Theories and research in financial management with emphasis on financial performance and financing decisions.

HSP M 638: Advanced Human Resources Management in Hospitality Organizations
(3-0) Cr. 3. Alt. F., offered odd-numbered years.Alt. SS., offered even-numbered years.
Prereq: HSP M 538; Enrollment in PhD program
Research in human resources management with an emphasis on organization or unit administration.

HSP M 640: Seminar on Marketing Thoughts
(3-0) Cr. 3. Alt. S., offered even-numbered years.Alt. SS., offered even-numbered years.
Prereq: HSP M 540; STAT 401. Enrollment in PhD program
Conceptual and theoretical development of marketing strategies. Analytical and critical review of marketing research and industry practices.

HSP M 652: Advanced Lodging Operations
(3-0) Cr. 3. Alt. F., offered odd-numbered years.Alt. SS., offered even-numbered years.
Prereq: Enrollment in PhD program
Analysis and applications of concepts and theories of operations research for lodging operations.

HSP M 660: Research Seminar in Tourism Management
(3-0) Cr. 3. Alt. F., offered even-numbered years.Alt. SS., offered odd-numbered years.
Prereq: Enrollment in PhD program
Advanced graduate course on tourism and destination theories and research. Analysis and application fo theories, research findings, and research methods in tourism and destination management.

HSP M 680: Analysis of Research in Foodservice Operations
(3-0) Cr. 3. Alt. S., offered even-numbered years.Alt. SS., offered odd-numbered years.
Prereq: Enrollment in PhD program
Analysis and application of theories, research, and research methods in foodservice operations.

HSP M 690: Advanced Topics
Cr. arr. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Enrollment in PhD program, application process
Advanced study of current topics in hospitality management.

HSP M 690B: Advanced Topics: Hospitality Management
Cr. arr. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Enrollment in PhD program, application process
Advanced study of current topics in hospitality management.

HSP M 690C: Advanced Topics: Tourism
Cr. arr. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Enrollment in PhD program, application process
Advanced study of current topics in hospitality management.

HSP M 690D: Advanced Topics: Lodging Operations
Cr. arr. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Enrollment in PhD program, application process
Advanced study of current topics in hospitality management.

HSP M 690E: Advanced Topics: Commercial/Retail Foodservice Operations
Cr. arr. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Enrollment in PhD program, application process
Advanced study of current topics in hospitality management.

HSP M 690F: Advanced Topics: Onsite Foodservice Operations
Cr. arr. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Enrollment in PhD program, application process
Advanced study of current topics in hospitality management.

HSP M 699: Research
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in PhD program
Research.

Human Development and Family Studies Department

The Department of Human Development and Family Studies offers courses that focus on the interactions among individuals, families, their resources, and their environments throughout the life span. The department offers work for the Bachelor of Science degree in five curricula: Child, Adult and Family Services; Early Childhood Education; Family and Consumer Sciences Education and Studies, Financial Counseling and Planning, and an affiliated program: Early Childcare Education and Programming (a distance education program offered in collaboration with six other universities).

Students graduating in Human Development and Family Studies will

1. Communicate with clear purpose, workable organization and effective style in written, oral, visual and electronic (WOVE) formats to foster collaboration, provide information and advance knowledge related to child, adult, family, and community services.

2. Consistently and realistically analyze and evaluate one's own knowledge, abilities and actions in comparison to professional standards and create action plans to enhance personal and professional efficacy related to working with children, adults, families and communities.

3. Understand content related to working with children, adults, families, and communities within a chosen program. Use critical thinking skills to evaluate and utilize evidence-based practices. Use logical and ethical reasoning to make decisions and solve problems.

4. Understand the diverse needs of children, adults, and families. Ensure equitable access of children, adults, and families to appropriate environments that support healthy living. Engage children, adults, and families with socially responsible and respectful behavior.

Communication Proficiency requirement: A student must achieve a grade of C or higher in ENGL 150, Critical Thinking and Communication, and ENGL 250, Written, Oral, Visual, and Electronic Composition. A student achieving a grade of C– or lower in 150 and/or 250 must either repeat the course(s), earning a minimum grade of C, or, in consultation with the adviser and the coordinator of freshman English, complete another appropriate English writing course with a minimum grade of C.

The **Child, Adult and Family Services** curriculum leads to work in helping professions with employment opportunities in public and private agencies. Graduates of the program are prepared for employment in agencies and organizations serving children, youth, families, and adults in the areas of education/prevention, treatment, and administration. This flexible program provides a broad emphasis in theory, research, and application in child, adult and family services including attention to community issues and public policy.

Students in Child, Adult and Family Services may choose coursework that leads to becoming a Certified Family Life Educator (CFLE), a program that has been approved by the National Council on Family Relations. These courses provide the basic education for students interested in working with families, including adolescents, parents, or adults working to strengthen relationships. The student takes courses that support the development of knowledge and skills in family life content areas selected by the National Council on Family Relations. The certification is a voluntary credential that requires the individual to complete a degree in an approved program and to have at least two years of work experience in family life education settings. Iowa State University does not grant the Certified Family Life Educator credential. The certification is granted only by the National Council on Family Relations. See http://www.hdfs.hs.iastate.edu/undergraduate-majors/cfle/ and/or http://www.ncfr.org/cfle-certification .

The curriculum in **Early Childhood Education – Unified** prepares graduates to teach young children and work with their families. This program leads to careers working with young children (both those who are typically developing and those with special needs) from birth through age eight. Graduates may be employed by either public or private agencies or schools to teach in early childhood classrooms (preschool through 3rd grade) or in home-based programs. This curriculum has been approved by the Iowa Department of Education and meets requirements for the early childhood education – unified teacher license, which permits individuals to teach general and special education for children from birth through age eight. The program is an interdepartmental major administered by the Department of Human Development and Family Studies and the School of Education. For more information about the program, see http://www.hdfs.hs.iastate.edu/undergraduate-majors/ece/.

Students who enroll in the early childhood education – unified program must apply to and be accepted into the teacher education program prior to enrolling in advanced courses. All early childhood education – unified students must meet general education requirements for teacher licensure.

Family and Consumer Sciences Education and Studies offers a curriculum for the Bachelor of Science degree. (http://catalog.iastate.edu/collegeofhumansciences/familyandconsumerscienceseducationandstudies)

The curriculum in Family and Consumer Sciences Education and Studies (FCEDS) prepares graduates with a broad understanding of individual and family well-being. Graduates apply knowledge and research in family and consumer sciences content in global professional settings. They work in an integrative fashion to improve well-being by addressing and acting on complex problems confronting individuals, families, and communities. The study of Family and Consumer Sciences Education incorporates the following 16 content areas (http://www.nasafacs.org/national-standards-and-competencies.html): Career, Community and Family Connections; Consumer and Family Resources; Consumer Services; Education and Early Childhood; Facilities Management and Maintenance; Family; Family and Community Services; Food Production and Services; Food Science, Dietetics, and Nutrition; Hospitality, Tourism and Recreation; Housing and Interior Design; Human Development; Interpersonal Relationship; Nutrition and Wellness; Parenting; and Textiles, Fashion and Apparel.

Students in the program choose one of three options, Teacher Licensure, Communications, or Professional Studies.

Students in Family and Consumer Sciences Education and Studies may choose coursework that leads to becoming a Certified Family Life Educator (CFLE), a program that has been approved by the National Council on Family Relations. These courses provide the basic education for students interested in working with families, including adolescents, parents, or adults working to strengthen relationships. The student takes courses that support the development of knowledge and skills in family life content areas selected by the National Council on Family

Relations. The certification is a voluntary credential that requires the individual to complete a degree in an approved program and to have at least two years of work experience in family life education settings. Iowa State University does not grant the Certified Family Life Educator credential. The certification is granted only by the National Council on Family Relations. See http://www.hdfs.hs.iastate.edu/undergraduate-majors/cfle/ and/or http://www.ncfr.org/cfle-certification.

Graduates may also choose from one of several nationally recognized professional certifications available from the American Association of Family and Consumer Sciences (AAFCS) Council for Certification. This program measures competencies of FCS professionals using high-quality, rigorous assessments. Certifications that are currently available are (http://www.aafcs.org/CredentialingCenter/Certification.asp): CFCS: Certified in Family and Consumer Sciences; CFCS-HDFS: Certified in Human Development and Family Studies; CFCS-HNFS: Certified in Hospitality, Nutrition, and Food Science; and CPFFE: Certified Personal and Family Finance Educator.

There is also an opportunity to obtain a family and consumer sciences endorsement or teacher licensure as a post baccalaureate student.

The **Financial Counseling and Planning** curriculum prepares students for careers in family financial services, offering three Emphases: Financial Planning, Financial Counseling or Family Financial Studies. Financial Counseling and Planning is a growing career field and appeals to students who want to work with individuals and families to help them meet their financial goals and improve their financial capability to better meet financial challenges. Coursework provides students with the family resource management and interpersonal skills needed to help families remain financially secure. Based on individual specific career goals students may select a path that leads to fulfilling the education requirements for the leading designations and certifications in financial counseling and planning. Graduates of the program are prepared for employment in personal banking, financial services, insurance, financial counseling and planning, and human service organizations. Laboratory and practicum opportunities exist in the Iowa State University Financial Counseling Clinic. An internship encourages students to apply their studies and to experience the profession in real-world settings.

Financial Counseling and Planning majors are also prepared to enter graduate programs in family financial planning, financial education, economics, finance, and law.

Juniors and seniors in Financial Counseling and Planning who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both a B.S. in Financial Counseling and Planning and a M.S. in Human Development and Family Studies or a B.S. in Financial Counseling and Planning and a Graduate Certificate in Family Financial Planning. Under concurrent enrollment, students simultaneously take undergraduate and graduate courses and may be eligible for assistantships. See Graduate Study for more information (http://www.hdfs.hs.iastate.edu/graduate/).

The Financial Planning emphasis in Financial Counseling and Planning is registered with Certified Financial Planner Board of Standards Inc. as a CFP Board-registered Program. ISU courses satisfy CFP Board's education requirement, allowing an individual to sit for the CFP® Certification Examination.

Iowa State University does not certify individuals to use the CFP® CERTIFIED FINANCIAL PLANNER™ title. CFP certification is granted only by Certified Financial Planner Board of Standards Inc. to those persons who, in addition to completing an educational requirement such as this CFP Board-Registered Program, have met its ethics, experience and examination requirements. (CFP Board of Standards web site www.cfp.net.)

Certified Financial Planner Board of Standards Inc. owns the certification marks CFP®, CERTIFIED FINANCIAL PLANNER™ and the federally registered CFP (with flame logo), which it awards to individuals who successfully complete initial and ongoing certification requirements.

Affiliated Programs

The **Early Childcare Education and Programming (E C P)** curriculum, offered by the Great Plains Interactive Distance Education Alliance (GPIDEA), is designed to prepare graduates to work in a variety of early care and education programs in local communities and on military installations. Some of these programs are childcare centers and homes, infant/toddler and preschool programs, Head Start programs, and before and after-school programs for children ages birth to eight. This is an online program offered through a collaboration of seven universities as part of GPIDEA. The program is known as Early Care and Education for a Mobile Society. For more information see http://www.hsidea.org/programs/ece/.

The E C P curriculum is designed to provide content for the final two years of a student's program; the content is focused specifically on topics directly relevant to the major. Students will complete a total of 120 credits for the major, 51 of which are specific to the E C P curriculum. These 51 credit hours are comprised of 12 core courses and 3 practica; the final practicum will be a 6-credit capstone experience. Students must complete 30 credits of college work, a lifespan development course, and have a 2.5 GPA to be admitted to E C P. If students prefer to be admitted to ISU before being admitted to the E C P major, they can enroll as Pre ECP (P ECP) students until they are eligible for the E C P major. For more information about the program at Iowa State, see http://www.online.hs.iastate.edu/ecp.

Curricula:

- **Child, Adult and Family Services**

- **Early Childhood Education — Unified**
- **Family and Consumer Sciences Education and Studies**
- **Financial Counseling and Planning**
- Affiliated Program: Early Childcare Education and Programming (GPIDEA program)

Minors

The department offers minors in Child, Adult and Family Services, Educational Services in Family and Consumer Sciences, and Financial Counseling and Planning. Minors consist of at least 15 credits including 6 credits taken at Iowa State University in courses numbered 300 or above.

The Child, Adult and Family Services minor may be earned by completing 15 credits:

HD FS 102	Individual and Family Development, Health, and Well-being	3
One of the following:		3
HD FS 223	Child Development and Health	
HD FS 226	Development and Guidance in Middle Childhood	
HD FS 227	Adolescent and Emerging Adulthood	
HD FS 234	Adult Development	
HD FS 377	Aging and the Family	
Three of the following:		9
HD FS 249	Parenting and Family Diversity Issues	
HD FS 270	Family Communications and Relationships	
HD FS 360	Housing and Services for Families and Children	
HD FS 367	Abuse and Illness in Families	
HD FS 373	Death as a Part of Living	
HD FS 395	Children, Families, and Public Policy	
HD FS 449	Program Evaluation and Proposal Writing	
HD FS 463	Environments for the Aging	
HD FS 479	Family Interaction Dynamics	
Total Credits		15

The Education Services in Family and Consumer Sciences minor may be earned by completing 15 credits:

FCEDS 206	Professional Roles in Family and Consumer Sciences	2
FCEDS 306	Educational Principles for Family and Consumer Sciences and Family Life Education	4
FCEDS 413	Planning and Assessment for Family and Consumer Sciences and Family Life Education	4
FCEDS 491A	Supervised Experiences in a Professional Setting: Communications	5
or FCEDS 491B	Supervised Experiences in a Professional Setting: Professional Studies	
Total Credits		15

The Financial Counseling and Planning minor may be earned by completing 15 credits:

HD FS 283	Personal and Family Finance	3
Select 12 credits from the courses below:		12
HD FS 341	Household Finance and Policy	
HD FS 378	Retirement Planning and Employee Benefits	
HD FS 383	Fundamentals of Financial Planning	
HD FS 482	Family Savings and Investments	
HD FS 484	Estate Planning for Families	
HD FS 489	Financial Counseling	
HD FS 489L	Financial Counseling Laboratory	
Total Credits		15

Graduate Study

The department offers work for the Master of Science (thesis or non-thesis options) and Doctor of Philosophy degrees with the major in Human Development and Family Studies. Minor work for students taking major work in other departments is also available. Graduates of M.S. and Ph.D. programs in the department will understand and apply relevant theories to educational, research, and/or intervention or prevention programs. It is intended that they will produce and disseminate research results and provide leadership in human development and family studies professions.

Graduate study in Human Development and Family Studies at Iowa State University is multidisciplinary and focuses on research and practice in several content areas such as adolescent/youth development, adult development and aging, family studies and policy, family economic well-being and financial planning, infant and child development, health and well-being, and lifespan development.

Prerequisite to work in the major is the completion of a related undergraduate program with basic courses and/or experiences in areas such as child/human development, community and regional planning, economics, education, family studies, psychology, or sociology. Additional coursework or prerequisites (e.g., basic statistics) may be required depending on the undergraduate program and program of study. Students may be admitted to our doctoral program with either a bachelor's (M.S./Ph.D. Track, 5 years) or a master's degree (Ph.D. Track only, 3 years). Students admitted to the Ph.D. Track without a prior master's degree complete requirements for a thesis-based master's degree as part of their doctoral program of study.

All students take a core set of courses; the program of study is then completed with a selection of courses that meet the individual needs of the student. The variety of and flexibility in the coursework allows a student to tailor a program to specific academic interests. The graduate programs are based on a theory, research, and application interactive paradigm with all three areas integrated into content and method courses.

The department offers a graduate minor in Human Development and Family Studies. To earn this minor, students in a Master's program must take 9 credits in HD FS graduate courses (500, 600 level) with a limit of 3 credits in seminar or workshop credit (credits in 591 or 691 not allowed). To earn a minor in HD FS students in a Doctoral program must take 12 credits in HD FS graduate courses (500, 600 level) with a limit of 3 credits in seminar or workshop credit (credits in 591 or 691 not allowed).

The department offers four Graduate Certificates available to HD FS majors as well as students in other departments and professionals in the field. The certificates emphasize application and relevance to growing diversity and demands on the work force and include Developmental and Family Sciences Advanced Research Design and Methods (15 credits); Family Well-Being in Diverse Society (12 credits); Infant and Early Childhood Mental Health (12 credits, online); and Life-span Development (12 credits, online).

The department also participates in several Master of Family and Consumer Sciences (MFCS) degree programs (http://catalog.iastate.edu/collegeofhumansciences/familyandconsumersciences/). Admission to the youth (YTH), family financial planning (FFP) and gerontology (GERON) specialization programs require submission of the Graduate College application form, transcripts, 2 letters of recommendation, resume and a goal statement. Students in a MFCS program select one of the options listed below.

First, students selecting this option may choose Human Development and Family Studies as the focus of their studies.

Second, a 36-credit Master of Family and Consumer Sciences-Youth Development (MFCS-YD), or a 13-credit Youth Development Specialist Certificate, or a 13-credit Youth Program Management and Evaluation Certificate are designed to prepare individuals who work directly with youth or are involved in education and research related to youth. The courses for this program are completely online.

Third, a 36-credit Master of Family and Consumer Sciences-Family Financial Planning Program (MFCS-FFP), along with the 18-credit Graduate Certificate Program, is designed to prepare individuals to work in the financial planning field. The courses for the program are completely online. Completion of course work in the Master degree and Graduate Certificate meets the educational requirements to sit for the Certified Financial Planner (CFP) Board of Standards Certification Examination.

The department offers a Financial Counseling and Planning (FCP) concurrent degree program that allows students to obtain a B.S. in FCP and an M.S. in HD FS or a B.S. in FCP and a Graduate Certificate in Family Financial Planning in 5 years. Application for admission to the Graduate College should be made near the end of the junior year. Under concurrent enrollment, students simultaneously take undergraduate and graduate courses and may be eligible for assistantships. Students interested in these programs should contact the department for details.

Finally, the department collaborates with the interdepartmental Gerontology program; students may declare a minor in Gerontology. The Master of Family and Consumer Sciences - Gerontology program (MFCS-GERON) and the Graduate Gerontology Certificate program are designed to prepare professionals who work directly with older people or are involved in education and research related to older adults. Professionals offering direct services often are involved in health promotion programs, directing inter-generational activities, managing senior centers or retirement communities, counseling older people and their families, and helping people plan for retirement. Professionals involved in education and research may evaluate community-based services, teach others about the aging process, develop policies and programs to serve the needs of older adults, and work with business and industry on issues related to an aging work force.

Courses primarily for undergraduates:

HD FS 102: Individual and Family Development, Health, and Well-being
(3-0) Cr. 3. F.S.SS.
Overview of life-span developmental tasks (physical, cognitive, language, social, emotional) examined from various theoretical perspectives. Discussion of topics related to family diversity, individual/family health and well-being and reciprocal relationships as affected by external factors.

HD FS 103: Professional Principles for Working with Children
(0.5-0) Cr. 0.5. F.S.
Introduction to professional principles and ethics, understanding of child abuse reporting, universal precautions. Completion of criminal background checks for ISU practica. Offered on a satisfactory-fail basis only. Only one of HD FS 103 or 105 may count toward graduation.

HD FS 105: Professional Principles for Working with Youth and Adults
(0.5-0) Cr. 0.5. F.S.
Introduction to professional principles and ethics, understanding of child, dependent adults and elder abuse reporting, working with aging adults, universal precautions. Offered on a satisfactory-fail basis only. Only one of HD FS 103 or 105 may count toward graduation.

HD FS 110: Freshman Learning Community Orientation
(1-0) Cr. 1. F.
Prereq: Membership in HD FS Learning Community
Introduction to the Department of Human Development and Family Studies including academic requirements and opportunities, strategies for transitioning to college, learning and study strategies, reading and reflection, and career awareness.

HD FS 111: New Transfer Student Seminar
(1-0) Cr. 1. F.S.
Introduction to HD FS curricula and faculty for students in CH FS, FCEDS or F C P. Department and University policies and procedures, degree audits, and registration. Exploration of campus resources and strategies for student success. Offered on a satisfactory-fail basis only.

HD FS 183: Personal Finance in Early Adulthood
(1-0) Cr. 1. F.S.SS.
Introduction to basic concepts and budgeting practices for management of resources and prevention of financial problems commonly associated with college, including credit and student loans. Offered on a satisfactory-fail basis only.

HD FS 208: Early Childhood Education Teacher Orientation
(Cross-listed with C I). Cr. 1. F.S.
Prereq: classification as ECE major
Overview of early childhood education (birth-grade 3) teacher licensure requirements. Program planning and university procedures. Required of all students majoring in early childhood education. Offered on a satisfactory-fail basis only.

HD FS 218: Professional Orientation and Service Learning
(2-0) Cr. 2. F.S.
Prereq: Credit or concurrent enrollment in HD FS 102. For child, adult and family services majors.
Ethics, professional development, and career exploration in child, adult and family services. Visits to and service learning with programs that serve children, adults and families with diverse needs. Participation in service learning project required. Offered on a satisfactory-fail basis only.

HD FS 223: Child Development and Health
(3-0) Cr. 3. F.S.
Typical and atypical development of children prenatal through middle childhood. Examination of healthy development and potential impact of health issues in children. Discussion of influence of the family and society on development.

HD FS 224: Development in Young Children: Birth through Age 8
(3-1) Cr. 3. F.S.
Prereq: HD FS 102 and HD FS 103
Learning, growth, and development (typical and atypical) of children from birth through age eight. Explores importance of family, programs, and a diverse society. Strategies for observing, recording, and interpreting children's cognitive, communication, motor, social, and emotional development. Practicum.

HD FS 226: Development and Guidance in Middle Childhood
(3-0) Cr. 3. F.
Prereq: HD FS 102 or PSYCH 230
Typical and atypical development from 5 to 12 years of age. Development in the contexts of family, school, and society. Guidance of children in family and group settings.

HD FS 227: Adolescent and Emerging Adulthood
(3-0) Cr. 3. F.S.
Prereq: HD FS 102 or PSYCH 230
Physical, cognitive, and socioemotional development of adolescents and young adults in the context of family, relationships, and culture.

HD FS 234: Adult Development
(Cross-listed with GERON). (3-0) Cr. 3. S.
Prereq: HD FS 102
Introductory exploration of the health, individual and social factors associated with adult development including young adulthood, middle age and older adulthood. Information is presented from a life-span developmental framework.

HD FS 239: Consumer Issues
(3-0) Cr. 3. F.S.
Introduction to factors affecting consumer decisions of individuals and families, including housing, healthcare, and personal finances. Emphasis on accessibility and affordability, community contexts for families; and consumer protection, legislation and regulation, and consumer fraud.
Meets U.S. Diversity Requirement

HD FS 240: Literature for Children
(3-0) Cr. 3. F.S.
Evaluation of literature for children, including an emphasis on diversity and inclusion; cultural competence. Roles of literature in the overall development of children. Literature selection and use in the home and educational settings.
Meets U.S. Diversity Requirement

HD FS 249: Parenting and Family Diversity Issues
(3-0) Cr. 3. F.S.
Parenting practices and family relationships across the lifespan. Practical knowledge and techniques about how to be an effective parent. Diverse families, discipline, and parent education programs.
Meets U.S. Diversity Requirement

HD FS 270: Family Communications and Relationships
(3-0) Cr. 3. F.S.Alt. SS., offered odd-numbered years.
Prereq: HD FS 102 or PSYCH 230
Family communication and its functions to develop, maintain, enrich and limit family relationships. Family theories related to communication and ethical considerations when working with families.
Meets U.S. Diversity Requirement

HD FS 276: Human Sexuality
(3-0) Cr. 3. F.S.SS.
Behavioral, biological, and psychological aspects of human sexuality within the social context of family, culture, and society. Role of sexuality in human development. Critical analysis of media and research. Communication and decision-making skills relating to sexuality issues and relationships.
Meets U.S. Diversity Requirement

HD FS 283: Personal and Family Finance
(3-0) Cr. 3. F.S.
Introduction to basic principles of personal and family finance. Budgeting, record keeping, checking and savings accounts, consumer credit, insurance, investments, and taxes.

HD FS 317: Field Experiences
Cr. 1-6. Repeatable. F.S.SS.
Prereq: Permission of instructor.
Consult department office for procedure. Supervised field experience in human development and family studies programs. Offered on a satisfactory-fail basis only.

HD FS 317B: Field Experiences: Human Development and Family Studies
Cr. 1-6. Repeatable. F.S.SS.
Prereq: 9 credits in HD FS.
Consult department office for procedure. Supervised field experience in human development and family studies programs. Offered on a satisfactory-fail basis only.

HD FS 317H: Field Experiences: Honors
Cr. 1-6. Repeatable. F.S.SS.
Prereq: 9 credits in HD FS
Consult department office for procedure. Supervised field experience in human development and family studies programs. Offered on a satisfactory-fail basis only.

HD FS 340: Assessment and Curricula: Ages Birth through 2 Years
(3-3) Cr. 4. F.S.
Prereq: HD FS 103; HD FS 224; admission to teacher education program
Assessment strategies for infants and toddlers, including those with special needs. Curricula, learning environments, teaching strategies, health and nutritional practices, and schedules that are developmentally, individually, and culturally appropriate. Using assessment to plan, implement, and evaluate activities to promote physical, motor, cognitive, communication, and social emotional development; practicum.

HD FS 341: Household Finance and Policy
(3-0) Cr. 3. F.
Prereq: 6 credits in social sciences
The social, economic, and governmental contexts of financial decision-making at the household level.

HD FS 342: Guidance and Group Management in Early Childhood
(2-2) Cr. 3. F.S.
Prereq: HD FS 103; HD FS 224
Guiding prosocial development, self-regulation, and task engagement of children birth to age 8. Focus is on promoting prosocial behaviors through supportive relationships and environments within diverse home, center, or school settings. Functional behavior assessment and ongoing progress monitoring for targeted and intensive interventions. Practicum.

HD FS 343: Assessment and Programming: Ages 3 through 6 Years
(3-3) Cr. 4. F.S.
Prereq: HD FS 103; HD FS 224; HD FS 240; admission to teacher education program
Assessment strategies for preschool and kindergarten children, including those with special needs. Learning environments, schedules, activities, nutritional practices, and teaching strategies that are developmentally, individually, and culturally appropriate. Using assessment to plan, implement, and evaluate activities to promote physical motor, cognitive, communication, and social emotional development; practicum.

HD FS 344: Programming for Children in Early Care and Education
(3-3) Cr. 4. F.S.
Prereq: HD FS 103; HD FS 224
Programming in inclusive child care centers and family child care homes, including those with special needs, aged birth through 8 years. Developing, implementing, and evaluating learning environments; activities and materials; behavioral guidance and classroom management practices; health and nutritional practices; and schedules to ensure developmental, individual, and cultural appropriateness. Monitoring children's development and behavior to promote physical, motor, cognitive, communication, and social emotional development. Learning to collaborate effectively with parents and staff. Practicum.

HD FS 345: Adapting Programming in Inclusive Settings
(3-0) Cr. 3. F.S.
Prereq: HD FS 224; SP ED 250
Adapting instruction, materials, and equipment to meet developmental needs of young children birth through age 8 with diverse learning needs and multiple disabilities in inclusive settings. Addressing individualized education programs; special health care needs, challenging behavior, and positioning and handling techniques.

HD FS 360: Housing and Services for Families and Children
(3-0) Cr. 3. F.
Prereq: 6 credits in social sciences
Approaches to and assessment of housing and services that assist those with special needs including those with disabilities, low-income, children at risk, single-parents, and the homeless. Emphasis on community settings; e.g., residential facilities, group housing, shelters and transitional housing.
Meets U.S. Diversity Requirement

HD FS 367: Abuse and Illness in Families
(3-0) Cr. 3. F.S.Alt. SS., offered even-numbered years.
Prereq: HD FS 102 or PSYCH 230
Causes and consequences of family stressors including physical, sexual, and emotional abuse; substance abuse; and mental and physical illness across the life span. Interplay between victims, offenders, and the treatment system.

HD FS 369: Research Methods in Human Development and Family Studies
(3-1) Cr. 3. F.S.
Prereq: HD FS 102 or PSYCH 230; 9 hours in HD FS; junior or senior status.
Understanding and evaluating research. Use of primary and secondary data to identify and study problems related to human development and family issues. An introduction to statistical concepts and data analysis. Computer laboratory experience.

HD FS 373: Death as a Part of Living
(Cross-listed with GERON). (3-0) Cr. 3. F.S.Alt. SS., offered even-numbered years.
Prereq: HD FS 102
Consideration of death in the life span of the individual and the family with opportunity for exploration of personal and societal attitudes.

HD FS 377: Aging and the Family
(Cross-listed with GERON). (3-0) Cr. 3. F.Alt. SS., offered odd-numbered years.
Prereq: HD FS 102
Interchanges of the aged and their families. Emphasis on role changes, social interaction, and independence as influenced by health, finances, life styles, and community development.
Meets U.S. Diversity Requirement

HD FS 378: Retirement Planning and Employee Benefits
(Cross-listed with ECON, GERON). (3-0) Cr. 3. S.
Prereq: 3 credits in Principles of Economics and 3 credits in Human Development and Family Studies
Economic well-being in the context of demographic change, the present and future of Social Security, family retirement needs analysis, investment strategies and characteristics of retirement plans, helping others to work towards financial security, family economic issues for retired persons. Overview of employee and retirement benefits.
Meets U.S. Diversity Requirement

HD FS 383: Fundamentals of Financial Planning
(3-0) Cr. 3. F.
Prereq: HD FS 283
Fundamental principles of the financial planning process, client/planner interactions, time value of money applications as well as analyses of ethics review, financial statements, cash flow and debt management, education planning, retirement planning, tax planning, and estate planning needs of families.

HD FS 395: Children, Families, and Public Policy
(3-0) Cr. 3. F.S.Alt. SS., offered odd-numbered years.
Prereq: HD FS 369 or equivalent
Public policy and politics as they affect children and families. Examination of how individuals and groups influence policy. Investigation of current issues and programs influencing the well-being and welfare of children and families.

HD FS 416: Human Development and Family Studies Seminar
Cr. arr. Repeatable. F.S.SS.
Prereq: 8 credits in human development and family studies
Intensive study of a selected topic in human development and family studies.

HD FS 417: Supervised Student Teaching
Cr. 8. Repeatable.
Prereq: Reservation required

HD FS 417C: Supervised Student Teaching: Early Childhood Special Education Programs.
Cr. 8. Repeatable. F.S.
Prereq: GPA 2.5, full admission to teacher education program, HD FS 455; HD FS 456.
Teaching experience with preschool children with disabilities.

HD FS 418: Professional Practice Reflection/Discussion
Cr. 0.5-2. Repeatable. F.S.
Discussion of professional practice experience. Offered on a satisfactory-fail basis only.

HD FS 418A: Professional Practice Reflection/Discussion: Teaching
(0.5-0) Cr. 0.5. F.S.
Prereq: Taken concurrently with HD FS 417
Discussion of HD FS 417 student teaching field experience. Offered on a satisfactory-fail basis only.

HD FS 418B: Professional Practice Reflection/Discussion: Internships
(2-0) Cr. 2. F.S.
Prereq: Junior classification
Process and development of skills necessary for professional preparation and practice including career planning, resume writing, and interviewing. Strategies for successful career management. Offered on a satisfactory-fail basis only.

HD FS 449: Program Evaluation and Proposal Writing
(3-0) Cr. 3. F.S.
Prereq: HD FS 369
Theory and practice of program evaluation and proposal writing in human services including needs assessment, outcome development and measurement, and proposal components. Assessment of programs' success in meeting goals.

HD FS 455: Curricula for Ages 3 through 6 Years
(3-3) Cr. 4. F.S.
Prereq: HD FS 343, HD FS 345, SP ED 355 and SP ED 455
Program models and methods leading to development and organization of appropriate curricula in preschool and kindergarten programs for young children with diverse learning needs. Government regulations and professional standards for child programming. Teaming with parents, colleagues, and paraprofessionals to plan, implement, and evaluate developmentally and culturally appropriate individualized education plans in inclusive settings; practicum.

HD FS 456: Working with Families in Early Intervention
(3-0) Cr. 3. F.S.
Prereq: Current background check; HD FS 340 or HD FS 344; or permission of instructor
Applying family systems theory and family centered principles in early intervention. Understanding the impact of disability on families and young children. Utilizing strategies for delivering family-centered interventions and service coordination in home-based and natural environments. Building trusting relationships, teaming with families and interdisciplinary colleagues to create, implement, and evaluate Individualized Family Service Plans (IFSPs) for children birth to age three. Understanding foundations of theory and policy and empowering families through effective supports and services. Experiences with families.

HD FS 463: Environments for the Aging
(Dual-listed with HD FS 563). (Cross-listed with ARTID, GERON). (3-0) Cr. 3. S.
Prereq: HD FS 360 or 3 credits in housing, architecture, interior design, rehabilitation, psychology, or human development and family studies or permission of instructor
Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (on-line course offering via Distance Education).
Meets U.S. Diversity Requirement

HD FS 479: Family Interaction Dynamics
(3-0) Cr. 3. F.S.
Prereq: HD FS 102 or equivalent; HD FS 369 or equivalent; 9 hours in social sciences; junior or senior status
Analysis of research related to family interaction processes across the family life span. Emphasis on relationship dynamics and cultural differences.

HD FS 482: Family Savings and Investments
(3-0) Cr. 3. F.
Prereq: HD FS 283
Management of family financial resources; emphasis on savings and the investment planning process; issues facing financial planners who manage family assets. Identification of investment options including common stocks, fixed income securities, convertible securities, and related choices.

HD FS 484: Estate Planning for Families
(3-0) Cr. 3. S.
Prereq: HD FS 283
Study of estate planning focusing on efficient conservation and transfer of wealth, consistent with client's goals. Legal, tax, financial and non-financial aspects of estate planning process; trusts, wills, probate, advanced directives, charitable giving, wealth transfers and related taxes.

HD FS 485: Capstone: Family Financial Planning
(3-0) Cr. 3. S.
Prereq: HD FS 283, HD FS 341, HD FS 378, HD FS 383, HD FS 482, FIN 361
Development and refinement of competencies required by personal financial planners to work with individuals and families in meeting financial objectives. Utilization of skills obtained in financial planning emphasis to complete one or more financial planning narratives.

HD FS 486: Administration of Human Services Programs
(3-0) Cr. 3. F.S.
Prereq: Junior classification; 6 credits in HD FS at 300 level and above
Examination of purpose, policies, staffing, operations, and clientele of organizations serving children, adults and families with diverse needs. Management/leadership principles and techniques. Introduction to financial management. Administrators/supervisors roles in employee management as well as development of client-oriented programs, fundraising, goal setting, strategic planning, and advocacy.

HD FS 489: Financial Counseling
(Dual-listed with HD FS 589). (2-0) Cr. 2. F.
Prereq: HD FS 283 for 489, graduate classification for 589
Personal, social/psychological and legal climates affecting family financial decisions. A life cycle approach to financial decision making. Development of financial counseling and planning skills to assist families and individuals to become self-sufficient in family financial management.

HD FS 489L: Financial Counseling Laboratory
(Dual-listed with HD FS 589L). (0-2) Cr. 1. Repeatable, maximum of 2 credits. F.S.
Prereq: HD FS 283 for 489L, graduate classification for 589L
Practical experience in remedial, preventative, and productive approaches to both financial and housing counseling in one-on-one and/or group settings.

HD FS 490: Independent Study
Cr. arr. Repeatable.
Prereq: 6 credits in human development and family studies
Consult department office for procedure.

HD FS 490H: Independent Study: Honors
Cr. arr. Repeatable.
Prereq: 6 credits in human development and family studies
Consult department office for procedure.

HD FS 491: Internship
Cr. 4-9. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: HD FS 418B; permission of instructor; senior classification; minimum 2.0 GPA; reservation required one semester before placement
Supervised work experience related to the student's curriculum. Offered on a satisfactory-fail basis only.

HD FS 493: Workshop
(Dual-listed with HD FS 593). Cr. arr. Repeatable. F.S.SS.
Prereq: Senior classification
Workshop in HD FS.

HD FS 499: Research
Cr. arr. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Consult department office for procedures.
Supervised research experience.

Courses primarily for graduate students, open to qualified undergraduates:

HD FS 501: Graduate Studies, Research, and Ethics in HD FS
(2-0) Cr. 2. F.
Prereq: Admission to HD FS Graduate program
Overview of graduate study, research, ethics, and professional development in the field of human development and family studies. Curriculum, programs of study, portfolios, faculty research interests, dissemination of research, career planning, and teaching discussed.

HD FS 502: Professional Development in Human Development and Family Studies
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: graduate classification; HD FS 501
Overview of professional skills, portfolio building, preparation for academic and nonacademic jobs, leadership fundamentals and project management training, time management, work balance issues, and professional ethics. Opportunities for graduate students to work on their professional development tailored to individual needs of students. Develop an individual professional portfolio.

HD FS 503: Quantitative Research Methods
(4-0) Cr. 4. F.
Prereq: Permission of instructor
Concepts, methods, and strategies for research in human development and family studies. Topics include the nature of scientific research, measurement, types of research in human development and family studies, validity of research designs, methods of data gathering, and strategies for and issues in the study of change.

HD FS 504: Qualitative Research Methods
(3-0) Cr. 3. F.
Prereq: 9 credits of social sciences or permission of instructor
Introduction to qualitative research methodology. Application of fieldwork methods, analysis, interpretation, and writing through individual qualitative research projects.

HD FS 505: Application of Quantitative Research Methods
(3-0) Cr. 3. S.
Prereq: HD FS 503 or permission of instructor
Practical applications of quantitative research methods, including an introduction to secondary data analysis, correlation and regression analysis, regression diagnostics; reporting results.

HD FS 510: Theories of Human Development
(3-0) Cr. 3. F.SS.
Prereq: 9 credits of social sciences or permission of instructor
Theoretical approaches and current research in child, adolescent, and adult development. Individual life span perspectives. Implications for research, policy and practice. (Summer course offering is on-line).

HD FS 511: Family Theory
(3-0) Cr. 3. S.
Prereq: 9 credits in social sciences or permission of instructor
Theoretical approaches and current research in family development. Review the nature and value of theory to the study of the family and evaluate the use of theory in empirical research. Implications for research, policy and practice.

HD FS 530: Perspectives in Gerontology
(Cross-listed with GERON). (3-0) Cr. 3. F.
Overview of current aging issues including theory and research, critical social and political issues in aging, the interdisciplinary focus of gerontology, career opportunities, and aging in the future. (on-line course offering via Distance Education).

HD FS 534: Adult Development
(Cross-listed with GERON). (3-0) Cr. 3. S.
Exploration of the biological, psychological and social factors associated with aging. Although the focus is on the later years, information is presented from a life-span developmental framework. Empirical studies are reviewed and their strengths, limitations and implications for normative and optimal functioning are discussed. (on-line course offering via Distance Education).

HD FS 538: Developmental Disabilities
(Cross-listed with PSYCH). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 9 credits in human development and family studies or psychology or permission of instructor
Theories, research, and current issues regarding the intersection of development and disabilities. Investigation of interventions with individuals and families. (on-line course offering via Distance Education).

HD FS 541: Housing and Real Estate in Family Financial Planning
(Cross-listed with FFP). (3-0) Cr. 3. Alt. SS., offered even-numbered years.
The role of housing and real estate in the family financial planning process, including taxation, mortgages, financial calculations, legal concerns, and ethical issues related to home ownership and real estate investments. Emphasis on emerging issues in the context of housing and real estate. (on-line course offering via Distance Education).

HD FS 545: Economics, Public Policy, and Aging
(Cross-listed with GERON). (3-0) Cr. 3. F.
Policy development in the context of the economic status of the older adult population. Retirement planning and the retirement decisions; social security and public transfer programs; intra-family transfers to/from the aged; private pensions; financing medical care; prospects and issues for the future.

HD FS 555: Current Issues and Research in Early Childhood Services
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 9 credits in social sciences or permission of instructor
Analysis of contemporary and historical early childhood/early intervention/early childhood special education model programs and services. Examination of relationships among service systems and implementation, program quality, teacher effectiveness, and outcomes for children with and without disabilities. (on-line course offering via Distance Education).

HD FS 563: Environments for the Aging
(Dual-listed with HD FS 463). (Cross-listed with ARTID, GERON). (3-0) Cr. 3. S.
Prereq: HD FS 360 or 3 credits in housing, architecture, interior design, rehabilitation, psychology, or human development and family studies or permission of instructor
Emphasis on independent living within residential settings including specialized shelter, supportive services and housing management. Application of criteria appropriate for accessibility and functional performance of activities; universal design principles. Creative project provides service learning opportunities. (on-line course offering via Distance Education).
Meets U.S. Diversity Requirement

HD FS 566: Family Policy
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in social sciences or permission of instructor
An introduction to policy for family researchers and practitioners. Examination of relevant policies through a family lens via discussion of theory and student interests in current and enduring family policies and programs. Descriptions of work roles in family policy and the interaction of family researchers and policymakers.

HD FS 567: Family Stress, Abuse, and Illness
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 9 credits in social sciences or permission of instructor
Explores research related to family stress within romantic, parent-child, and sibling relationships. Examines contemporary theory and research on the nature, causes, and consequences of family stressors. These stressors include, but are not limited to economic distress; physical and emotional abuse; substance abuse; and mental and physical illness across the life span. (on-line course offering via Distance Education).

HD FS 568: Individual and Family Assessment
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HD FS 510 or permission of instructor
Use of interviews, observational assessments, direct tests with individuals and families for research and intervention. Opportunities to practice assessments.

HD FS 575: Cross-cultural Perspectives about Families and Children
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in social sciences or permission of instructor
Review of current research regarding family diversity including an examination of cultural and structural influences on the development and well-being of families and children. Discussion of the impact on human rights and social justice. (on-line course offering via Distance Education).

HD FS 577: Aging in the Family Setting
(Cross-listed with GERON). (3-0) Cr. 3. S.
Prereq: 9 credits in social sciences or permission of instructor
Theories and research related to personal and family adjustments in later life affecting older persons and their intergenerational relationships. Related issues including demographics also are examined through the use of current literature. (on-line course offering via Distance Education).

HD FS 579: Family Well-being Across the Lifespan
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 9 credits in social sciences or permission of instructor
Review of current research to provide a theoretical and practical understanding of the economic, social, and psychological factors that influence interpersonal relationships and individual well-being within the institution of the family system. Economic and policy effects considered. (on-line course offering via Distance Education).

HD FS 581: International Study in Human Development and Family Studies
Cr. 1-12. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission by application
Limited enrollment. Supervised international study experiences in Human Development and Family Studies. Countries vary.

HD FS 581A: International Study in HD FS: Practicum
Cr. 1-12. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission by application
Limited enrollment. Supervised international study experiences in Human Development and Family Studies. Countries vary.

HD FS 581B: International Study in HD FS: Exchange
Cr. 1-12. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission by application
Limited enrollment. Supervised international study experiences in Human Development and Family Studies. Countries vary.

HD FS 581C: International Study in HD FS: Group Study
Cr. 1-12. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Permission by application
Limited enrollment. Supervised international study experiences in Human Development and Family Studies. Countries vary.

HD FS 583: Investing for the Family's Future
(Cross-listed with FFP). (3-0) Cr. 3. F.
Prereq: HD FS 483
Evaluation of investment markets for the household. Analysis of how families choose where to put their savings. Emphasis is on using the family's overall financial and economic goals to help inform investment choices. (on-line course offering via Distance Education).

HD FS 584: Program Evaluation and Research Methods in Gerontology
(Cross-listed with GERON). (3-0) Cr. 3. S.
Overview of program evaluation, research methods, and grant writing in gerontology. Includes application of quantitative and qualitative methods in professional settings. (on-line course offering via Distance Education).

HD FS 585: Program Evaluation
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 6 credits in graduate level social sciences or permission of instructor
Theoretical and practical issues related to design and implementation of program evaluation in social sciences. Includes theory, design, implementation, analysis and report writing to assist programs to be successful in meeting program goals.

HD FS 588: Family Economics
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 6 credits in sociology or economics
Analysis of family income, wealth, and economic well-being. Emphasis on effects of family behavior and public policies on the adequacy and security of income across the family life cycle. Implications of resource allocation within the family for adult and child well-being.

HD FS 589: Financial Counseling
(Dual-listed with HD FS 489). (2-0) Cr. 2. F.
Prereq: HD FS 283 for 489, graduate classification for 589
Personal, social/psychological and legal climates affecting family financial decisions. A life cycle approach to financial decision making. Development of financial counseling and planning skills to assist families and individuals to become self-sufficient in family financial management.

HD FS 589L: Financial Counseling Laboratory
(Dual-listed with HD FS 489L). (0-2) Cr. 1. Repeatable, maximum of 2 credits. F.S.
Prereq: HD FS 283 for 489L, graduate classification for 589L
Practical experience in remedial, preventative, and productive approaches to both financial and housing counseling in one-on-one and/or group settings.

HD FS 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Consult department office on procedure for filing a written plan of study.

HD FS 590I: Special Topics: Human Development and Family Studies
Cr. arr. Repeatable.
Prereq: Permission of instructor
Consult department office on procedure for filing a written plan of study.

HD FS 591: Internship
Cr. arr. Repeatable. F.S.SS.
Prereq: 10 graduate credits
Supervised experience in an area of human development and family studies.

HD FS 591I: Internship: Human Development and Family Studies
Cr. arr. Repeatable. F.S.SS.
Prereq: 10 graduate credits
Supervised experience in an area of human development and family studies.

HD FS 593: Workshop
(Dual-listed with HD FS 493). Cr. arr. Repeatable. F.S.SS.
Prereq: Senior classification
Workshop in HD FS.

HD FS 594: Professional Seminar in Gerontology
(Cross-listed with GERON). (3-0) Cr. 3. SS.
An integrative experience for gerontology students designed to be taken near the end of the degree program. By applying knowledge gained in earlier coursework, students will strengthen skills in ethical decision-making behavior, applying these skills in gerontology-related areas such as advocacy, professionalism, family and workplace issues. Students from a variety of professions will bring their unique perspectives to bear on topics of common interest. (on-line course offering via Distance Education).

HD FS 599: Creative Component
Cr. arr. F.S.SS.
Prereq: 9 graduate credits in HD FS
Nonthesis students creative component (e.g., a special report, capstone course, integrated field experience, annotated bibliography, research project, design, or other creative endeavor). A minimum of five credits of independent work is required on the programs of study (POS). Creative component format determined cooperation with the POS committee.

Courses for graduate students:

HD FS 603: Advanced Quantitative Methods
(3-0) Cr. 3. F.
Prereq: HD FS 503, HD FS 505; STAT 402 or STAT 404 or permission of instructor
Methodological and analytical issues in research in human development and family studies. Advanced research design and measurement, selection of statistical techniques, and issues in the interpretation of findings.

HD FS 604: Advanced Qualitative Methods
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HD FS 504 or permission of instructor
Research methodologies including phenomenology, grounded theory, ethnography, and case studies. Methods of data collection and analysis procedures. Issues of ethics and interpretation of findings. (on-line course offering via Distance Education).

HD FS 605: Multi-level Modeling
(Cross-listed with PSYCH). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HD FS 503 and HD FS 505 or STAT 404 or permission of instructor
Rationale for and interpretation of random coefficient models. Strategies for the analysis of multi-level and panel data including models for random intercepts, random slopes, and growth curves.

HD FS 606: Advanced Structural Equation and Longitudinal Modeling
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HD FS 603 or STAT 404 or permission of instructor
Rationale for and interpretation of advanced structural equation modeling for the analysis of longitudinal data. Emphasis will be placed on developing a working familiarity with some of the common statistical procedures, coupled with their application through the use of statistical software.

HD FS 607: Mixed Methods
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HD FS 503, HD FS 504,HD FS 505, or permission of instructor
Foundations of mixed methods research, controversies, and philosophical concerns. Rationale for and interpretation of mixed methods designs. Research design, sampling, data collection, data analysis, results, and interpretation. (on-line course offering via Distance Education).

HD FS 608: Grant Writing for Research
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: HD FS 503, HD FS 505, and HD FS 504 or permission of instructor
Understand how to identify funding sources as well as the fundamental components of a federal research grant proposal such as the abstract or summary, background and significance, specific aims/goals and objectives, project design and methods, sustainability, assessment, broader impacts, dissemination, budget, budget justification, and cover letter.

HD FS 616: Seminar
Cr. arr.
May be repeated. F.S.SS.

HD FS 631: Child Health and Development
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: HD FS 510 or permission of instructor
Young children's cognitive, physical, communication, and social-emotional health and development will be examined. Both typical and atypical trajectories will be explored. Research on current trends in the field will be emphasized.(on-line course offering via Distance Education).

HD FS 632: Behavioral Interventions in Early Childhood
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HD FS 510 or permission of instructor
Issues related to behavioral development and needs of children ages 3-8. Design and implementation of group and individual behavioral interventions. Discussion of coaching strategies to improve intervention implementation. (on-line course offering via Distance Education).

HD FS 633: Infant Mental Health
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HD FS 510 or permission of instructor
Examination of the individual, interpersonal, and familial factors that influence infant (birth through age 3) mental health. Analysis of the risk and protective factors that influence these systems and their potential effects on social-emotional development. Current issues relating to effective programs for improving parent-infant interactions and additional supports available to families.(on-line course offering via Distance Education).

HD FS 634: Adolescent and Emerging Adult Health and Development
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: HD FS 510 or permission of instructor
Theory and research on biopsychosocial, cognitive, physical and sexual health and development from early adolescence to emerging adulthood. Contexts of development including families, peers, schools, neighborhoods, romantic relationships, economics and public policies are considered.(on-line course offering via Distance Education).

HD FS 635: Adult Development, Aging, and Health
(Cross-listed with GERON). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: HD FS 510 or permission of instructor
Review of the impact of the growing older adult population as well as individual development and aging on individuals, families, and society. Exploration of theoretical perspectives applied to adult development and aging and distinction of normative and non-normative changes in adulthood. Discussion of methods to assess development across adulthood and consideration of the role of individual and environmental factors impacting efforts to optimize adult development.(on-line course offering via Distance Education).

HD FS 640: Biomarkers and Family Research
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HD FS 510 or permission of instructor.
Research on the biological underpinnings of human development and the biobehavioral health of the family. Exposure to interdisciplinary research and practice on biomarkers in the family, with particular emphasis on health-and well being-related measures. Application of biomarker collection, measurement, analysis and dissemination.

HD FS 690: Advanced Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor and enrollment in Ph.D. program

HD FS 690I: Advanced Topics: Human Development and Family Studies
Cr. arr. Repeatable.
Prereq: Permission of instructor and enrollment in Ph.D. program

HD FS 691: Internship
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor
Supervised practice and experience in the following specified areas. Offered on a satisfactory-fail basis only.

HD FS 691A: Internship: College Teaching
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor
Supervised practice and experience in college-level teaching. Offered on a satisfactory-fail basis only.

HD FS 691B: Internship: Research
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor
Supervised practice and experience in conducting research. Offered on a satisfactory-fail basis only.

HD FS 691D: Internship: Professional Experience
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor
Supervised practice and experience in relevant professional experiences. Offered on a satisfactory-fail basis only.

HD FS 699: Research
Cr. arr. Repeatable.
Offered on a satisfactory-fail basis only.

HD FS 699I: Research: Human Development and Family Studies
Cr. arr. Repeatable.
Offered on a satisfactory-fail basis only.

Human Sciences

Human Sciences courses provide integrative study and enriching experiences in areas that cut across the diverse curricula of the College of Human Sciences. These may include such areas as leadership, global understanding, social justice/responsibility, and ethics. Students in any college may take these courses.

Courses primarily for undergraduates:

H SCI 110: Orientation and Human Sciences Career Exploration
(2-0) Cr. 2. F.S.
Orientation and adjustment to the university and college; review of policies and procedures; academic resources; and course selection and planning. Comprehensive approach to career development; intensive self-analysis; and in-depth examination of majors in Human Sciences. Required for all students declared as an Undecided major in the College of Human Sciences.

H SCI 150: Dialogues on Diversity
(1-0) Cr. 1. F.S.
An exploration of diversity within the context of the Iowa State University community through understanding human relations issues.
Meets U.S. Diversity Requirement

H SCI 490: Independent Study
Cr. 1-4.

H SCI 490E: Entrepreneurship
Cr. 1-4.

Kinesiology

Mission

We promote health and well-being by creating and disseminating knowledge about physical activity and active living. Through discovery, learning and engagement we improve the lives of citizens of Iowa, the United States and the world.

Goals

The department has identified the following goals to support this mission:

1. We seek to improve the lives of citizens of Iowa, the United States, and the world by the creation and dissemination of knowledge about physical activity and its relationship to health and well-being.
2. We prepare scholars and professionals in the study of physical activity at the undergraduate and graduate levels.
3. We educate the public and the University community in the scientific aspects of physical activity especially exercise, sport, and the role of movement throughout the lifespan.

Undergraduate Study

The Department of Kinesiology offers two Bachelor of Science degrees: Athletic Training and Kinesiology & Health. The undergraduate curriculum major/option is comprised of three components: general education, required departmental courses and the major/option courses.

The intent of the general education component is to promote intellectual and personal growth and to prepare students for success in the basic, advanced and major/option components. Required courses provide an introduction to the field and fundamental principles of physical activity, fitness, health and disease.

B.S. degree in Athletic Training

Certified Athletic Trainers are allied medical health professionals who specialize in the prevention, assessment, treatment and rehabilitation of injuries to athletes and physically active individuals who are engaged in physical and athletic activities. To gain certification, candidates must graduate from a CAATE accredited athletic training education program and successfully pass the Board of Certification (BOC) examination.

Many states also have licensure requirements to practice athletic training. The Athletic Training education program at Iowa State University, accredited since 2001, includes various athletic training clinical rotations including high school, physical therapy clinics, surgical observation experiences, and emergency room observation. The Athletic Training Program utilizes a competitive admission process for undergraduate students.

B.S. degree in Kinesiology & Health

The Kinesiology & Health major includes five specialization options. Options comprise a focused area of study within Kinesiology and Health. Coursework within each specialization option builds upon personal and scholarly learning by enabling students to master content and skills specific to career applications. Options available are:

1. Community and Public Health
2. Exercise Science
3. Physical Activity and Health Promotion
4. Physical Education Teacher Education
5. Pre-Health Professions

Academic options within the Kinesiology & Health major

Students in the **Community and Public Health** option are prepared for professional employment at local, state or national health agencies, medical centers, and other public or private organizations that seek to promote health in the population.

Students in the **Exercise Science** option are prepared for professional roles as health and fitness leaders or program managers. Employment opportunities include work in corporate fitness programs, health clubs, or hospitals. Graduates are able to plan, implement and supervise exercise programs which will improve fitness and health. Graduates also have a basic understanding of management issues related to business applications in the health and fitness field.

Students in the **Physical Activity and Health Promotion** option are prepared for careers focused on health and physical activity. This option provides more emphasis on behavioral and psychological aspects of physical activity. Students are prepared for careers in community based settings, including work sites, schools, hospitals, and other community agencies.

Students in the **Physical Education/Teacher Education** option are prepared to teach physical education in grades K-12 and to meet the State of Iowa learning outcomes for teachers. Graduates can plan developmentally appropriate physical education, and individualize instruction and assessment for diverse audiences.

Students in the **Pre-Health Professions** option utilize an interdisciplinary approach to the study of human movement. In so doing, they become prepared for graduate study in Kinesiology or advanced study leading to careers in medicine, physical therapy, physician assistant or other healthcare professions.

Learning outcomes for the undergraduate degree

Despite the diversity of options, the learning outcomes comprise a common framework for each student as they progress through Iowa State University.

The learning outcomes emphasized in academic coursework in the Department of Kinesiology are:

Communication

Uses clear and effective written, oral, visual, and electronic (WOVE) communication techniques to foster inquiry, collaboration, and engagement in physical activity and health related settings.

Lifelong learning, assessment, and self-reflection

Analyzes and evaluates one's own knowledge, abilities and actions relative to professional standards, seeks opportunities to grow professionally, and utilizes self-assessment and assessment of others to foster physical, cognitive, social, and emotional well-being.

Content knowledge, discovery, and critical thinking

Understands fundamental concepts of physical activity and health, conducts scientific inquiry, and applies critical thinking to solve problems from personal, scholarly, and professional perspectives.

Ethics, diversity, and social justice

Demonstrates leadership and social responsibility to improve quality of life for others and ensures equitable access for diverse groups by creating appropriate environments to initiate and maintain a physically active, healthy lifestyle.

Other Program Offerings:

B.S./M.S. degree in Diet and Exercise

A combined Bachelor of Science and Master of Science (B.S./M.S.) degree in Diet and Exercise is available. The program is jointly administered by the Department of Food Science and Human Nutrition (FS HN), and the Department of Kinesiology. Students interested in this program must enroll as freshmen in the Pre-Diet and Exercise program. In the fall of the junior year, students will apply for admission to the B.S./M.S. program. Students not accepted into the program will continue toward completion of a B.S. degree in Dietetics or Kinesiology & Health. Coursework has been designed to facilitate a 4-year graduation date for those students not accepted into the program and electing to complete a single undergraduate degree. Students accepted into the program will progress toward completion of B.S./M.S. degrees in Diet and Exercise.

More information can be found at: http://www.fshn.hs.iastate.edu/undergraduate-programs/diet-exercise/

Endorsement to coach interscholastic athletics

The State Department of Education has provided for the endorsement of licensed teachers for the coaching of athletic teams in schools. The endorsement does not lead to licensure to teach physical education. For requirements of the program, leading to the coaching endorsement, see School of Education, Teacher Education. More information can be found at: http://www.kin.hs.iastate.edu/

Endorsement to teach health education

Those interested in teaching health education in the public schools may get a primary licensure or an additional endorsement. The State Department of Education has approved the Health Teaching Licensure for grades 5-12.

Basic Activity Instruction Program

The department offers a wide selection of beginning, intermediate, and advanced courses in the areas of aquatics, dance, fitness, martial arts, and sports. These courses are designed to serve general education purposes for all students.

Dance

Coursework in dance provides opportunities for students to develop an understanding and appreciation of dance as part of a liberal education. Those interested in teaching dance and physical education in the public schools may major in Kinesiology and Health (Physical Education Teacher Education) and minor in Dance.

An interdisciplinary Performing Arts major with a Dance emphasis is available through the College of Liberal Arts and Sciences. For further information see Index, Performing Arts Program, Dance.

Curriculum in Athletic Training

The athletic training major prepares students for a career as an athletic trainer in high school, college or professional settings or for work in other settings (such as sports medicine clinics, the military, industry, and fitness centers). See program details for course requirements. Admission procedures and technical standards can be found at *http://www.kin.hs.iastate.edu/programs/athletic-training/#program-information-and-requirements*.

Curriculum in Kinesiology and Health

The curriculum in Kinesiology and Health is designed for students preparing to enter professional areas related to the medical, health, physical activity, exercise or sport science fields. Students majoring in Kinesiology & Health may select one of five options:

1. Community and Public Health
2. Exercise Science
3. Physical Activity and Health Promotion
4. Physical Education Teacher Education
5. Pre-Health Professions

Minors in dance, exercise science, health promotion, and kinesiology, are available; see requirements under Kinesiology, Undergraduate Programs.

A major in Performing Arts with a dance emphasis is available; see requirements under Curriculum in Performing Arts Program, Dance.

Communication Proficiency

In order to meet graduation requirements, all students must earn an average of C (2.0) or better in ENGL 150 and ENGL 250, with neither grade being lower than a C-. Students not meeting this condition must earn a C or better in an advanced writing course:

ENGL 302	Business Communication	3
or ENGL 314	Technical Communication	
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3

U.S. Diversity and International Perspectives

In order to meet graduation requirements, all students must complete 3 cr. of course work in U.S. Diversity and 3 cr. in International Perspectives. See university approved list.

General Education:

Physical and Life Sciences:

BIOL 255	Fundamentals of Human Anatomy	3
BIOL 255L	Fundamentals of Human Anatomy Laboratory	1
BIOL 256	Fundamentals of Human Physiology	3
BIOL 256L	Fundamentals of Human Physiology Laboratory	1

Additional option-specific requirements are:
Community and Public Health

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1

CHEM 163	College Chemistry	4
CHEM 163L	Laboratory in College Chemistry	1
FS HN 167	Introduction to Human Nutrition	3
MICRO 201	Introduction to Microbiology	2
MICRO 201L	Introductory Microbiology Laboratory	1

Exercise Science

FS HN 167	Introduction to Human Nutrition	3
PHYS 115	Physics for the Life Sciences	4

Physical Activity and Health Promotion

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
CHEM 163	College Chemistry	4
CHEM 163L	Laboratory in College Chemistry	1
FS HN 167	Introduction to Human Nutrition	3
MICRO 201	Introduction to Microbiology	2
MICRO 201L	Introductory Microbiology Laboratory	1

Physical Education Teacher Education

PHYS 115	Physics for the Life Sciences	4

Pre-Health Professions

PHYS 111	General Physics	4-5
or PHYS 115	Physics for the Life Sciences	

Mathematics and Statistics:

Community and Public Health

From the following: 3-4

STAT 101	Principles of Statistics
or STAT 104	Introduction to Statistics

Exercise Science

From the following: 3-4

MATH 140	College Algebra
or MATH 143	Preparation for Calculus
or MATH 145	Applied Trigonometry
or MATH 165	Calculus I
or MATH 181	Calculus and Mathematical Modeling for the Life Sciences I

From the following: 3-4

STAT 101	Principles of Statistics
or STAT 104	Introduction to Statistics

Physical Activity and Health Promotion

One of the following: 3-4

STAT 101	Principles of Statistics
or STAT 104	Introduction to Statistics

Physical Education Teacher Education

One of the following: 3-4

MATH 104	Introduction to Probability
or MATH 140	College Algebra
or STAT 101	Principles of Statistics
or STAT 104	Introduction to Statistics

Pre-Health Professions

One of the following: 3-4

MATH 140	College Algebra
or MATH 143	Preparation for Calculus
or MATH 145	Applied Trigonometry
or MATH 165	Calculus I
or MATH 181	Calculus and Mathematical Modeling for the Life Sciences I

From the following: 3-4

STAT 101	Principles of Statistics
or STAT 104	Introduction to Statistics

Social Sciences: 9 cr. min required

Option-specific requirements are:

Community and Public Health

PSYCH 101	Introduction to Psychology	3
PSYCH 230	Developmental Psychology	3
SOC 134	Introduction to Sociology	3

Exercise Science

PSYCH 101	Introduction to Psychology	3
or PSYCH 230	Developmental Psychology	
SOC 134	Introduction to Sociology	3

Physical Activity and Health Promotion

PSYCH 101	Introduction to Psychology	3
or PSYCH 230	Developmental Psychology	
SOC 134	Introduction to Sociology	3

Physical Education Teacher Education

PSYCH 230	Developmental Psychology	3
SOC 134	Introduction to Sociology	3

Pre-Health Professions

PSYCH 101	Introduction to Psychology	3
or PSYCH 230	Developmental Psychology	
SOC 134	Introduction to Sociology	3

Humanities: 6 cr. min required

Choose from department approved list.

Communications: 13 cr. min required

ENGL 150	Critical Thinking and Communication	3

ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
One of the following		3
ENGL 302	Business Communication	
or ENGL 314	Technical Communication	
or SP CM 31	Business and Professional Speaking	

Program requirements:

The following courses are required in all majors and options:

H S 110	Personal and Consumer Health	3
H S 350	Human Diseases (*)	3
KIN 252	Disciplines and Professions in Kinesiology and Health	1
KIN 253	Orientation and Learning Community in Kinesiology and Health	1
KIN 258	Physical Fitness and Conditioning	2
KIN 358	Physiology of Exercise (*)	3

* A grade of C- or better is required.

Total cr. required to graduate: A minimum of 124 credits is required, with a minimum of 46 credits in courses numbered 300 or above.

Courses for Kinesiology and Health Major

Option 1. Community and Public Health

This option prepares students for a diverse array of careers in public and private health agencies as well as local, state and federal government programs. Students are qualified for careers in a variety of health and human service agencies, community organizations, and hospitals. This option also provides the ideal background training for credentials as a Certified Health Education Specialist (CHES).

Option Requirements:

P R 220	Principles of Public Relations	3
or P R 305	Publicity Methods	
H S 105	First Aid and Emergency Care	2
H S 215	Drug Education	3
H S 310	Community and Public Health (*)	3
H S 385	Strategies for Professional School and Field Experience Opportunities	.5
H S 430	Community Health Program Development	3
H S 464	Physical Activity Epidemiology	3
or VDPAM 428	Principles of Epidemiology and Population Health	
H S 485	Directed Field Experience in Health Promotion	8-16
HD FS 270	Family Communications and Relationships	3
HD FS 449	Program Evaluation and Proposal Writing	3
or ENGL 309	Proposal and Report Writing	
PSYCH 485	Health Psychology	3
One of the following		
HD FS 377	Aging and the Family	3
or HD FS 395	Children, Families, and Public Policy	
Electives: 6-14 credits		

* A grade of C- or better is required.

Option 2. Exercise Science

This option prepares students for careers in exercise/fitness promotion. Students are prepared as health/fitness specialists, personal trainers, strength and conditioning specialists, and health coaches. Students find work in fitness centers, worksite health programs, medical facilities, cardiac rehabilitation centers, and other agencies that provide fitness services. Students are eligible to sit for certification exams offered by the American College of Sports Medicine and the National Strength & Conditioning Association.

Option Requirements:

KIN 259	Leadership Techniques for Fitness Programs	2
KIN 266	Advanced Strength Training and Conditioning	2
KIN 345	Management of Health-Fitness Programs and Facilities	3
KIN 355	Biomechanics (*)	3
KIN 360	Sociology of Sport and Exercise (*)	3
KIN 366	Exercise Psychology (*)	3
KIN 372	Motor Control and Learning Across the Lifespan (*)	3
KIN 385	Strategies for Professional School and Field Experience Opportunities	0.5
KIN 458	Principles of Fitness Assessment and Exercise Prescription (*)	4
KIN 459	Internship in Exercise Leadership	1
KIN 462	Medical Aspects of Exercise	3
KIN 485A	Internship in Exercise Science: Health/Fitness Management.	8-16
H S 380	Worksite Health Promotion	3
A TR 220	Basic Athletic Training	2
or H S 305	Instructor's First Aid and Cardio-pulmonary Resuscitation	
Electives: 12-21 credits		

* A grade of C- or better is required.

Option 3. Physical Activity and Health Promotion

This option prepares students for a variety of career outlets focused on health and physical activity promotion. The coursework provides the ideal background for students interested in worksite wellness programming. Students are also well suited to pursue career opportunities in health coaching and health promotion in schools, community agencies, as well as clinical settings. This option provides ideal background training for students interested in pursuing the Physical Activity in Public Health Specialist Certification offered by the American College of Sports Medicine.

Option Requirements:

FS HN 364	Nutrition and Prevention of Chronic Disease	3
FS HN 365	Obesity and Weight Management	3
or FS HN 366	Communicating Nutrition Messages	
H S 310	Community and Public Health (*)	3
H S 380	Worksite Health Promotion	3
H S 385	Strategies for Professional School and Field Experience Opportunities	0.5
H S 430	Community Health Program Development	3
H S 464	Physical Activity Epidemiology	3
H S 485	Directed Field Experience in Health Promotion	8-16
KIN 259	Leadership Techniques for Fitness Programs	2
KIN 366	Exercise Psychology (*)	3
KIN 458	Principles of Fitness Assessment and Exercise Prescription (*)	4
KIN 467	Exercise and Health: Behavior Change	3
Electives: 9-18 credits		

* A grade of C- or better is required.

Option 4. Physical Education Teacher Education

This option is for students seeking a license to teach K-12 physical education. All courses required for licensure have a minimum grade requirement of a C or C-. Students interested in a coaching and/or a health endorsement must complete additional coursework.

Option Requirements:

KIN 231	Fundamentals of Tumbling and Gymnastics (*)	1
KIN 232	Fundamentals of Team Sports (*)	1
KIN 236	Fundamentals of Individual Sports and Fitness (*)	1
KIN 259	Leadership Techniques for Fitness Programs	2
KIN 280	Directed Field Experience in Elementary Physical Education	1
KIN 281	Directed Field Experience in Secondary Physical Education	1
KIN 282	Field Experience with Educational Outreach	1
KIN 312	Movement Education in Elementary School Physical Education (**)	3
KIN 313	Teaching Secondary Physical Education (**)	3
KIN 355	Biomechanics (*)	3
KIN 360	Sociology of Sport and Exercise (*)	3
KIN 365	Sport Psychology (*)	3
KIN 372	Motor Control and Learning Across the Lifespan (*)	3
KIN 395	Adapted Physical Education (**)	3
KIN 417	Supervised Teaching in Physical Education in the Secondary School (**)	8
KIN 418	Supervised Teaching in Physical Education in the Elementary School (**)	8
KIN 471	Measurement in Physical Education (**)	3
KIN 475	Physical Education Curriculum Design and Program Organization (**)	3
DANCE 211	Fundamentals and Methods of Social and World Dance (*)	1
H S 105	First Aid and Emergency Care (*)	2
H S 305	Instructor's First Aid and Cardio-pulmonary Resuscitation (*)	2
C I 202	Learning Technologies in the 7-12 Classroom (**)	3
C I 204	Social Foundations of Education in the United States (**)	3
C I 406	Social Justice Education and Teaching: Secondary (**)	3
Electives: 5 credits		

* A grade of C- or better is required.

** A grade of C or better is required.

Option 5. Pre-Health Professions

This option is for students interested in graduate study or for those who are preparing for professional programs in medicine, physical therapy, physician assistant, and other healthcare professions. Course work provides background in human movement while completing the requirements for entry into graduate or professional school.

Option Requirements:

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
KIN 242X	Planning for Success in a Health Career	.5
KIN 355	Biomechanics (*)	3
KIN 360	Sociology of Sport and Exercise (*)	3

KIN 365	Sport Psychology (*)	3
or KIN 366	Exercise Psychology (*)	
KIN 372	Motor Control and Learning Across the Lifespan (*)	3
9 cr. from the following		9
H S 464	Physical Activity Epidemiology	3
KIN 455	Research Topics in Biomechanics	3
KIN 458	Principles of Fitness Assessment and Exercise Prescription	4
KIN 462	Medical Aspects of Exercise	3
KIN 467	Exercise and Health: Behavior Change	3
KIN 472	Neural Basis of Human Movement	3
KIN 473	Physical Dimensions of Aging	3
KIN 480	Functional Anatomy	3
Specialization Requirements: Other prerequisites as required by professional schools.		
Electives: 6-14 credits		

* A grade of C- or better is required.

Minors

Dance

The minor requires a minimum of 19 credits and may be earned by completing the following:

DANCE 220	Modern Dance Composition	2
DANCE 222/223	Modern Dance II	1
DANCE 270	Dance Appreciation	3
DANCE 320	Sound and Movement	3
DANCE 360	History and Philosophy of Dance	3
DANCE 384	Teaching Children's Dance	2
DANCE 385	Methods of Teaching Dance	2
or DANCE 386	Teaching Dance Technique and Composition	
3 additional credits selected from dance courses numbered 200 or above.*		

*Participation in Orchesis I or II is recommended.

Exercise Science

The minor requires a minimum of 17 credits and may be earned by completing the following:

KIN 258	Physical Fitness and Conditioning	2
KIN 358	Physiology of Exercise	3
KIN 366	Exercise Psychology	3
KIN 458	Principles of Fitness Assessment and Exercise Prescription	4
5 cr. from the following		
A TR 220	Basic Athletic Training	
KIN 259	Leadership Techniques for Fitness Programs	
KIN 266	Advanced Strength Training and Conditioning	
KIN 345	Management of Health-Fitness Programs and Facilities	
KIN 360	Sociology of Sport and Exercise	
KIN 462	Medical Aspects of Exercise	
KIN 467	Exercise and Health: Behavior Change	

Health promotion

The minor requires a minimum of 18 credits and may be earned by completing the following:

H S 110	Personal and Consumer Health	3
H S 350	Human Diseases	3
H S 380	Worksite Health Promotion	3
3-6-cr. from the following		
H S 215	Drug Education	
H S 305	Instructor's First Aid and Cardio-pulmonary Resuscitation	
H S 310	Community and Public Health	
3-6 cr. from the following		
H S 430	Community Health Program Development	
KIN 467	Exercise and Health: Behavior Change	

Kinesiology

The minor requires a minimum of 15 credits and may be earned by completing the following: (For non-majors only)

KIN 355	Biomechanics	3
KIN 358	Physiology of Exercise	3
KIN 360	Sociology of Sport and Exercise	3
KIN 372	Motor Control and Learning Across the Lifespan	3
KIN 365	Sport Psychology	3
or KIN 366	Exercise Psychology	

Gerontology

The department participates in the interdepartmental minor in gerontology (see Index).

FOUR YEAR PLANS

Students must complete a 3-credit course in US diversity and a 3-credit course in international perspectives. Check the ISU homepage for a list of approved courses. You must complete a minimum of 46 credits in 300/400 level courses and a total of 124 credits for graduation. Four year plans are arranged with courses in prerequisite sequence and within

the term a course is usually offered. These are SAMPLE plans - use the degree audit as "official" documentation of progress toward your degree.

Athletic Training, B.S.

Freshman

Fall	Credits	Spring	Credits
BIOL 255	3	A TR 221	1
BIOL 255L	1	A TR 222	3
ENGL 150	3	BIOL 256	3
H S 110	3	BIOL 256L	1
KIN 252	1	FS HN 167	3
KIN 253	1	SOC 134	3
LIB 160	1	STAT 101 or 104	3-4
PSYCH 101 or PSYCH 230	3		
	16		17-18

Sophomore

Fall	Credits	Spring	Credits
A TR 219	1	A TR 224	3
A TR 223	1	A TR 225	1
A TR 226	3	A TR 240	1
A TR 227	1	H S 215	3
ENGL 250	3	KIN 266	2
KIN 258	2	PHYS 111 or 115	4-5
MATH 140, 143, 145, 165 or 181	3-4	Humanities Choice	3
	14-15		17-18

Junior

Fall	Credits	Spring	Credits
A TR 323	3	A TR 326	3
A TR 324	1	A TR 327	1
CHEM 163	4	H S 350	3
CHEM 163L	1	KIN 358	3
KIN 355	3	KIN 365	3
Social Science Choice	3	SP CM 212	3
	15		16

Senior

Fall	Credits	Spring	Credits
A TR 425	3	A TR 488	2
A TR 450	3	A TR 489	1
KIN 360	3	ENGL 302, 314 or SP CM 312	3
Electives	3	H S 305	2
Humanities Choice	3	KIN 445	3
		KIN 480	3
	15		14

Kinesiology and Health, B.S. - Community/Public Health

Freshman

Fall	Credits	Spring	Credits
BIOL 211	3	CHEM 163	4
BIOL 211L	1	CHEM 163L	1
ENGL 150	3	FS HN 167	3
H S 110	3	H S 105	2
KIN 252	1	KIN 258	2
KIN 253	1	PSYCH 230	3
LIB 160	1	Elective	1
PSYCH 101	3		
	16		16

Sophomore

Fall	Credits	Spring	Credits
BIOL 255	3	BIOL 256	3
BIOL 255L	1	BIOL 256L	1
ENGL 250	3	H S 215	3
HD FS 270	3	SP CM 212	3
SOC 134	3	Electives	3
STAT 101 or 104	3-4	Humanities Choice	3
	16-17		16

Junior

Fall	Credits	Spring	Credits
H S 310	3	H S 385	0.5
H S 350	3	H S 464 or VDPAM 428	3
HD FS 377 or 395	3	HD FS 449 or ENGL 309	3
KIN 358	3	MICRO 201	2
PSYCH 485	3	MICRO 201L	1
Elective	1	Electives	3
		Humanities Choice	3
	16		15.5

Senior

Fall	Credits	Spring	Credits
ENGL 302, 314 or SP CM 312	3	H S 485	8-16
H S 430	3		
P R 220 or 305	3		
Electives (300+ level courses)	6		
	15		8-16

Kinesiology and Health, B.S. - Exercise Science

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	FS HN 167	3
H S 110	3	KIN 258	2
KIN 252	1	SOC 134	3
KIN 253	1	MATH 140, 143, 145, 165 or 181	3-4
LIB 160	1	SP CM 212	3
PSYCH 101 or 230	3	Electives	2
Humanities Choice	3		
	15		16-17

Sophomore

Fall	Credits	Spring	Credits
BIOL 255	3	A TR 220 or H S 305	2
BIOL 255L	1	BIOL 256	3
ENGL 250	3	BIOL 256L	1
KIN 259	2	KIN 266	2
Electives	5	STAT 101 or 104	3-4
Social Science Choice	3	Electives	5
	17		16-17

Junior

Fall	Credits	Spring	Credits
H S 350	3	KIN 355	3
KIN 345	3	KIN 360	3
KIN 358	3	KIN 372	3
KIN 366	3	KIN 385	0.5
PHYS 115	4	Electives	5
		Humanities Choice	3
	16		17.5

Senior

Fall	Credits	Spring	Credits
ENGL 302, 314 or SP CM 312	3	KIN 485A	8-16
H S 380	3		
KIN 458	4		
KIN 459	1		
KIN 462	3		
Electives	3		
	17		8-16

Kinesiology and Health, B.S. - Physical Activity and Health Promotion

Freshman

Fall	Credits	Spring	Credits
BIOL 211	4	CHEM 163	4
BIOL 211L	1	CHEM 163L	1
ENGL 150	3	FS HN 167	3
H S 110	3	KIN 258	2
KIN 252	1	SOC 134	3
KIN 253	1	Humanities Choice	3
LIB 160	1		
PSYCH 101 or 230	3		
	16		16

Sophomore

Fall	Credits	Spring	Credits
BIOL 255	3	BIOL 256	3
BIOL 255L	1	BIOL 256L	1
ENGL 250	3	SP CM 212	3
KIN 259	2	STAT 101 or 104	3-4
MICRO 201	2	Electives	3
MICRO 201L	1	Social Science Choice	3
Electives	3		
	15		16-17

Junior

Fall	Credits	Spring	Credits
FS HN 364	3	FS HN 365 or 366	3
H S 310	3	H S 380	3
H S 350	3	H S 385	0.5
KIN 358	3	H S 464	3
KIN 366	3	Electives	6
Elective	1		
	16		15.5

Senior

Fall	Credits	Spring	Credits
ENGL 302, 314 or SP CM 312	3	H S 485	8-16
H S 430	3		
KIN 458	4		
KIN 467	3		
Humanities Choice	3		
	16		8-16

Kinesiology and Health, B.S. - Physical Education Teacher Education

Freshman

Fall	Credits	Spring	Credits
C I 204	3	DANCE 211	1
ENGL 150	3	KIN 236	1
H S 110	3	KIN 258	2
KIN 252	1	KIN 280	1
KIN 253	1	MATH 104, 140, STAT 101, or STAT 104	3-4
LIB 160	1	SOC 134	3
PSYCH 230	3	Humanities Choices	3
	15		14-15

Sophomore

Fall	Credits	Spring	Credits
BIOL 255	3	BIOL 256	3
BIOL 255L	1	BIOL 256L	1
ENGL 250	3	C I 202	3
H S 105	2	H S 305	2
KIN 231	1	KIN 282	1
KIN 232	1	SP CM 212	3
KIN 259	2	Humanities Choice	3
KIN 281	1		
Social Science Choice	3		
	17		16

Junior

Fall	Credits	Spring	Credits
KIN 312	3	H S 350	3
KIN 365	3	KIN 313	3
KIN 372	3	KIN 360	3
KIN 395	3	KIN 358	3
PHYS 115	4	KIN 471	3
	16		15

Senior

Fall	Credits	Spring	Credits
C I 406	3	KIN 417	8
ENGL 302, 314 or SP CM 312	3	KIN 418	8
KIN 355	3		
KIN 475	3		
Electives	2		
	14		16

Kinesiology and Health, B.S. - Pre-Health Professions - Chiropractic

Freshman

Fall	Credits	Spring	Credits
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
CHEM 177	4	CHEM 178	3
CHEM 177L	1	CHEM 178L	1
ENGL 150	3	H S 110	3
KIN 252	1	MATH 140, 143, 145, 165 or 181	3-4
KIN 253	1		
LIB 160	1		
	15		14-15

Sophomore

Fall	Credits	Spring	Credits
BIOL 255 & 255L	4	BIOL 256 & 256L	4
CHEM 331	3	CHEM 332 & 332L or BBMB 301	3-4
CHEM 331L	1	KIN 242X	.5
ENGL 250	3	SOC 134	3
KIN 258	2	SP CM 212	3
PSYCH 101 or 230	3	Humanities Choice	3
	16		16.5-17.5

Junior

Fall	Credits	Spring	Credits
KIN 365 or 366	3	H S 350	3
KIN 372	3	KIN 355	3
PHYS 111	5	KIN 360	3
STAT 101, 104	3-4	PHIL 331	3
Social Science Choice	3	Electives	3
	17-18		15

Senior

Fall	Credits	Spring	Credits
ENGL 302, 314 or SP CM 312	3	KIN 400-level Courses*	9
FS HN 367	1	Electives	6
KIN 358	3		
Electives (300+ level courses)	6		
Humanities Choice	3		
	16		15

* KIN 400+ Course Choices (9 cr): KIN 455, 458, 462, 467, 472, 473, 480, H S 464.

Kinesiology and Health, B.S. - Pre-Health Professions - Dentistry

Freshman

Fall	Credits	Spring	Credits
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
CHEM 177	4	CHEM 178	3
CHEM 177L	1	CHEM 178L	1
ENGL 150	3	H S 110	3
KIN 252	1	MATH 143, 145, 165 or 181	3-4
KIN 253	1		
LIB 160	1		
	15		14-15

Sophomore

Fall	Credits	Spring	Credits
BIOL 255 & 255L	4	BIOL 256 & 256L	4
CHEM 331	3	CHEM 332	3
CHEM 331L	1	CHEM 332L	1
ENGL 250	3	KIN 242X	.5
KIN 258	2	SOC 134	3
PSYCH 101 or 230	3	STAT 101 or 104	3-4
	16		14.5-15.5

Junior

Fall	Credits	Spring	Credits
BBMB 404 or 420	3	H S 350	3
KIN 365 or 366	3	KIN 355	3
KIN 372	3	PHYS 112	5
PHYS 111	5	Electives	3
SP CM 212	3	Humanities Choice	3
	17		17

Senior

Fall	Credits	Spring	Credits
ENGL 302, 314 or SP CM 312	3	3-5 credits:	3-5
KIN 358	3	BIOL 313	
KIN 360	3	BIOL 313L	
Humanities Choice	3	BIOL 314	
Social Science Choice	3	BIOL 328*	
		BIOL 334	
		BIOL 335	
		BIOL 350*	
		BIOL 351*	
		or	
		BBMB 405	
		Electives (300+ level courses)	3
		KIN 400-level Courses*	9
	15		15-17

* KIN 400+ Course Choices (9 cr): KIN 455, 458, 462, 467, 472, 473, 480, H S 464.

Kinesiology and Health, B.S. - Pre-Health Professions - Human Medicine (Pharmacy)

Freshman

Fall	Credits	Spring	Credits
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
CHEM 177	4	CHEM 178	3
CHEM 177L	1	CHEM 178L	1
ENGL 150	3	H S 110	3
KIN 252	1	MATH 165 or 181	4
KIN 253	1		
LIB 160	1		
	15		15

Sophomore

Fall	Credits	Spring	Credits
BIOL 255 & 255L	4	BIOL 256 & 256L	4
CHEM 331	3	CHEM 332	3
CHEM 331L	1	CHEM 332L	1
ENGL 250	3	KIN 242X	.5
KIN 258	2	SOC 134	3
PSYCH 101 or 230	3	STAT 101 or 104	3-4
	16		14.5-15.5

Junior

Fall	Credits	Spring	Credits
BBMB 404 or 420	3	H S 350	3
KIN 365 or 366	3	KIN 355	3
KIN 372	3	PHYS 112	5
PHYS 111	5	Electives	3
SP CM 212	3	Humanities Choice	3
	17		17

Senior

Fall	Credits	Spring	Credits
ENGL 302, 314 or SP CM 312	3	BIOL 306, 313 & 313L, 314, 328, 335, 350, 351, or BBMB 405	3-5
KIN 358	3	KIN 400-level Courses*	9
KIN 360	3	Electives (300+ level courses)	3
Humanities Choice	3		
Social Sciences Choice	3		
	15		15-17

* KIN 400+ Course Choices (9 cr): KIN 455, 458, 462, 467, 472, 473, 480, H S 464.

Kinesiology and Health, B.S. - Pre-Health Professions - Occupational Therapy

Freshman

Fall	Credits	Spring	Credits
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
ENGL 150	3	KIN 258	2
H S 110	3	MATH 140, 143, 145, 165 or 181	3-4
KIN 252	1	SOC 134	3
KIN 253	1	Humanties Choice	3
LIB 160	1		
PSYCH 101	3		
	16		15-16

Sophomore

Fall	Credits	Spring	Credits
BIOL 255 & 255L	4	BIOL 256 & 256L	4
CHEM 163 & 163L or CHEM 177 & 177L	5	KIN 242X	.5
ENGL 250	3	PHYS 111 or 115	4-5
PSYCH 230	3	Humanities Choice	3
Elective	1	Social Science Choice	3
	16		14.5-15.5

Junior

Fall	Credits	Spring	Credits
KIN 365 or 366	3	H S 350	3
KIN 372	3	KIN 355	3
SP CM 212	3	KIN 360	3
STAT 101 or 104	3-4	PHIL 331	3
Electives	3	Electives	3
	15-16		15

Senior

Fall	Credits	Spring	Credits
ENGL 302, 314 or SP CM 312	3	KIN 400-level Courses*	9
FS HN 367	1	PSYCH, SOC, or Humanities Choice	3
KIN 358	3	Elective	1
PSYCH 460	3	Electives (300+ level courses)	3
Electives (300+ level courses)	6		
	16		16

* KIN 400+ Course Choices (9 cr): KIN 455, 458, 462, 467, 472, 473, 480, H S 464.

Kinesiology and Health, B.S. - Pre-Health Professions - Optometry

Freshman

Fall	Credits	Spring	Credits
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
CHEM 177	4	CHEM 178	3
CHEM 177L	1	CHEM 178L	1
ENGL 150	3	H S 110	3
KIN 252	1	MATH 165 or 181	4
KIN 253	1		
LIB 160	1		
	15		15

Sophomore

Fall	Credits	Spring	Credits
BIOL 255 & 255L	4	BIOL 256 & 256L	4
CHEM 331	3	CHEM 332	3
CHEM 331L	1	CHEM 332L	1
ENGL 250	3	KIN 242X	.5
KIN 258	2	SOC 134	3
PSYCH 101 or 230	3	STAT 101 or 104	3-4
	16		14.5-15.5

Junior

Fall	Credits	Spring	Credits
BBMB 404 or 420	3	H S 350	3
KIN 365 or 366	3	KIN 355	3
KIN 372	3	PHYS 112	5

PHYS 111	5	Electives (300+ level courses)	3
SP CM 212	3	Humanities Choice	3
	17		17

Senior

Fall	Credits	Spring	Credits
ENGL 302, 314 or SP CM 312	3	KIN 400-level Courses*	9
KIN 358	3	MICRO 201/L or 302/L-Microbiology	3-4
KIN 360	3	Electives (300+ level courses)	3
Humanities Choice	3		
Social Science Choice	3		
	15		15-16

* KIN 400+ Course Choices (9 cr): KIN 455, 458, 462, 467, 472, 473, 480, H S 464.

Kinesiology and Health, B.S. - Pre-Health Professions - Physical Therapy

Freshman

Fall	Credits	Spring	Credits
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
ENGL 150	3	KIN 258	2
H S 110	3	MATH 143, 145, 165 or 181	3-4
KIN 252	1	PSYCH 101 or 230	3
KIN 253	1	Humanties Choice	3
LIB 160	1		
SOC 134	3		
	16		15-16

Sophomore

Fall	Credits	Spring	Credits
BIOL 255 & 255L	4	BIOL 256 & 256L	4
CHEM 177	4	CHEM 178	3
CHEM 177L	1	CHEM 178L	1
ENGL 250	3	FS HN 367	1
Humanities Choice	3	KIN 242X	.5
		Electives	3
		Social Science Choice	3
	15		15.5

Junior

Fall	Credits	Spring	Credits
KIN 365 or 366	3	H S 350	3
KIN 372	3	KIN 355	3
PHYS 111	5	PHYS 112	5
SP CM 212	3	PSYCH 460	3
STAT 101 or 104	3-4	Electives	3
	17-18		17

Senior

Fall	Credits	Spring	Credits
ENGL 302, 314 or SP CM 312	3	KIN 400-level Courses*	9
KIN 358	3	Electives (300+ level courses)	6
KIN 360	3		
Electives (300+ level courses)	6		
	15		15

* KIN 400+ Course Choices (9 cr): KIN 455, 458, 462, 467, 472, 473, 480, H S 464.

Kinesiology and Health, B.S. - Pre-Health Professions - Physician Assistant

Freshman

Fall	Credits	Spring	Credits
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
CHEM 177	4	CHEM 178	3
CHEM 177L	1	CHEM 178L	1
ENGL 150	3	H S 110	3
KIN 252	1	MATH 140, 143, 145, 165, 181	3-4
KIN 253	1	PSYCH 101	3
LIB 160	1		
	15		17-18

Sophomore

Fall	Credits	Spring	Credits
BIOL 255 & 255L	4	BIOL 256 & 256L or 335	4
CHEM 231/L or 331/L	4	KIN 242X	.5
ENGL 250	3	SOC 134	3
KIN 258	2	SP CM 212	3
PSYCH 230	3	STAT 101 or 104	3-4
		Humanities Choice	3
	16		16.5-17.5

Junior

Fall	Credits	Spring	Credits
BBMB 316 or 404	3	BIOL 313 & 313L	4

KIN 365 or 366	3	H S 350	3
KIN 372	3	KIN 242X	.5
PSYCH 460	3	KIN 360	3
Electives	4	PHYS 111 or 115	4-5
	16		14.5-15.5

Senior

Fall	Credits	Spring	Credits
ENGL 302, 314 or SP CM 312	3	KIN 400-level Course*	9
KIN 355	3	Electives (300+ level courses)	6
KIN 358	3		
MICRO 201/L or 302/L	3-4		
Humanities Choice	3		
	15-16		15

* KIN 400+ Course Choices (9 cr): KIN 455, 458, 462, 467, 472, 473, 480, H S 464.

Graduate Study

The Department of Kinesiology graduate seeks to integrate discovery and learning by preparing graduate students to understand and create basic and applied knowledge in the study of physical activity, exercise and sport. The normal prerequisite to major graduate work is the satisfactory completion of a curriculum essentially equivalent to that required of undergraduate students in kinesiology at this university. However, it is possible for students to qualify for graduate study if undergraduate preparation has been in a related area.

Students in the M.S. and Ph.D. degrees are required to complete original research and write a thesis or dissertation. There is a non-thesis degree option for M.S. students requiring more coursework and an internship experience or other creative component. Specific information about the requirements for these degree options is available from the department office or from the department web site (http://www.kin.hs.iastate.edu/graduate).

Courses primarily for undergraduates:

KIN 101: Swimming I

(0-3) Cr. 1. F.S.SS.

Basic course for nonswimmers. Emphasis on two fundamental strokes and personal water safety skills. Offered on a satisfactory-fail basis only.

KIN 102: Swimming II

(0-3) Cr. 1. F.S.

Prereq: KIN 101 or equivalent skill

Intermediate course. Emphasis on learning and improving five basic strokes and personal water safety skills. Offered on a satisfactory-fail basis only.

KIN 108: Aquatic Fitness

(0-3) Cr. 1. F.S.

Prereq: KIN 102 or equivalent skill

Water related exercises, activities, and swimming workouts to improve physical fitness. Offered on a satisfactory-fail basis only.

KIN 122: Badminton

(0-2) Cr. 1. F.S.SS.

Introduction to fundamental badminton skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 129: Bowling

(0-2) Cr. 1. F.S.SS.

Introduction to bowling skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 135: Golf

(0-2) Cr. 1. F.S.SS.

Introduction to fundamental golf skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 144: Racquetball

(0-2) Cr. 1. F.S.SS.

Introduction to fundamental racquetball skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 153: Ice Skating

(0-2) Cr. 1. F.S.SS.

Introduction to fundamental ice skating skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 158: Tennis

(0-2) Cr. 1. F.S.SS.

Introduction to basic skills (forehand, backhand, service) and basic knowledge of game play. Offered on a satisfactory-fail basis only.

KIN 163: Physical Fitness

(0-3) Cr. 1. F.S.SS.

Evaluation of fitness status. Exercises, activities, and programs to improve physical fitness. Improve physical fitness and weight control. Offered on a satisfactory-fail basis only. Credit for only KIN 163 or 258 may be applied toward graduation.

KIN 164: Walking for Fitness
(0-3) Cr. 1. F.S.SS.
Fitness walking as an activity to improve health and fitness; values of this type of activity as a lifetime endeavor with knowledge and usage of pedometers. Offered on a satisfactory-fail basis only.

KIN 165: Running for Fitness
(0-2) Cr. 1. F.S.SS.
Running as a physical activity to improve physical fitness and health. Promotion of this activity as a lifetime endeavor. Offered on a satisfactory-fail basis only.

KIN 166: Weight Training
(0-3) Cr. 1. F.S.SS.
Introduction to fundamental skills of weight training and strategic game play. Offered on a satisfactory-fail basis only.

KIN 168: Judo
(0-2) Cr. 1. F.S.
Fundamentals of self defense, focusing on throwing with the hands, hips and feet as well as applying pins, chokes and arm-bars. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self control, & indomitable spirit. Emphasis on learning a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only.

KIN 170: Tae Kwon Do/Karate I
(0-2) Cr. 1. F.S.
Teaches fundamentals of self-defense, focusing on hand and foot striking and blocking techniques. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only.

KIN 171: Tae Kwon Do/Karate II
(0-2) Cr. 1. F.S.
Teaches advanced application of self-defense focusing on hand and foot striking and blocking techniques. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health and citizenship. Offered on a satisfactory-fail basis only.

KIN 173: Hap Ki Do/Martial Self-Defense
(0-2) Cr. 1. F.S.
Teaches fundamentals of self-defense focusing on joint locks, pressure points and throwing techniques to escape from an attacker. The physical skills will be taught focused on training through development of courtesy, integrity, perseverance, self-control and indomitable spirit. It will be emphasized that each student learns a way of life that promotes personal development, physical health & citizenship. Offered on a satisfactory-fail basis only.

KIN 182: Volleyball
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental volleyball skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 185: Soccer
(0-2) Cr. 1. F.S.SS.
Introduction to fundamental soccer skills and strategic game play. Offered on a satisfactory-fail basis only.

KIN 210: Concepts of Fitness and Wellness
(2-0) Cr. 2. F.S.
Coverage of behavioral skills needed to adopt and maintain lifestyles conducive to fitness and wellness. Provides students with knowledge and skills needed to adopt and maintain healthy lifestyles. Includes self-assessments and content on physical activity, nutrition, weight control, stress management and other lifestyle behaviors related to health. For non-kinesiology majors.

KIN 231: Fundamentals of Tumbling and Gymnastics
(0-3) Cr. 1. F.
Prereq: Eligibility for admission to KIN teacher education program
Fundamentals of tumbling and gymnastics apparatus. Skill enhancement, analysis, understanding practice and the development of progressions.

KIN 232: Fundamentals of Team Sports
(0-3) Cr. 1. F.
Prereq: Eligibility for admission to KIN teacher education program
Fundamentals of indoor and outdoor team sports, for example basketball, volleyball, flag football, and soccer. Skill enhancement, analysis, understanding practice and the development of progressions.

KIN 236: Fundamentals of Individual Sports and Fitness
(0-3) Cr. 1. S.
Prereq: Eligibility for admission to KIN teacher education program
Fundamentals of individual sports and fitness, for example disc golf, bowling, badminton, and weight training. Skill enhancement, analysis, understanding practice and the development of progressions.

KIN 252: Disciplines and Professions in Kinesiology and Health
(1-0) Cr. 1. F.S.
Overview of the various disciplines and professions that comprise the field of Kinesiology (the study of human movement) and help students determine the career option that best fits their interests.

KIN 253: Orientation and Learning Community in Kinesiology and Health
(1-0) Cr. 1. F.S.
Prereq: Concurrent enrollment or credit in KIN 252
Overview of ISU policies and procedures, academic advising operations, degree requirements, program of study planning, and campus resources. Students will have out-of-class activities and work with faculty, staff and mentors to explore careers in Kinesiology and complete assignments related to identification & development of their skills and interests. Department of Kinesiology students only. Offered on a satisfactory-fail basis only.

KIN 258: Physical Fitness and Conditioning
(1-3) Cr. 2. F.S.
Prereq: Kinesiology and health majors only
Introduction to five components of fitness: cardiorespiratory, muscular strength, muscular endurance, flexibility, and body composition. Students will be introduced to basic exercise prescription and evaluation principles, develop skills to assess each component of fitness, and learn different exercise modalities to enhance each component. Credit for only one of the following courses may be applied toward graduation: KIN 163, 258.

KIN 259: Leadership Techniques for Fitness Programs
(1-3) Cr. 2. F.S.
Prereq: KIN 258
Development of exercise leadership skills for a variety of activities. Includes planning, promotion, and teaching techniques for developing fitness in others using a variety of exercise modalities including group fitness and weight training. Kinesiology and health majors only.

KIN 266: Advanced Strength Training and Conditioning
(1-2) Cr. 2. F.S.
Prereq: KIN 258
This course is designed to enhance the student's current level of knowledge and expertise to an advanced level in the area of strength training and conditioning. The course will prepare students interested in taking the National Strength and Conditioning Association Certified and Conditioning Specialist's exam. The course will focus on the assessment and implementation of training programs with strong emphasis on the areas of resistance training, metabolic training, flexibility, reaction time, speed, and agility. Kinesiology and health majors only and permission of instructor needed.

KIN 280: Directed Field Experience in Elementary Physical Education
(0-3) Cr. 1. F.S.
Observing, planning, and facilitating movement experiences of children in an elementary school setting. Offered on a satisfactory-fail basis only.

KIN 281: Directed Field Experience in Secondary Physical Education
(0-3) Cr. 1. F.S.
Prereq: Admission to Educator Preparation Program
Observing, planning, and facilitating movement experiences of students in a middle and/or high school setting. Offered on a satisfactory-fail basis only.

KIN 282: Field Experience with Educational Outreach
(0-2) Cr. 1. F.S.
Prereq: Admission to Educator Preparation Program
Planning and facilitating physical education experiences for children in a community outreach setting. Experiences take place on campus. Offered on a satisfactory-fail basis only.

KIN 284: Elementary and Pre-school Movement Education
(2-3) Cr. 3. F.S.SS.
Prereq: 3 credits in human development and family studies
Approaches to teaching movement skills, health-related fitness and school-based physical activities (in the classroom, in PE, during recess) to pre-school and elementary school age children are covered. Emphasis is placed on planning and conducting developmentally appropriate movement experiences for preschool and elementary aged children throughout the school day based upon educational psychology, exercise psychology and motor development research. Practical experience is provided. Credit in only one of the following courses may be applied toward graduation: KIN 284, 312.

KIN 285: Pre-Internship in Kinesiology and Health
(Cross-listed with H S). Cr. 1-2. F.S.SS.
Prereq: Kinesiology and Health major and permission of internship coordinator
Pre-internship experience with a health or fitness organization based on option. Offered on a satisfactory-fail basis only.

KIN 290: Independent Study
Cr. 1. Repeatable, maximum of 3 credits. F.
Study under supervision of faculty.

KIN 312: Movement Education in Elementary School Physical Education
(2-2) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280
Planning for management and instruction of developmentally appropriate physical education for children pre-school through grade six. Laboratory experience required. Credit for only one of KIN 284 or KIN 312 may be applied toward graduation.

KIN 313: Teaching Secondary Physical Education
(2-3) Cr. 3. S.
Prereq: Admission to Educator Preparation Program, KIN 281
Current theory, practice and research on teaching focusing on management, instructional, and learning styles of students in secondary schools.

KIN 315: Coaching Theory and Administrative Issues
(3-0) Cr. 3. F.S.SS.
Study in the theory, ethics, strategy, and mechanics of coaching various interscholastic and/or intercollegiate sports. Emphasis on formulating a philosophy, identifying goals and psychological aspects, teaching skills, and developing strategies.

KIN 345: Management of Health-Fitness Programs and Facilities
(3-0) Cr. 3. F.S.
Application of management concepts to the fitness industry, e.g., understanding customers, marketing, program management, financial management, legal issues, and evaluation and planning.

KIN 355: Biomechanics
(3-0) Cr. 3. F.S.SS.
Prereq: PHYS 111 or PHYS 115
Mechanical basis of human performance; application of mechanical principles to exercise, sport and other physical activities.

KIN 358: Physiology of Exercise
(3-0) Cr. 3. F.S.SS.
Prereq: BIOL 255, BIOL 255L, BIOL 256 and BIOL 256L
Physiological basis of human performance; effects of physical activity on body functions.

KIN 360: Sociology of Sport and Exercise
(3-0) Cr. 3. F.S.
Prereq: SOC 134 and one of STAT 101, STAT 104 or STAT 226/STAT 326, or KIN 471
Sport and exercise as social systems and as institutions related to other institutions such as the polity, the economy, mass media, and education.

KIN 363: Basic Electrocardiography
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Understanding of human electrocardiography, including normal and abnormal 12-lead ECGs and arrhythmia identification.

KIN 365: Sport Psychology
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101 or PSYCH 230
Psychological factors that influence performance in sport settings. The influence of personality, anxiety, motivation and social factors. Psychological skills training and strategic methods for improvement of athletic performance.

KIN 366: Exercise Psychology
(3-0) Cr. 3. F.S.SS.
Prereq: PSYCH 101 or PSYCH 230
Psychological theories for understanding and predicting health-oriented exercise behavior. Psychological and psychobiological responses to exercise. Psychological interventions for increasing exercise participation and adherence rates.

KIN 372: Motor Control and Learning Across the Lifespan
(3-0) Cr. 3. F.S.SS.
Prereq: PSYCH 101 or PSYCH 230, BIOL 255, BIOL 256
Introduction to major concepts of neuromotor control, behavioral motor control and motor learning in the child, adult and older adult, with emphasis on the adult system.

KIN 385: Strategies for Professional School and Field Experience Opportunities
(Cross-listed with H S). Cr. 0.5. F.S.
Prereq: Junior classification; to be taken minimum of two semesters prior to graduation or field experience placement.
Search techniques and preparation of relevant material for work and/or professional school admission. Information specifically related to health care and kinesiology fields. Field experience process and procedures will be reviewed.

KIN 391: Service Learning Leadership Experience
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Applied service learning experiences designed to provide students with opportunities to apply classroom knowledge to real world applications. Students will gain professional skills and programming experience while supporting health, education and wellness programming in school, work site or community settings. Offered on a satisfactory-fail basis only.

KIN 395: Adapted Physical Education
(Dual-listed with KIN 595). (2-3) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280/281
Etiology, characteristics, needs and movement experiences for individuals with disabling conditions. Designed to provide appropriate methods of physical education instruction for students including those with disabilities as identified by the Individuals with Disabilities Education Act and students who are talented and gifted. Assessments and strategies to differentiate instruction and to adapt activities for all exceptional learners will be addressed. Laboratory experience required. KIN 595 may not be taken by students who previously earned credit in KIN 395.

KIN 399: Recreational Sport Management
(3-0) Cr. 3. F.
Prereq: SOC 134
The role of sport in developing fitness, recreational opportunities, and tourism, with special emphasis on issues related to youth sport, volunteerism, and the marketing of sport events and facilities.

KIN 417: Supervised Teaching in Physical Education in the Secondary School
Cr. arr. F.S.
Prereq: KIN 281, KIN 282, KIN 313, KIN 355, KIN 395, KIN 471, KIN 475; admission to Teacher Education; approval before enrolling in the course.
Supervised teaching in the secondary schools.

KIN 418: Supervised Teaching in Physical Education in the Elementary School
Cr. 8. F.S.
Prereq: KIN 280, KIN 282, KIN 312, KIN 355, KIN 395, KIN 471, KIN 475. Students must be fully admitted to Teacher Education and must apply for approval to enroll at the beginning of the semester prior to registering
Supervised teaching in the elementary schools.

KIN 445: Legal Aspects of Sport
(3-0) Cr. 3. S.
Students will understand legal concepts and terminology relevant to sport/activity, identify strategies for limiting liability in sport/fitness programs, and identify solutions for elimination of discriminatory practices in sport and physical activity.

KIN 455: Research Topics in Biomechanics
(3-0) Cr. 3.
Prereq: KIN 355 or permission of instructor
Examination of biomechanics and kinesiology research literature to evaluate the application of mechanical principles and analyses to human movement in exercise, sport, physical activity, and activities of daily living and to assess research outcomes and their implications for motor performance, movement energetic, musculoskeletal loading, and injury.

KIN 458: Principles of Fitness Assessment and Exercise Prescription
(3-2) Cr. 4. F.S.
Prereq: KIN 258, KIN 358
Principles of cardiac risk factor identification and modification; risk classification of potential exercise clients; fitness assessments; developing comprehensive exercise prescriptions for individuals.

KIN 459: Internship in Exercise Leadership
(0-3) Cr. 1. F.S.
Prereq: C- or better in KIN 259, CPR certification, concurrent enrollment in KIN 458
Observation and practice of exercise leadership techniques in an on-campus adult fitness program.

KIN 462: Medical Aspects of Exercise
(3-0) Cr. 3. F.S.
Prereq: KIN 358
The role of exercise in preventive medicine. Impact of exercise on various diseases, and the effect of various medical conditions on the ability to participate in vigorous exercise and competitive sports. Principles of exercise testing and prescription for individuals with these conditions. Environmental and nutritional aspects of exercise.

KIN 467: Exercise and Health: Behavior Change
(Dual-listed with KIN 567). (3-0) Cr. 3. S.
Prereq: Introductory course with emphasis on exercise psychology (i.e., KIN 366 or equivalent)
Advanced analysis of theoretical health behavior models and their application to physical activity behavior. Includes practical techniques, tools and interventions (e.g., counseling skills, motivational interviewing) to enhance exercise prescription and motivation, and considerations for working with special populations.

KIN 471: Measurement in Physical Education
(Dual-listed with KIN 571). (2-3) Cr. 3. S.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practice and research on teaching focusing on management, instructional, and learning styles of students in secondary schools.

KIN 472: Neural Basis of Human Movement
(Dual-listed with KIN 572). (3-0) Cr. 3. S.
Prereq: KIN 372 or PSYCH 310
Addresses the role of the central nervous system in the control of voluntary human movement, with the focus on the cerebral cortex, basal ganglia and cerebellum. Content organized around specific nervous system damage (such as stroke, apraxia, spasticity, or spinal cord damage) and functional movements (such as reaching and grasping, balance and gait). Converging evidence from human movement disorders, brain imaging, animal lesion and single cell studies provide the primary basis for the content.

KIN 473: Physical Dimensions of Aging
Cr. 3. F.
Prereq: KIN 355 or KIN 358 or KIN 372
Understanding the physiological, behavioral, and cognitive changes associated with aging with focus on the effects of physical activity on the aging human system. Discussions of what it means to become older, what a person can expect during the aging process, and what kind of control a person has over the aging process.

KIN 475: Physical Education Curriculum Design and Program Organization
(Dual-listed with KIN 575). (3-0) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practices and principles applied to curriculum development for programs in physical education, K-12. Organizing for teaching in a variety of school settings.

KIN 480: Functional Anatomy
(3-0) Cr. 3. F.S.
Prereq: KIN 355; BIOL 155 or BIOL 255 and BIOL 256
The structure and function of human muscular, skeletal and nervous systems. The relationship of these systems to efficient and safe human motion.

KIN 481: Biomechanics Lab
(0-2) Cr. 1.
Prereq: KIN 355
Learning lab techniques in Biomechanics and engaging in the experimental process.

KIN 482: Exercise Physiology Lab
(0-2) Cr. 1.
Prereq: KIN 358
Learning lab techniques in Exercise Physiology and engaging in the experimental process.

KIN 483: Exercise Psychology Lab
(0-2) Cr. 1.
Prereq: KIN 366
Learning lab techniques in Exercise Psychology and engaging in the experimental process.

KIN 484: Assessment and Control of Locomotion
(0-2) Cr. 1.
Prereq: KIN 372
Learning lab techniques in Motor Control and engaging in the experimental process.

KIN 485: Internship in Exercise Science
Cr. 1-16.
Prereq: Senior classification and advance registration
Observation and practice in fitness agencies. Offered on a satisfactory-fail basis only.

KIN 485A: Internship in Exercise Science: Health/Fitness Management.
Cr. 1-16.
Prereq: Prereq: C- or better in KIN 458, KIN 459 and KIN 462, Kinesiology and Health majors only. Cumulative GPA 2.0.
Observation and practice in selected exercise science agencies. Offered on a satisfactory-fail basis only.

KIN 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits from KIN advanced core and permission of coordinator
Independent study of problems of areas of interest in exercise and sport science and related areas.

KIN 490A: Independent Study: Exercise and Sport Science
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits from KIN advanced core and permission of coordinator
Independent study of problems of areas of interest in exercise and sport science and related areas.

KIN 490H: Independent Study: Honors
Cr. 1-2. Repeatable, maximum of 4 credits.
Prereq: 6 credits from KIN advanced core and permission of coordinator
Independent study of problems of areas of interest in exercise and sport science and related areas.

KIN 495: Special Topics in Kinesiology
Cr. 1-3.
Prereq: Junior or Senior classification
Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

KIN 501: Research Methods in Physical Activity
(3-0) Cr. 3. Repeatable.
Prereq: Graduate classification in kinesiology and health
Methods and techniques used in the design and interpretation of research involving physical activity. Emphasis on styles of writing, library use, and computer applications.

KIN 505: Research Laboratory Techniques in Exercise Physiology
(0-4) Cr. 2.
Prereq: KIN 358 or equivalent course with basic laboratory experience
Application and use of laboratory research equipment in exercise physiology, including operation, calibration, and use in selected situations.

KIN 510: Advanced Medical Aspects of Exercise
(2-0) Cr. 2.
Prereq: KIN 358
The role of exercise in preventive medicine. Impact of exercise on various diseases, and the effect of various medical conditions on the ability to participate in vigorous exercise and competitive sports. Principles of exercise testing and prescription for individuals with these conditions.

KIN 512: Movement Education in Elementary School Physical Education
(2-2) Cr. 3. F.
Planning for management and instruction of developmentally appropriate physical education for children pre-school through grade six. Laboratory experience required. Emphasis on evaluating published research on physical education and school-wide physical activity.

KIN 515: Injury Biomechanics
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Kin 355 or permission of instructor.
Utilization of biomechanical principles to model injury mechanisms. Introduction to tissue mechanics of bone, articular cartilage, ligament, tendon, and muscle. Biomechanics of lower extremity, upper extremity, and head/neck/trunk injuries.

KIN 516: Quantitative Analysis of Human Movement
(3-1) Cr. 3.
Prereq: KIN 355
Application of the principles of mechanics to the analysis of human motion. Investigation of the effects of kinematics and kinetics on the human body with special emphasis on exercise and sport applications. Includes consideration of two-dimensional and three-dimensional imaging techniques and force measurements.

KIN 517: Musculoskeletal Modeling
(3-1) Cr. 3. F.
Prereq: KIN 355 or permission from instructor
Systematic problem-solving approaches and design of computer programs for biomechanical analyses. Estimation of anthropometric parameters and mechanical properties of muscles, bones, and joints. Integration of anthropometrics, kinematics, and muscle mechanics into simulations of human movement.

KIN 518: Student Teaching in Elementary Physical Education
(0-8) Cr. 8. F.S.
Prereq: KIN 512, KIN 570, KIN 575
Student teaching for 8 weeks in an elementary school.

KIN 519: Student Teaching in Secondary Physical Education
(0-8) Cr. 8. F.S.
Prereq: KIN 512, KIN 570, KIN 575
Student teaching for 8 weeks in a middle or high school.

KIN 520: The Social Analysis of Sport
(3-0) Cr. 3.
Prereq: KIN 360; open to majors only or by permission of instructor
Sociological analysis of sport with emphasis on sociological theory, sports structure, and function in modern industrialized society; the systems of sport in regard to their role structure; formal organization, and professionalization and its differentiation along social class, age, and sex.

KIN 521: Advanced Topics in Exercise and Sport Psychology
(3-0) Cr. 3.
Prereq: KIN 365 or KIN 366, 3 courses in psychology; open to majors only or by permission of instructor
Aspects of psychology which form a basis for understanding and explaining behavior in the context of exercise and sport. Emphasis on evaluating published research, particularly theory and research methodology. Student presentations.

KIN 549: Advanced Vertebrate Physiology I
(Cross-listed with AN S, NUTRS). (4-0) Cr. 4. F.
Prereq: Biol 335; credit or enrollment in BBMB 404 or BBMB 420
Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems.

KIN 550: Advanced Physiology of Exercise I
(2-3) Cr. 3.
Prereq: KIN 505
Concepts and methods of assessing neurological, muscular, cardiovascular, and respiratory adjustments to exercise.

KIN 551: Advanced Physiology of Exercise II
(2-3) Cr. 3.
Prereq: KIN 505
Analysis of factors affecting work capacity and performance. Human energy metabolism concepts and measurement.

KIN 552: Advanced Vertebrate Physiology II
(Cross-listed with AN S, NUTRS). (3-0) Cr. 3. S.
Prereq: BIOL 335; credit or enrollment in BBMB 404 or BBMB 420
Cardiovascular, renal, respiratory, and digestive physiology.

KIN 558: Physical Fitness - Principles, Programs and Evaluation
(2-3) Cr. 3.
Prereq: KIN 358
Physiological principles of physical fitness, design and administration of fitness programs; testing, evaluation, and prescription; electrocardiogram interpretation.

KIN 560: Principles of Motor Control and Learning
(2-3) Cr. 3.
Prereq: KIN 372
Theoretical perspectives of motor control and learning will be examined as well as factors that facilitate motor learning. Motor control and learning will also be addressed by studying functional tasks such as reach and grasp, posture and locomotor, handwriting, catching and/or speech.

KIN 561: Motor Development and Physical Activity
(2-0) Cr. 2-3.
Prereq: PSYCH 230
Addresses theories and underlying mechanisms of motor development and motor control applied to typically and atypically developing children. Developmental control of balance, locomotion, reach-to-grasp, and other functional skills will be discussed, as will the role of physical activity in a child's life.

KIN 567: Exercise and Health: Behavior Change
(Dual-listed with KIN 467). (3-0) Cr. 3. S.
Prereq: Introductory course with emphasis on exercise psychology (i.e., KIN 366 or equivalent)
Advanced analysis of theoretical health behavior models and their application to physical activity behavior. Includes practical techniques, tools and interventions (e.g., counseling skills, motivational interviewing) to enhance exercise prescription and motivation, and considerations for working with special populations.

KIN 570: Physical Activity Assessment for Health Related Research
(2-2) Cr. 3.
This course will cover the broad scope of research in physical activity and public health. Emphasis will be placed on the application of physical activity assessment techniques since accurate measures are needed to more accurately assess the health benefits from physical activity and to evaluate the effectiveness of behavioral interventions designed to promote physical activity.

KIN 571: Measurement in Physical Education
(Dual-listed with KIN 471). (2-3) Cr. 3. S.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practice and research on teaching focusing on management, instructional, and learning styles of students in secondary schools.

KIN 572: Neural Basis of Human Movement
(Dual-listed with KIN 472). (3-0) Cr. 3. S.
Prereq: KIN 372 or PSYCH 310
Addresses the role of the central nervous system in the control of voluntary human movement, with the focus on the cerebral cortex, basal ganglia and cerebellum. Content organized around specific nervous system damage (such as stroke, apraxia, spasticity, or spinal cord damage) and functional movements (such as reaching and grasping, balance and gait). Converging evidence from human movement disorders, brain imaging, animal lesion and single cell studies provide the primary basis for the content.

KIN 575: Physical Education Curriculum Design and Program Organization
(Dual-listed with KIN 475). (3-0) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280 and 281
Current theory, practices and principles applied to curriculum development for programs in physical education, K-12. Organizing for teaching in a variety of school settings.

KIN 590: Special Topics
Cr. 1-3. Repeatable.

KIN 590A: Special Topics: Physical Education
Cr. 1-3. Repeatable.

KIN 590B: Special Topics: Health and Exercise Promotion
Cr. 1-3. Repeatable.

KIN 590D: Special Topics: Exercise Physiology
Cr. 1-3. Repeatable.

KIN 590E: Special Topics: Sport Sociology
Cr. 1-3. Repeatable.

KIN 590F: Special Topics: Sport/Exercise Psychology
Cr. 1-3. Repeatable.

KIN 590G: Special Topics: Motor Behavior
Cr. 1-3. Repeatable.

KIN 590H: Special Topics: Biomechanics
Cr. 1-3. Repeatable.

KIN 590I: Special Topics: Research Ethics
Cr. 1-3. Repeatable.

KIN 591: Supervised Field Experience
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 591A: Supervised Field Experience: Physical Education
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 591B: Supervised Field Experience: Health and Exercise Promotion
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 591D: Supervised Field Experience: Exercise Physiology
Cr. 1-6.
Prereq: 10 graduate credits in kinesiology and/or related areas
Supervised on-the-job field experience in special areas.

KIN 592: Practicum in College Teaching
Cr. 1-3. Repeatable, maximum of 3 credits. F.S.SS.
Supervised experience with teaching an upper division, classroom-based course. Offered on a satisfactory-fail basis only.

KIN 595: Adapted Physical Education
(Dual-listed with KIN 395). (2-3) Cr. 3. F.
Prereq: Admission to Educator Preparation Program, KIN 280/281
Etiology, characteristics, needs and movement experiences for individuals with disabling conditions. Designed to provide appropriate methods of physical education instruction for students including those with disabilities as identified by the Individuals with Disabilities Education Act and students who are talented and gifted. Assessments and strategies to differentiate instruction and to adapt activities for all exceptional learners will be addressed. Laboratory experience required. KIN 595 may not be taken by students who previously earned credit in KIN 395.

KIN 599: Creative Component
Cr. 1-3. Repeatable.

Courses for graduate students:

KIN 615: Seminar
Cr. 1-3. Repeatable.

KIN 620: Advance Research Methods in Physical Activity
(3-0) Cr. 3. S.
Prereq: KIN 501, STAT 401 and STAT 402. Doctoral students only
Culminating seminar designed to synthesize statistical and design courses with practical research issues using data from physical activity.

KIN 670: Molecular Biology of Muscle
(Cross-listed with AN S). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BBMB 405, BBMB 420, or BBMB 502
Ultrastructure of muscle; chemistry, structure, function, and molecular biology of muscle proteins. Molecular aspects of muscle contraction, development and turnover. Cytoskeletal proteins and dynamics.

KIN 699: Research
Cr. 1-6. Repeatable.

Nutritional Science (H SCI)

Nutritional science looks at the connection between diet and health. Students learn how diet can play a crucial role in the cause, treatment, and prevention of many diseases. There are degree program options within nutritional science. The pre-health professional and research option coursework prepares students for work in research laboratories, graduate study in nutrition or biological sciences, or entrance into health professional programs, such as medical, dental, physician assistant, and pharmacy schools. Students gain a strong science education along with human nutrition expertise. Additional options in family health, global health and policy, health coach, and nutrition and wellness prepare students for work positions in program planning and evaluation for community, public health, non-profit, and corporate wellness programs addressing the growing public interest in nutrition, wellness, and preventative health. Students learn about the role of nutrition and healthy eating for disease prevention and wellness. The food service option prepares students for school nutrition and food service management positions.

The department also offers a nutrition minor.

Administered by the Department of Food Science and Human Nutrition

- Pre-Health Professional and Research Option
- Family Health Option
- Food Service Option
- Global Health and Policy Option
- Health Coach Option
- Nutrition and Wellness Option

PRE-HEALTH PROFESSIONAL AND RESEARCH OPTION

Total Degree Requirement: 120 cr.
Students must fulfill International Perspectives and U.S. Diversity requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communications and Library: 13 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGL 314	Technical Communication	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		13

Humanities and Social Sciences: 6-12 cr.

Select Humanities courses from approved list		3
Select Social Science course from approved list		3
If H SCI student, select:		6
Additional Humanities course		
Additional Humanities or Social Science course		

Ethics and Environmental: 3-6 cr.

FS HN 342	World Food Issues: Past and Present	3
If AG LS student, select from:		2-3
ENV S 120	Introduction to Renewable Resources	
ENV S 201	Introduction to Environmental Issues	

Mathematical Sciences: 6-12 cr.

Select at least 3 credits from:		3
MATH 140	College Algebra	
Select at least 3 credits from:		3-4
MATH 143	Preparation for Calculus	
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 165 & MATH 166	Calculus I and Calculus II	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
MATH 181 & MATH 182	Calculus and Mathematical Modeling for the Life Sciences I and Calculus and Mathematical Modeling for the Life Sciences II	
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	

Physical Sciences: 17 cr.

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 178L	Laboratory in College Chemistry II	1
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
CHEM 332	Organic Chemistry II	3
CHEM 332L	Laboratory in Organic Chemistry II	1
Total Credits		17

Biological Sciences: 24-29 cr.

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 255	Fundamentals of Human Anatomy	3
BIOL 255L	Fundamentals of Human Anatomy Laboratory	1
Select at least 3 credits from:		3-4
BIOL 256 & 256L	Fundamentals of Human Physiology and Fundamentals of Human Physiology Laboratory	
BIOL 334	Metabolic Physiology of Mammals	
BIOL 335	Principles of Human and Other Animal Physiology	
BIOL 313	Principles of Genetics	3
Select at least 3 credits from:		3-6
BBMB 301	Survey of Biochemistry	
BBMB 316	Principles of Biochemistry	
BBMB 404 & BBMB 405	Biochemistry I and Biochemistry II	
MICRO 201	Introduction to Microbiology	2
or MICRO 302	Biology of Microorganisms	
MICRO 201L	Introductory Microbiology Laboratory	1
or MICRO 302L	Microbiology Laboratory	
Total Credits		24-28

Food Science and Human Nutrition: 37 cr.

FS HN 110	Professional and Educational Preparation	1
FS HN 167	Introduction to Human Nutrition	3
FS HN 203	Contemporary Issues in Food Science and Human Nutrition	1
FS HN 265	Nutrition for Active and Healthy Lifestyles	3
FS HN 360	Advanced Human Nutrition and Metabolism	3
FS HN 361	Nutrition and Health Assessment	2
FS HN 362	Nutrition in Growth and Development	3
FS HN 467	Molecular Basis of Nutrition in Disease Prevention	3
FS HN 480	Professional Communication in Food Science and Human Nutrition	1
FS HN 492	Research Concepts in Human Nutrition	2
Select at least 15 additional credits from:		15
BIOL 314	Principles of Molecular Cell Biology	
FS HN 214 & FS HN 215	Scientific Study of Food and Advanced Food Preparation Laboratory	
FS HN 242	The US Food System	
FS HN 311	Food Chemistry	
FS HN 365	Obesity and Weight Management	
FS HN 367	Medical Terminology for Health Professionals	
FS HN 403	Food Laws and Regulations	
FS HN 419	Foodborne Hazards	
FS HN 420	Food Microbiology	

FS HN 461	Medical Nutrition and Disease I	
FS HN 463	Community Nutrition	
FS HN 464	Medical Nutrition and Disease II	
FS HN 466	Nutrition Counseling and Education Methods	
FS HN 490C	Independent Study: Nutrition	
FS HN 499	Undergraduate Research	
FS HN 575	Processed Foods	
NUTRS 501	Biochemical and Physiological Basis of Nutrition: Macronutrients and Micronutrients	
NUTRS 503	Biology of Adipose Tissue	
NUTRS 504	Nutrition and Epigenetic Regulation of Gene Expression	
NUTRS 562	Assessment of Nutritional Status	
PHYS 111	General Physics	
or PHYS 221	Introduction to Classical Physics I	
PHYS 112	General Physics	
or PHYS 222	Introduction to Classical Physics II	
Total Credits		37

Electives: 0-12 cr. Select from any university coursework to earn at least 120 total credits. Students planning to apply to health professional programs should review entrance requirements and select appropriate courses as electives.

Concurrent B.S. and M.S. Program: Well-qualified students in Nutritional Science, pre-health professional and research option, who are interested in graduate study may apply for concurrent enrollment in the Graduate College to simultaneously pursue both a Bachelor of Science (B.S.) degree in Nutritional Science and a Master of Science (M.S.) degree in Nutritional Sciences. For more information, refer to www.fshn.hs.iastate.edu (http://www.fshn.hs.iastate.edu)

COMMON CORE FOR FAMILY HEALTH, FOOD SERVICE, GLOBAL HEALTH AND POLICY, HEALTH COACH, AND NUTRITION AND WELLNESS OPTIONS

Total Degree Requirement: 120 cr.

Students must fulfill International Perspectives and U.S. Diversity requirements by selecting coursework from approved lists. These courses may also be used to fulfill other area requirements. Only 65 cr. from a two-year institution may apply to the degree which may include up to 16 technical cr.; 9 P-NP cr. of electives; 2.00 minimum GPA.

International Perspectives: 3 cr.
U.S. Diversity: 3 cr.
Communications/Library: 10 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		10

Humanities and Social Sciences: 12-15 cr.

Select Humanities course from approved list		3
PSYCH 101	Introduction to Psychology	3
or PSYCH 230	Developmental Psychology	
SOC 134	Introduction to Sociology	3
POL S 344	Public Policy	3
If H Sci student, select additional Humanities course		3

Ethics and Environmental: 3-6 cr.

FS HN 342	World Food Issues: Past and Present	3
If AG LS student, select from:		2-3
ENV S 120	Introduction to Renewable Resources	
ENV S 201	Introduction to Environmental Issues	

Mathematical Sciences: 6-8 cr.

Select at least 3 credits from:		3
MATH 140	College Algebra	
Select at least 3 credits from:		3-4
MATH 143	Preparation for Calculus	
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 165 & MATH 166	Calculus I and Calculus II	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
MATH 181 & MATH 182	Calculus and Mathematical Modeling for the Life Sciences I and Calculus and Mathematical Modeling for the Life Sciences II	
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	

Physical Sciences: 5 cr.

CHEM 163	College Chemistry	4
or CHEM 177	General Chemistry I	
CHEM 163L	Laboratory in College Chemistry	1
or CHEM 177L	Laboratory in General Chemistry I	
Total Credits		5

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 255	Fundamentals of Human Anatomy	3

BIOL 255L	Fundamentals of Human Anatomy Laboratory	1
Select at least 3 credits from:		3-4
BIOL 256 & 256L	Fundamentals of Human Physiology and Fundamentals of Human Physiology Laboratory	
BIOL 334	Metabolic Physiology of Mammals	
BIOL 335	Principles of Human and Other Animal Physiology	
BIOL 313	Principles of Genetics	3
Select at least 3 credits from:		3-6
BBMB 301	Survey of Biochemistry	
BBMB 316	Principles of Biochemistry	
BBMB 404 & BBMB 405	Biochemistry I and Biochemistry II	
MICRO 201	Introduction to Microbiology	2
or MICRO 302	Biology of Microorganisms	
MICRO 201L	Introductory Microbiology Laboratory	1
or MICRO 302L	Microbiology Laboratory	
Total Credits		24-28

Biological Sciences: 19 cr.

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 255	Fundamentals of Human Anatomy	3
BIOL 255L	Fundamentals of Human Anatomy Laboratory	1
BIOL 256	Fundamentals of Human Physiology	3
BIOL 256L	Fundamentals of Human Physiology Laboratory	1
MICRO 201	Introduction to Microbiology	2
MICRO 201L	Introductory Microbiology Laboratory	1
Total Credits		19

Food Systems: 5 cr.

FS HN 242	The US Food System	3
FS HN 342 World Food Issues (course shown above)		
FS HN 442	Issues in Food and Society	2
Total Credits		5

Food Science and Human Nutrition: 36 cr.

FS HN 101	Food and the Consumer	3
FS HN 110	Professional and Educational Preparation	1
FS HN 111	Fundamentals of Food Preparation	2
FS HN 115	Food Preparation Laboratory	1
FS HN 167	Introduction to Human Nutrition	3
FS HN 203	Contemporary Issues in Food Science and Human Nutrition	1
FS HN 264	Fundamentals of Nutritional Biochemistry and Metabolism	3
or BBMB 301	Survey of Biochemistry	
FS HN 265	Nutrition for Active and Healthy Lifestyles	3
FS HN 361	Nutrition and Health Assessment	2
FS HN 364	Nutrition and Prevention of Chronic Disease	3
FS HN 365	Obesity and Weight Management	3
FS HN 366	Communicating Nutrition Messages	3
FS HN 403	Food Laws and Regulations	2
FS HN 463	Community Nutrition	3
FS HN 480	Professional Communication in Food Science and Human Nutrition	1
FS HN 495	Practicum	2
Total Credits		36

FAMILY HEALTH OPTION: 18 credits

HD FS 102	Individual and Family Development, Health, and Well-being	3
Select two of the following:		6
HD FS 223	Child Development and Health	
HD FS 226	Development and Guidance in Middle Childhood	
HD FS 227	Adolescent and Emerging Adulthood	
HD FS 234	Adult Development	
HD FS 249	Parenting and Family Diversity Issues	
HD FS 270	Family Communications and Relationships	
Select three of the following:		9
HD FS 367	Abuse and Illness in Families	
HD FS 373	Death as a Part of Living	
HD FS 377	Aging and the Family	
HD FS 395	Children, Families, and Public Policy	
HD FS 449	Program Evaluation and Proposal Writing	
HD FS 463	Environments for the Aging	
HD FS 479	Family Interaction Dynamics	

FOOD SERVICE OPTION: 17 credits

HSP M 380	Quantity Food Production Management	3
HSP M 380L	Quantity Food Production and Service Management Experience	2
HSP M 391	Foodservice Systems Management I	3
HSP M 392	Foodservice Systems Management II	3
ECON 101	Principles of Microeconomics	3

ACCT 284	Financial Accounting	3

GLOBAL HEALTH AND POLICY OPTION: 18 credits

GLOBE 201	Global Resource Systems	3
GLOBE 303	Agricultural, Food and Natural Global Resource Systems	3
ECON 101	Principles of Microeconomics	3
MICRO 310	Medical Microbiology	3
POL S 340	Politics of Developing Areas	3
FS HN 560	Global Nutrition	3

HEALTH COACH OPTION: 18 credits

KIN 258	Physical Fitness and Conditioning	2
KIN 358	Physiology of Exercise	3
KIN 458	Principles of Fitness Assessment and Exercise Prescription	4
PSYCH 101 or PSYCH 230	Introduction to Psychology Developmental Psychology	3
PSYCH 422	Counseling Theories and Techniques	3
PSYCH 485	Health Psychology	3

NUTRITION AND WELLNESS OPTION: 10-18 credits of electives

At least 9 credits of electives must be 300-400 level courses. Select from any university coursework to earn at least 120 total credits prior to graduation.

Go to FS HN courses.

Nutritional Science, B.S.

Options: Family Health[1], Food Service[2], Global Health & Policy[3], Health Coach[4], Nutrition & Wellness[5]

First Year

Fall	Credits	Spring	Credits
FS HN 110	1	FS HN 101	3
FS HN 167	3	CHEM 163 or 177	4
MATH 140, 143, 160, 165, or 181	3-4	CHEM 163L or 177L	1
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
ENGL 150	3	Course based on option:	3
LIB 160	1	HD FS 102[1]	
		ECON 101[2,3]	
		PSYCH 101 or 230[4]	
		Elective [5]	
	15-16		15

Second Year

Fall	Credits	Spring	Credits
FS HN 111	2	FS HN 203	1
FS HN 115	1	FS HN 242	3
FS HN 264 (Or, BBMB 301, if organic chem. completed)	3	FS HN 265	3
BIOL 255	3	BIOL 256	3
BIOL 255L	1	BIOL 256L	1
ENGL 250	3	MICRO 201	2
Course based on option:	2-3	MICRO 201L	1
HD FS course from list[1]			
ACCT 284[2]			
GLOBE 201[3]			
KIN 258[4]			
Elective[5]			
	15-16		14

Third Year

Fall	Credits	Spring	Credits
FS HN 364	3	FS HN 342	3
PSYCH 101 or 230	3	FS HN 361	2
SP CM 212	3	FS HN 365	3
STAT 104 or 101	3-4	FS HN 366	3
Course based on option:	3-5	Humanities (H Sci) or ENV S (AgLS)	2-3
HD FS course from list[1]		Course based on option:	3
HSP M 380 (and HSP M 380L)[2]		HD FS course from list[1]	
GLOBE 303[3]		Elective[2]	
PSYCH 485[4]		POL S 340[3]	
Elective[5]		KIN 358[4]	
		300-400 level elective[5]	
	15-18		16-17

Fourth Year

Fall	Credits	Spring	Credits
FS HN 442	2	FS HN 403	2
FS HN 463	3	FS HN 495	2
Humanities[1,2,4,5]	3	POL S 344	3
Or, FS HN 567[3]		FS HN 480	1
SOC 134	3	Course based on option:	3
Course based on option:	3	HD FS course from list[1]	
HD FS course from list[1]		HSP M 392[2]	

HSP M 391[2]		Humanities[3]	
MICRO 310[3]		KIN 458[4]	
PSYCH 422[4]		300-400 level elective[5]	
300-400 level elective[5]		Electives (choose electives to total at least 120 credits)	2-4
	14		13-15

1-5 Courses for options: Family Health[1], Food Service[2], Global Health & Policy[3], Health Coach[4], Nutrition & Wellness[5]

Note This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

Nutritional Science, B.S.

Option: Pre-health professional & research option

First Year

Fall	Credits	Spring	Credits
FS HN 110	1	FS HN 167	3
CHEM 177	4	CHEM 178	3
CHEM 177L	1	CHEM 178L	1
BIOL 211	3	BIOL 212	3
BIOL 211L	1	BIOL 212L	1
ENGL 150	3	MATH 140, 143, 160, 165, or 181	3-4
LIB 160	1		
Humanities course	3		
	17		14-15

Second Year

Fall	Credits	Spring	Credits
CHEM 331	3	CHEM 332	3
CHEM 331L	1	CHEM 332L	1
BIOL 313	3	BBMB 301 or 316, or BBMB 404 and 405 the next year	3
STAT 101 or 104	3-4	FS HN 265	3
ENGL 250	3	FS HN 203	1
SP CM 212	3	Social Science	3
	16-17		14

Third Year

Fall	Credits	Spring	Credits
BIOL 255	3	BIOL 256 and 256L, or 334 or 335 Physiology	3-4
BIOL 255L	1	FS HN 361	2
FS HN 360	3	FS HN 362	3
MICRO 201 or 302	2-3	Humanities/Social Sci. (H Sci) or ENV S (AgLS)	3
MICRO 201L or 302L	1	Additional course from approved list**	3
Humanities course (H Sci) or elective*	3		
FS HN 342	3		
	16-17		14-15

Fourth Year

Fall	Credits	Spring	Credits
FS HN 480	1	ENGL 314	3
FS HN 492	2	FS HN 467	3
Additional course from approved list**	3	Additional course from approved list**	3
Additional course from approved list**	3	U.S. Diversity (if not already taken) or elective*	3
Additional course from approved list**	3	Elective*	2-3
Elective*	3		
	15		14-15

* Choose elective courses to total equal to or greater than 120 credits.

** Select at least 15 additional credits from: BIOL 314; FS HN 214 with lab (FS HN 115 or 215); FS HN 242, 311, 365, 367, 403, 419, 420, 461, 463, 464, 466, 490C, 499, 575; NUTRS 501, 503, 504, 562; PHYS 111 or 221; PHYS 112 or 222.

Note This sequence is only an example. The number of credits taken each semester should be based on the individual student's situation. Factors that may affect credit hours per semester include student ability, employment, health, activities, and grade point consideration.

School of Education

Marlene Strathe, Director of the School of Education

School of Education (http://www.education.iastate.edu)

Mission and Goals

The School of Education at Iowa State University (http://iastate.edu) is committed to engaging in rigorous and socially meaningful research, preparing leaders and practitioners across the P-20 continuum that support rich and equitable learning opportunities for all students, and supporting public education as a cornerstone of a healthy, vibrant, and just society. We strive to be a national leader in educational theory, policy, and practice, and to honor the land-grant tradition and the broader mission of the university to serve the people of Iowa.

Undergraduate Study

The School of Education provides the professional education coursework to support the completion of the teacher education preparation program. Program completers can then be recommended for licensure in the state of Iowa. Majors offered in the School include **Elementary Education (K-6)**, and **Early Childhood Education-Unified (birth through age 8)**. The Early Childhood Education-Unified major is an interdepartmental program administered by the School of Education and the Department of Human Development and Family Studies.

Students who are interested in teaching at the secondary level (7-12) or at the K-12 level major in a specific discipline and complete additional required coursework in the School of Education to complete the teacher education preparation program. K-12 and secondary education programs include: Agriculture Education, English Education, Family Consumer Sciences Education, Health Education, History-Social Studies Education, Mathematics Education, Music Education, Physical Education, Science Education (Biology, Chemistry, Earth Science, and Physics), and World Languages and Cultures.

The School of Education offers a Learning Technologies minor. In order for candidates to earn this minor, they must register for the minor and complete the following sequence of courses:

C I 201	Learning Technologies in the PK-6 Classroom	3
or C I 202	Learning Technologies in the 7-12 Classroom	
C I 280B	Pre-Student Teaching Experience I: Learning Technologies	1
C I 302	Principles and Practices of Learning with Technology	3
C I 407	Principles and Practices of Distance Learning	3
C I 454	Emerging Topics in Learning Technologies (3 modules required, 1 credit each)	3
One of the following:		3
COM S 107	Applied Computer Programming	
COM S 207	Fundamentals of Computer Programming	
MAT E 370	Toying with Technology	
CPR E 370	Toying with Technology	
Total Credits		16

The School of Education offers courses that can lead to a reading endorsement for grades K-8 or grades 5-12. Candidates seeking a K-8 reading endorsement should consult with a School of Education academic adviser. The 5-12 reading endorsement is offered collaboratively with the English Department. Candidates seeking this endorsement should consult with an adviser in the English Department. Inquiries can be sent to the Licensure Analyst in Teacher Education Services (133 MacKay) to receive a list of courses needed for an Iowa State University reading endorsement. Prerequisites for the reading endorsement courses are listed in the catalog course descriptions.

Early Childhood Education – Unified

The curriculum in Early Childhood Education – Unified prepares graduates to teach young children and work with their families. This program leads to careers working with young children (both those who are typically developing and those with special needs) from birth through age eight. Graduates may be employed by either public or private agencies or schools to teach in early childhood classrooms (preschool through 3rd grade) or in home-based programs. The program is an interdepartmental major administered by the Department of Human Development and Family Studies and the School of Education. For more information about the program, see Early Childhood Education - Unified Curriculum (http://www.education.iastate.edu/undergraduate-studies/early-childhood-education).

Students who enroll in the early childhood education – unified program must apply to and be accepted into the teacher education program prior to enrolling in advanced courses. All early childhood education – unified students must meet general education requirements in order to complete the teacher education preparation program.

Early Childhood Education- Unified majors must complete this professional course sequence:

C I 201	Learning Technologies in the PK-6 Classroom	3
C I 204	Social Foundations of Education in the United States (C I 205X for Early Childhood and Elementary Education)	3
C I 332	Educational Psychology of Young Learners	3
C I 406	Social Justice Education and Teaching: Secondary (C I 405X for Early Childhood and Elementary Education)	3
SP ED 250	Education of the Exceptional Learner in a Diverse Society	3
Total Credits		15

Elementary Education

The undergraduate curriculum in elementary education leads to the Bachelor of Science degree.

The curriculum in elementary education is designed for students preparing to teach at the elementary school level. This program leads to careers in working with school-aged children in kindergarten through sixth grade. Graduates who complete the teacher education preparation program will be qualified to teach in elementary classrooms in either public or private schools. For more information about the program,

see Elementary Education Curriculum (http://www.education.iastate.edu/undergraduate-studies/elementary-education).

Elementary Education majors must complete this professional course sequence:

C I 201	Learning Technologies in the PK-6 Classroom	3
C I 204	Social Foundations of Education in the United States (C I 205X for Early Childhood and Elementary Education)	3
C I 245	Strategies in Teaching	3
C I 332	Educational Psychology of Young Learners	3
C I 406	Social Justice Education and Teaching: Secondary (C I 405X for Early Childhood and Elementary Education)	3
SP ED 250	Education of the Exceptional Learner in a Diverse Society	3
HD FS 102	Individual and Family Development, Health, and Well-being	3
or PSYCH 230	Developmental Psychology	
Total Credits		21

In addition to pursuing a degree in Elementary Education, candidates are required to pursue an endorsement in at least one additional area. Candidates will be prepared to teach students in grades kindergarten through eighth grade in this area of specialization. Endorsements in the following areas are available for elementary education majors: art, English/language arts, English as a Second Language (ESL), health, basic science, social studies, mathematics and special education (Instructional Strategist I: Mild/Moderate Disabilities K-8). An endorsement for teaching world languages in elementary schools is available through the Department of World Languages and Cultures. Additional information about endorsements can be found at: http://www.education.iastate.edu/undergraduate-studies/endorsements.html

Elementary education majors must satisfy a world languages requirement for graduation. Students must complete two years of a foreign language in high school or one year of a foreign language in college.

Students who enroll in elementary education must apply and be accepted into the teacher education program prior to enrolling in advanced elementary education courses.

K-12 and Secondary Education

Students seeking K-12 or Secondary Teacher Licensure major in the content area in which they want to focus. In addition, coursework is taken to complete the teacher education preparation program. Program completers can then be recommended to the state of Iowa for licensure.

K-12 and secondary education candidates must complete this professional course sequence:

C I 202	Learning Technologies in the 7-12 Classroom	3
C I 204	Social Foundations of Education in the United States	3
C I 333	Educational Psychology	3
C I 406	Social Justice Education and Teaching: Secondary	3
C I 426	Principles of Secondary Education (*not all secondary education programs require this course. Check with your program coordinator and/or academic adviser.)	3
SP ED 401	Teaching Secondary Students with Exceptionalities in General Education	3
Total Credits		18

Graduate Study

The School of Education is comprised of two divisions: Higher Education and Teaching, Learning, Leadership, and Policy (TLLP). Within these divisions, the School offers coursework and experiences for the degrees Doctor of Philosophy, Master of Science, and Master of Education with a major in education. Graduate programs leading to completion of a teacher preparation program and recommendation for teacher licensure are offered in secondary science and secondary mathematics. In addition, endorsements in reading and special education can also be pursued by graduate students. Graduate students interested in educational leadership may also participate in our educator preparation programs in educational leadership. Program completers may be recommended for administrative licensure for roles as principals and superintendents. The School of Education offers graduate coursework leading to a minor for masters and doctoral students in other fields of study. Several graduate certificate programs are offered through the School of Education.

Doctoral Degree Program

Students in the School of Education may complete the Ph.D. with a major in education. Students pursuing a Ph.D. in the division of Higher Education may earn an education degree with an emphasis in either higher education administration or community college leadership. Students pursuing a Ph.D. in the division of TLLP may earn an education degree with an emphasis in one of the following areas: educational leadership, organizations, and policy; instructional technology; mathematics education; science education; literacy; special education; or social and cultural studies of education. Specific information about the requirements of and options available within the Ph.D. degree in education are available from the School office or on the School of Education Graduate Studies website.

Graduates of the Ph.D. program in education are prepared to pursue careers as scholars, leaders, and administrators in various educational settings, including public and private colleges and universities, community colleges, public and private educational agencies, and corporate training settings.

Master's Degree Programs

In the division of Higher Education, students may earn an M.Ed in education with an emphasis in either student affairs or higher education. In the division of TLLP, students may earn an M.S. or an M.Ed. in education with an emphasis in one of the following areas: educational leadership, organizations and policy; instructional technology; mathematics education; science education; literacy; special education; or social and cultural studies of education.

Specific information about the requirements of and options available within M.S. or M.Ed. degrees in education are available from the school office or on the website School of Education Graduate studies http://www.education.iastate.edu/graduate-studies.

Graduates of the master's degree programs are prepared to pursue careers as educational leaders, higher education professionals, researchers, and advanced practitioners in colleges and universities, community colleges, public and private schools, education agencies, and informal (free-choice) education settings.

A minor is available in Curriculum and Instructional Technology at both the master's and doctoral level. Information about the minors can be found here: http://www.education.iastate.edu/graduate-studies/gradprograms/

Other graduate programs related to education (including General Graduate Studies) may be planned for students on the basis of previous education and experiences as well as future plans and needs. For more information, students should refer to Agricultural Education and Studies, Family and Consumer Sciences Education, Kinesiology, and General Graduate Studies or to graduate level course offerings within other departments.

Graduate Teacher and Educational Leadership Licensure Programs

A Master of Arts in Teaching degree program (science education) is available to students who currently have a bachelor's degree in a science area (or a closely related field). A teacher preparation program in mathematics education is also available to graduate students (School of Education). In these teacher preparation programs, program completers can be recommended for teacher licensure to the Iowa Board of Educational Examiners.

Teacher preparation programs at the graduate level are also offered in Agricultural Education (College of Agriculture and Life Sciences), Family and Consumer Sciences Education (College of Human Sciences), and Physical Education (College of Human Sciences). The School of Education provides the professional education coursework for these programs. Students in a graduate teacher preparation program must complete specific courses.

Graduate level programs leading to recommendation for teaching endorsements are offered through the School of Education. Graduate students who seek a teaching endorsement in reading or special education, but do not wish to pursue a master's degree can incorporate those courses in a professional certificate program. Endorsement programs include Instructional Strategist II: Behavior Disorders/Learning Disabilities, Reading K-8 and Reading 5-12.

The School of Education offers graduate programs for students seeking Iowa licensure as principals and superintendents. The PreLEAD (Preparation for Leadership) program is designed for working professionals and includes coursework and field experiences in a principal preparation program. Program completers can be recommended for licensure to the Iowa Board of Educational Examiners. Students must complete the program as a Master of Education degree. A Certificate of Advanced Studies program allows students who hold a master's degree in Educational Administration to pursue the coursework and clinical field experiences necessary to be recommended for an Iowa Superintendent or AEA Chief Administrator license.

Graduate Certificate Programs

The School of Education offers Graduate Certificate programs to allow students to enhance their skills outside of full degree programs. The Certificate programs currently offered include Applied Research Methods in the Human Sciences, Community College Teaching, Instructional Design, Literacy Coaching, Education for Social Justice, Special Education, and Superintendent Licensure (Certificate of Advanced Studies). Certificate programs require a minimum of 12 graduate credits (several require more than this) and can be earned in conjunction with a degree program. More information about graduate certificate programs can be found on the School of Education web site.

Courses:
Curriculum and Instruction (C I)
Educational Administration (EDADM)
Educational Leadership and Policy Studies (EL PS)
Higher Education (HG ED)
Historical, Philosophical, and Comparative Studies in Education (H P C)
Human Sciences (H SCI)
Research and Evaluation (RESEV)
Special Education (SP ED)

Educator Preparation Program at Iowa State University

Heidi Doellinger, Director of Educator Preparation

Educator Preparation (http://www.education.iastate.edu/undergraduate-studies/undergraduate-applicants)

Educator Preparation Program at Iowa State University is a shared responsibility that spans three colleges. For most licensure areas, students major in a content area while taking additional education courses. All students who are recommended by Iowa State University for teacher licensure must meet the requirements of the Educator Preparation Program and be recommended by their department, college, and the ISU recommending official. Students who successfully complete the requirements for any of the endorsement areas offered at ISU must demonstrate the skills and knowledge required of beginning teachers.

Undergraduate Educator Preparation Programs

An undergraduate student seeking a bachelor's degree must be enrolled in the department in which he or she plans to major and must meet the graduation requirements of that department and college.

Currently, there are fifteen undergraduate Educator Preparation areas offered at Iowa State University. These areas and their corresponding grade levels are listed below:

Agricultural Education (grades 5-12)
Biology (grades 5-12)
Chemistry (grades 5-12)
Early Childhood Education-Unified (birth-grade 3, including special education)
Earth Science (grades 5-12)
Elementary Education (grades K-6)
English (grades 5-12)
Family and Consumer Sciences (grades 5-12)
Health Education (grades 5-12)
History-Social Sciences (grades 5-12)
Mathematics (grades 5-12)
Music (grades K-12)
Physical Education (grades K-12)
Physics (grades 5-12)
World Languages and Cultures (French, German, and Spanish) (grades 5-12)

Endorsements Areas

Students majoring in Elementary Education must complete coursework for at least one endorsement. Students in other programs may complete coursework for additional endorsements (http://www.education.iastate.edu/undergraduate-studies/endorsements).

Minors

Students in the Educator Preparation Program may also choose to pursue a minor in Learning Technologies (http://www.education.iastate.edu/undergraduate-studies/learning-technologies-minor).

Post-Bachelor's Educators Preparation Programs

Students already holding an appropriate bachelor's degree may complete an educators preparation program in order to be recommended for teacher licensure in any of the undergraduate licensure programs. Interested students should consult with the program coordinator of the area in which they plan to specialize so that an individualized program of study can be developed.

Educator Preparation Programs for which candidates take undergraduate Educator Preparation courses;

Elementary Education (grades K-6)
English (grades 5-12)
Health Education (grades 5-12)
History-Social Sciences (grades 5-12)
Music (grades K-12)
World Languages and Cultures (French, German, and Spanish) (grades 5-12)

THE PROFESSIONAL Educator Preparation REQUIREMENT (PROFESSIONAL CORE)

Undergraduate Students

Prospective teachers must complete certain studies related directly to the profession of teaching. All undergraduate students in educator preparation program must take the following courses prior to student teaching, unless the student's program area has an approved content-area course deemed to be equivalent. Areas with approved equivalents include: Agricultural Education (for CI 426), Physical Education (for CI 333, CI 401, CI 426) and all Secondary Sciences (for CI 426). (See program coordinator for more information).

EARLY CHILDHOOD EDUCATION-Unified

C I 201	Learning Technologies in the PK-6 Classroom	3
C I 204	Social Foundations of Education in the United States (C I 205X for Early Childhood and Elementary Education)	3
C I 332	Educational Psychology of Young Learners	3
C I 406	Social Justice Education and Teaching: Secondary (C I 405X for Early Childhood and Elementary Education)	3

SP ED 250	Education of the Exceptional Learner in a Diverse Society	3
Total Credits		15

ELEMENTARY EDUCATION:

C I 201	Learning Technologies in the PK-6 Classroom	3
C I 204	Social Foundations of Education in the United States (C I 205X for Early Childhood and Elementary Education)	3
C I 245	Strategies in Teaching	3
C I 332	Educational Psychology of Young Learners	3
C I 406	Social Justice Education and Teaching: Secondary (C I 405X for Early Childhood and Elementary Education)	3
HD FS 102	Individual and Family Development, Health, and Well-being	3
or PSYCH 230	Developmental Psychology	
SP ED 250	Education of the Exceptional Learner in a Diverse Society	3
C I 416	Supervised Student Teaching - Elementary	16
Total Credits		37

K-12 AND SECONDARY EDUCATION:

C I 202	Learning Technologies in the 7-12 Classroom	3
C I 204	Social Foundations of Education in the United States	3
C I 333	Educational Psychology	3
C I 406	Social Justice Education and Teaching: Secondary	3
SP ED 401	Teaching Secondary Students with Exceptionalities in General Education	3
C I 426	Principles of Secondary Education *Not all secondary education programs require this course. Check with program coordinator and/or academic advisor.	3

Student teaching (semester-long experience). See Program Area Coordinator for more information.

Post-Bachelor's Students

Students who hold an appropriate bachelor's degree and seek a teaching license must complete an educator preparation program. This includes the professional education requirements listed above through course work or examination.

Master's Students

Prospective teachers must complete certain studies related directly to the profession of teaching. All students enrolled in Master's programs that lead to completion of an educator preparation program must take the following courses prior to student teaching, unless the student's program area has an approved content area course deemed to be equivalent. (See Master's Programs section below for details.)

C I 505	Using Technology in Learning and Teaching	3
C I 506	Social Justice Education and Teaching: Advanced	3
C I 526	Principles of Secondary Education * Not all programs require this course. Check with program coordinator.	3
C I 529	Educational Psychology and the Secondary Classroom	3
H P C 504	Studies in the Foundations of Education in the United States	3
SP ED 501	Teaching Secondary Students with Exceptionalities in General Education	3

PROGRAM CURRICULUM

Undergraduate Students

Early Childhood Education – Unified

The curriculum in Early Childhood Education – Unified prepares graduates to teach young children and work with their families. This program leads to careers working with young children (both those who are typically developing and those with special needs) from birth through age eight. Graduates may be employed by either public or private agencies or schools to teach in early childhood classrooms (preschool through 3rd grade) or in home-based programs. The program is an interdepartmental major administered by the Department of Human Development and Family Studies and the School of Education. For more information about the program, see Early Childhood Education - Unified Curriculum http://www.education.iastate.edu/undergraduate-studies/early-childhood-education.

Students who enroll in the early childhood education – unified program must apply to and be accepted into the educator preparation program prior to enrolling in advanced courses. All early childhood education – unified students must meet general education requirements in order to complete the teacher.

Elementary Education

The undergraduate curriculum in elementary education leads to the Bachelor of Science degree.

The curriculum in elementary education is designed for students preparing to teach at the elementary school level. This program leads to careers in working with school-aged children in kindergarten through sixth grade. Graduates who complete the educator preparation program will be qualified to teach in elementary classrooms in either public or private schools. For more information about the program, see Elementary Education Curriculum: http://www.education.iastate.edu/undergraduate-studies/elementary-education

Endorsements in art, English/language arts, English as a Second Language (ESL), health, basic science, social studies, mathematics, and special education (Instructional Strategist I: Mild/Moderate Disabilities K-8) are available for elementary education students. An endorsement for teaching world languages in elementary schools is available through the Department of World Languages and Cultures. For additional information, see http://www.education.iastate.edu/undergraduate-studies/endorsements

Elementary education majors must satisfy a world languages requirement for graduation. Students must complete two years of a foreign language in high school or one year of a foreign language in college.

Students who enroll in elementary education must apply and be accepted into the educator preparation program prior to enrolling in advanced elementary education courses.

K-12 and Secondary Education

K-12 and secondary educator preparation programs at Iowa State University include:

- AGRICULTURAL EDUCATION (GRADES 5-12) – COLLEGE OF AGRICULTURE (http://www.education.iastate.edu/te/programs/secondary-education/#agricultural-education-grades-5-12-agriculture)
- BIOLOGY (GRADES 5-12) – COLLEGE OF LIBERAL ARTS AND SCIENCES (http://www.education.iastate.edu/te/programs/secondary-education/#biology-grades-5-12-liberal-arts-and-sciences)
- CHEMISTRY (GRADES 5-12) – COLLEGE OF LIBERAL ARTS AND SCIENCES (http://www.education.iastate.edu/te/programs/secondary-education/#chemistry-grades-5-12-liberal-arts-and-sciences)
- EARTH SCIENCES (GRADES 5-12) – COLLEGE OF LIBERAL ARTS AND SCIENCES (http://www.education.iastate.edu/te/programs/secondary-education/#earth-sciences-grades-5-12-liberal-arts-and-sciences)
- ENGLISH (GRADES 5-12) – COLLEGE OF LIBERAL ARTS AND SCIENCES (http://www.education.iastate.edu/te/programs/secondary-education/#english-grades-5-12-liberal-arts-and-sciences)
- FAMILY AND CONSUMER SCIENCES EDUCATION – COLLEGE OF HUMAN SCIENCES (http://www.education.iastate.edu/te/programs/secondary-education/#family-and-consumer-sciences-education-human-sciences)
- HEALTH EDUCATION (GRADES 5-12) – COLLEGE OF HUMAN SCIENCES (http://www.education.iastate.edu/te/programs/secondary-education/#health-education-grades-5-12-human-sciences)
- HISTORY – SOCIAL SCIENCES (GRADES 5-12) – COLLEGE OF LIBERAL ARTS AND SCIENCES, HUMAN SCIENCES (http://www.education.iastate.edu/te/programs/secondary-education/#history-social-sciences-grades-5-12-liberal-arts-and-sciences-human-sciences)
- MATHEMATICS (GRADES 5-12) – COLLEGE OF LIBERAL ARTS AND SCIENCES (http://www.education.iastate.edu/te/programs/secondary-education/#mathematics-grades-5-12-liberal-arts-and-sciences)
- MUSIC (GRADES K-12) – COLLEGE OF LIBERAL ARTS AND SCIENCES (http://www.education.iastate.edu/te/programs/secondary-education/#music-grades-k-12-liberal-arts-and-sciences)
- PHYSICAL EDUCATION (GRADES K-12) – COLLEGE OF HUMAN SCIENCES (http://www.education.iastate.edu/te/programs/secondary-education/#physical-education-grades-k-12-human-sciences)
- PHYSICS (GRADES 5-12) – COLLEGE OF LIBERAL ARTS AND SCIENCES (http://www.education.iastate.edu/te/programs/secondary-education/#physics-grades-5-12-liberal-arts-and-sciences)
- WORLD LANGUAGES AND CULTURES (GRADES 5-12) – COLLEGE OF LIBERAL ARTS AND SCIENCES (http://www.education.iastate.edu/te/programs/secondary-education/#world-languages-and-cultures-grades-5-12-liberal-arts-and-sciences)

Students seeking recommendations for a license to teach in the secondary schools must be admitted to the educator preparation program. For specific requirements for each area of specialization, see Teacher Education (http://www.education.iastate.edu/undergraduate-studies/secondary-education) and curricula for the college in which the chosen degree major is sought.

Notes:

- Students seeking licensure in physical education, agriculture and science do not take C I 426 Principles of Secondary Education Principles of Secondary Education.
- Students seeking a teaching license in physical education must see an adviser in the Department of Kinesiology in the College of Human Sciences.
- All students who are recommended by Iowa State University for teacher licensure must meet the requirements of the Iowa State University Educator Preparation Education Program and the Iowa Board of Educational Examiners.
- Each student must meet the performance outcome standards for program completion by completing a portfolio. Each standard will be assessed in every major. Students will receive both formative and summative evaluations of their progress toward meeting these outcomes throughout their program at Iowa State University.

- A detailed explanation of the standards and assessment process may be found at http://www.education.iastate.edu/educator-preparation-resources For more information, students should contact the academic adviser in their major. Each student will be enrolled in the department in which he or she plans to major, and must meet the graduation requirements of that department and the college in which it is situated.

Post-Bachelor's Students

Students holding an appropriate bachelor's degree who wish to complete a teacher preparation program in order to pursue teacher licensure must have at least one course in each of the following five general education groups identified for undergraduate students in the preceding section: Natural Sciences, Mathematics or Statistics, Social Sciences, Humanities, and Communication Skills. Individual departments preparing teachers may require additional credits in general education. (See program coordinator for more information).

Graduate Students

Each Master's program will determine what, if any, general education requirements Master's students must fulfill beyond a bachelor's degree from a regionally accredited institution. (See program coordinator for more information.)

Standards

Educator Preparation Program has a rigorous standards-based curriculum. Two sets of standards are used in the program, one originates from the Iowa Administrative Code, Chapter 79, Standards for Practitioner Preparation Programs and the other is the Iowa Teaching Standards and Model Criteria adopted by the State Board of Education. The former is listed below in full.

Iowa State University Teacher Education Standards (InTASC Standards)

The Learner and Learning

Standard #1: Learner Development. The teacher understands how learners grow and develop, recognizing that patterns of learning and development vary individually within and across the cognitive, linguistic, social, emotional, and physical areas, and designs and implements developmentally appropriate and challenging learning experiences.

Standard #2: Learning Differences. The teacher uses understanding of individual differences and diverse cultures and communities to ensure inclusive learning environments that enable each learner to meet high standards.

Standard #3: Learning Environments. The teacher works with others to create environments that support individual and collaborative learning, and that encourage positive social interaction, active engagement in learning, and self-motivation.

Content

Standard #4: Content Knowledge. The teacher understands the central concepts, tools of inquiry, and structures of the discipline(s) he or she teaches and creates learning experiences that make the discipline accessible and meaningful for learners to assure mastery of the content.

Standard #5: Application of Content. The teacher understands how to connect concepts and use differing perspectives to engage learners in critical thinking, creativity, and collaborative problem solving related to authentic local and global issues.

Instructional Practices

Standard #6: Assessment. The teacher understands and uses multiple methods of assessment to engage learners in their own growth, to monitor learner progress, and to guide the teacher's and learner's decision making.

Standard #7: Planning for Instruction. The teacher plans instruction that supports every student in meeting rigorous learning goals by drawing upon knowledge of content areas, curriculum, cross-disciplinary skills, and pedagogy, as well as knowledge of learners and the community context.

Standard #8: Instructional Strategies. The teacher understands and uses a variety of instructional strategies to encourage learners to develop deep understanding of content areas and their connections, and to build skills to apply knowledge in meaningful ways.

Standard #8A: Technology. The teacher integrates current and emerging technology in instruction to encourage student creativity, problem solving, collaboration, and digital literacy. Teachers practice and advocate safe, legal, and responsible use of information and technology (this standard is unique to the Iowa State University Teacher Preparation Program).

Professional Responsibility

Standard #9: Professional Learning and Ethical Practice. The teacher engages in ongoing professional learning and uses evidence to continually evaluate his/her practice, particularly the effects of his/her choices and actions on others (learners, families, other professionals, and the community), and adapts practice to meet the needs of each learner.

Standard #10: Leadership and Collaboration. The teacher seeks appropriate leadership roles and opportunities to take responsibility for student learning, to collaborate with learners, families, colleagues, other school professionals, and community members to ensure learner growth, and to advance the profession.

Electronic Portfolio

An e-portfolio is used to showcase the teacher candidate's understanding and implementation of the Iowa State University Educator Preparation Program Standards throughout the program. Teacher candidates should visit with their program coordinator and/or their academic advisor for information pertaining to the e-portfolio.

Clinical Experiences

The Standards for Practitioner and Administrator Preparation Programs (chapter 79.13(1)) requires that "candidates admitted to educator preparation program participate in field experiences including both observation and participation in teaching activities in a variety of school settings and totaling at least 80 hours' duration, with at least 10 hours occurring prior to acceptance into the program." This requirement may be met through pre-student teaching courses (e.g., C I 280, C I 480, CI 468, C I 580) or, in certain endorsement areas, a course designated to provide an equivalent experience. For most programs, there are four levels for clinical experiences. Level 1 involves observation in local schools. Level 2 involves actively teaching in the classroom with one lesson, at minimum. Level 3 involves actively teaching in the classroom with two lessons, at minimum and being observed by a supervisor during teaching. Level 4 is student teaching and involves actively teaching for a semester-long experience where the student teacher bears primary responsibility for planning and instruction within the classroom for a minimum of four weeks during the semester. Level 2, 3 and 4 field experiences involve a course fee, which ranges from $25.00 to $328.00 and are assessed to cover the costs of supervision and placement with a cooperating teacher. Course fees are increased when student teaching nationally or internationally. For current course fees, consult the Schedule of Classes. For level 2, 3 and 4 field experiences, the student needs access to transportation because the placement may be within 60 miles of the university. The time commitment for clinical experiences ranges from 1/2 day for level 2 and 3 to the full day for level 4. Students complete a background check before initial placement in schools and other appropriate locations

Admission to educator Preparation program REQUIREMENTS

Students must have:

- A minimum of 9 credits hours at Iowa State University with a 2.5 cumulative grade-point-average (GPA). (Student must maintain 2.5 cumulative GPA throughout the program in order to continue through the program)
- Praxis CORE scores with a minimum of 156 in Reading, 162 in Writing, and 150 in Mathematics.
- Documented completion of an Iowa State University-approved 10 hours of pre-student teaching field experience.
- A minimum of a "C" in ALL Curriculum and Instruction (C I), Human Development and Family Studies (HD FS), and Special Education (Sp Ed) courses required for licensure (pedagogy coursework).
- A minimum of a "C-" in ALL Major department courses/content courses required for teacher licensure (content coursework). (This is for courses taken from Fall 2007 forward).
- A valid criminal background check report processed by ISU's recommending official.
- An e-portfolio started and meeting the program requirements for admission to the teacher education program. NOTE: Some programs may have additional requirements. Consult the Program Coordinator.

A (http://www.education.iastate.edu/undergraduate-studies/undergraduate-applicants/admission)dmission to Education Preparation Program (http://www.education.iastate.edu/undergraduate-studies/undergraduate-applicants/admission)

Graduate Degree Programs with Teacher Licensure

Currently, there are five graduate teacher preparation programs. These programs are designed for students who do not currently hold a teaching license. The programs are listed below:

Agricultural Education (M.S.)
Family and Consumer Sciences Education (M.Ed. or M.S.)
Mathematics Education (M.Ed.)
Physical Education (M.S.)
Secondary Sciences Education (M.A.T.)

Iowa State University also offers Master's programs for practicing teachers. The Mathematics Department offers a Masters in School Mathematics. (See Mathematics in Courses and Programs section of this catalog.) The Curriculum and Instruction Department offers a Master's degree program and a certificate program that lead to a special education endorsement. (See Curriculum and Instruction in Courses and Programs section of this catalog.)

Graduate programs are also available for those who seek licensure in Educational Leadership and Policy Studies as PK-12 school principals or PK-12 superintendents. (See Educational Leadership and Policy Studies in Courses and Programs section of this catalog.)

Master's Programs with Teacher Preparation

AGRICULTURAL EDUCATION

The Agricultural Education and Studies Department offers a Master's of Science program that prepares Agricultural Education teachers for grades 5-12

See coordinator for program requirements.

MATHEMATICS

The School of Education offers a Master's of Education program that prepares Mathematics teachers for grades 5-12

See coordinator for program requirements.

Physical Education

The Department of Kinesiology offers a Master's of Science program that prepares Physical Education teachers for grades K-12.

See coordinator for program requirements.

Secondary Sciences

The School of Education offers a Master's of Arts in Teaching program that prepares Secondary Science teachers for grades 5-12

See coordinator for program requirements.

Regents Alternative Pathway to Iowa Licensure

The Regents Alternative Pathway to Iowa Licensure is a collaborative program involving the three Iowa Regents' universities. The program is designed for adult learners holding a baccalaureate degree with work experience who are seeking 5-12 licensure in a high needs area. For more information: http://www.iowateacherintern.org/

Youth Development

Interinstitutional Graduate Program

Iowa State University offers a Master's degree in Family and Consumer Sciences with specialization in Youth Development. This is an interinstitutional distance education program offered entirely online. The student selects the home institution that grants the degree. After admission at the home institution, the student takes courses from each of the participating institutions: Iowa State University; Kansas State University; Michigan State University; University of Missouri; University of Nebraska-Lincoln; North Dakota State University; and Texas Tech University.

At Iowa State University, Youth Development is a specialization within the Master of Family and Consumer Sciences degree program (MFCS-YTH) that consists of 36 semester credits. A computer with minimum specifications, Web access, and an email address are required for completing the program. A creative component is completed as the final project/exam for this degree. The final project is tailored to the needs of the individual student and determined in cooperation with the POS committee. The student presents the agreed-upon project to the committee in a 60- to 90-minute final oral examination meeting via a video conference call. http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-youth-development/

The **Master of Family and Consumer Sciences with Youth Development specialization** is the only online degree available focusing solely on the skills to serve today's young people. Students become immersed in a strengths-based curriculum and learn a methodology that supports youth, enabling them to grow socially, emotionally, and cognitively. The program has its roots in positive youth development. Rather than focusing solely on corrective measures, a positive youth development approach equips individuals in the second decade of life with the skillset necessary for a successful transition into adulthood.

Registration

Students choosing to receive their degree from Iowa State University complete all the admissions, registration and fee payment processes through ISU.

Two on-line graduate certificates are available as a part of this program:

- Youth Development Specialist Graduate Certificate http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-youth-development/
- Youth Program Management and Evaluation Graduate Certificate (http://www.online.hs.iastate.edu/graduate-programs/masters/mfcs-youth-development/)

Courses primarily for graduate students, open to qualified undergraduates:

YTH 501: Foundations of Youth Development
(1-0) Cr. 1. F.S.SS.
Fundamentals of youth development and the youth development profession. Through this introduction to the field, students will explore the ethical, professional, and historical elements of youth development as it has evolved toward professionalization. (on-line course offering via Distance Education).

YTH 508: Grant Development and Management
(3-0) Cr. 3. F.S.
Basic Grant Development and Management will introduce students to the grant-getting process and provide an overview of what happens after a project is funded. The following topics will be covered: researching funding sources, generating cutting edge ideas, assessing needs, planning a project, establishing credibility, formulating a sustainable budget, designing an evaluation plan, managing the funded project, and disseminating project results. (on-line course offering via Distance Education).

YTH 510: Adolescents and Their Families
(3-0) Cr. 3. F.S.
Adolescent development as it is related to and intertwined with family development; reciprocal influences between adolescents and their families are examined. Working with youth vis à vis the family system will be highlighted. (on-line course offering via Distance Education).

YTH 520: Community Youth Development
(3-0) Cr. 3. F.S.
Focus on the national emphasis of a strength-based or asset approach to community youth development, encompassing individual development (i.e., positive youth development) and adolescent interrelationships with environments. Emphasis is placed upon research, theory, and practice applied in communities throughout the U.S. Students will explore existing models, read theoretical and applied literature, and examine current community efforts as a basis for understanding community youth development. (on-line course offering via Distance Education).

YTH 530: Youth in Cultural Contexts
(3-0) Cr. 3. F.S.
Examination of the cultural context factors that affect youth from a holistic perspective within and outside the family unit. The course will provide an understanding of the cultural heritage of differing family structures and types. Students will explore the social and educational processes experienced by youth through in-depth reading, writing, discussion, critical listening, viewing of contemporary videos, and informal interviews with youth. Students will be encouraged to think critically about society and culture, gain further knowledge of how ethnic groups fit historically into society, and examine the results of how history has shaped the current cultural climate of the U.S. (on-line course offering via Distance Education).

YTH 540: Youth Professionals as Consumers of Research
(3-0) Cr. 3. F.S.
This course will help youth development professionals understand and evaluate research reports to reduce anxiety about applying research results and theories to practice. Specific emphasis will be on research and theory reports related to youth development. (on-line course offering via Distance Education).

YTH 550: Youth Policy
(3-0) Cr. 3. F.S.
Various federal and state policies designed specifically for youth. Students will examine how and why policies for youth are constructed. A guiding question that will be used to evaluate existing state and national policies is whether they contribute to, or act as, barriers to desired developmental outcomes. (on-line course offering via Distance Education).

YTH 570: Contemporary Youth Issues
(3-0) Cr. 3. Repeatable. F.S.SS.
Issues faced by youth today and associated risk and resiliency factors. A different topic will be presented each year, with the course rotating among participating universities. Past topics have included Youth Violence, Youth and Appearance, Adolescent Health, Global Perspectives and Volunteerism. The course may be taken more than once, as long as the content is different each time. (on-line course offering via Distance Education).

YTH 580: Administration and Program Management
(3-0) Cr. 3. F.S.
This course will introduce students to the development, administration and management of youth-serving organizations. (on-line course offering via Distance Education).

YTH 585: Program Design, Evaluation and Implementation
(3-0) Cr. 3. F.S.
Theoretical, methodological, and pragmatic issues involved in conducting programs and scholarship. Overview of the program development process and outcome evaluation of children and family programs. Modes of outcome scholarship and their implications for community-based programs are discussed. Students will develop knowledge through participating in a community-based project involving the practical application of program design and evaluation methods. (on-line course offering via Distance Education).

YTH 599: Creative Component
Cr. arr. Repeatable. F.S.SS.
Nonthesis students creative component (e.g., a special report, capstone course, integrated field experience, annotated bibliography, research project, design, or other creative endeavor). A minimum of five credits of independent work is required on the programs of study (POS). Creative component format determined cooperation with the POS committee. (on-line course offering via Distance Education). Offered on a satisfactory-fail basis only.

Courses for graduate students:

YTH 634: Youth Development
(3-0) Cr. 3. F.S.
Introduction to the developmental period of adolescence. The theory and research of positive youth development will be the lens through which this developmental period is examined. The course will emphasize how the developmental tasks of this life stage are influenced by (and influence) family and home, school, peers, and other contextual forces. The course will help students recognize and become familiar with the major issues and transitions adolescents face as they successfully navigate this developmental stage by critically examining the theoretical and research literature. (on-line course offering via Distance Education).

YTH 690: Advanced Topics
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor.
Advanced topics. (on-line course offering via Distance Education).

YTH 691: Internship
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor.
Supervised practice and experience in college teaching, research, professional experience. On-line course offering via Distance Education. Offered on a satisfactory-fail basis only.

College of Liberal Arts and Sciences

Beate Schmittmann, Dean
William Gutowski, Associate Dean
Arne Hallam, Associate Dean
Amy Slagell, Associate Dean
Ruth W. Swenson, Associate Dean Emerita
Zora D. Zimmerman, Associate Dean Emerita

www.las.iastate.edu/ (http://www.las.iastate.edu)

The College of Liberal Arts and Sciences is a world-class learning and research community. Iowa State's most academically diverse college, LAS educates students to become global citizens, providing rigorous academic programs in the sciences, humanities and social sciences within a supportive, student-centered learning environment. The college also is home to the Open Option Program that prepares students for any curriculum at the University.

Learning GOALS

The primary mission of the college is to promote learning in all its dimensions by providing students with ample opportunities to acquire the requisite knowledge, abilities, and skills to succeed in the world beyond the university. Through coursework within the major and in general education, students will develop skills in reasoning, analysis, and communication; achieve an understanding of the intellectual, historical, and artistic foundations of culture; and work to strengthen their abilities to interact with people, cultures, and the environment in an ethical and sensitive manner. To achieve these learning goals, the college asks students to acquire depth in learning within disciplines of their own choosing, and to acquire breadth through general education courses and electives.

Entering the College of Liberal Arts and Sciences

From High School

Students entering the college are required to have the minimum high school preparation:

- 4 years of English
- 3 years of Social Studies
- 2 years of a single world language (3 or more years of a single world language in high school meets the world language graduation requirement in the College of Liberal Arts and Sciences.)
- 3 years of Mathematics
- 3 years of Science

The College also recommends a course in computer applications.

By Transfer

Students are eligible to transfer to the College of Liberal Arts and Sciences with no deficiencies by completing 24 credit hours from an accredited two or four year institution with a 2.0 minimum GPA. To graduate from the LAS College, a transfer student must complete the general requirements of the college as well as those of the university.

Early planning can improve the transfer process and support a timely graduation. For information on articulation/transfer agreements that apply to students who have earned Associate of Arts degrees from an Iowa public community college or who have satisfied general education requirements at the University of Northern Iowa or in the College of Liberal Arts at the University of Iowa, see Articulation/Transfer Agreements in the Admission Transfer Information section of the catalog. Transfer students should also note that in order to graduate "with distinction" students must have completed 60 semester credits of coursework at Iowa State University at the time they graduate, including a minimum of 50 graded credits and have a 3.5 or higher GPA at the beginning of their final term.

Transfer students in the College of Liberal Arts and Sciences may choose to graduate under the catalog in effect at the time of their graduation or under one of the five immediately preceding catalogs, provided that it covers the period of his or her enrollment either at Iowa State or any other accredited school. Full requirements of the chosen catalog must be met though adjustments will be made in instances where courses are no longer available or where programs have been changed. Transfer students are responsible for reviewing their transfer credit evaluation with the academic adviser during the first semester of enrollment. Prospective transfer students are urged to contact the College of Liberal Arts and Sciences well before arriving on campus so that pre-transfer courses are appropriate to the planned major and transferable toward graduation from ISU.

CURRICULA OF THE COLLEGE OF LIBERAL ARTS AND SCIENCES

The college has four curricula: a curriculum in Liberal Arts and Sciences, leading to the Bachelor of Arts or the Bachelor of Science degree; a curriculum in music, leading to the Bachelor of Music degree; a

curriculum in liberal studies, leading to the Bachelor of Liberal Studies degree; and a curriculum in Software Engineering, leading to the Bachelor of Science degree.

Liberal Arts and Sciences Curriculum

To obtain a bachelor's degree from the curriculum in liberal arts and sciences, an undergraduate student must meet all university graduation requirements:

- 120 credits or more
- minimum of 32 semester credits earned in residence at Iowa State University
- last 32 credits in residence
- GPA of 2.0 or better on courses taken at Iowa State University
- credit for LIB 160: Information Literacy
- credit for ENGL 150; credit for ENGL 250 (LAS requires a grade of C or better in ENGL 250)*
- U.S. diversity and international perspectives requirements

Students must also meet all college and program specific requirements for:

- General Education
- World Languages
- Advanced Communication
- Advanced Credits
- Completion of the Major

**College of Liberal Arts and Sciences Communication Proficiency Grade Requirement: At a minimum, students must demonstrate their communication proficiency by earning a grade of C or better in ENGL 250; some majors set higher requirements for communication proficiency.*

General Education

Requirements and Learning Goals

The central importance of a general education is reflected in the learning goals of each of three disciplinary areas. Whereas the courses in a major are designed to develop mastery of a specific field or discipline, courses in general education are designed to establish a strong, intellectual foundation to support learning for all majors.

General Education Areas

The general education areas with their minimum credit requirements for the College of Liberal Arts and Sciences are:

- Arts and Humanities—(Minimum 12 credits). The student should develop an understanding of human cultural heritage and history, and an appreciation of reasoning and the aesthetic value of human creativity.
- Mathematical Disciplines and Natural Sciences —(Minimum 11 credits, including 3 in the mathematical disciplines and 8 in the natural sciences). The student should appreciate mathematics as a valuable tool of the sciences and as an intrinsically important way of thinking, and should experience science as a rational search for understanding the structure and behavior of the natural world.
- Social Sciences—(Minimum 9 credits). The student should develop an appreciation of the principal methods of studying human behavior and an understanding of the structure and functioning of institutions.

Lists of courses approved for the three general education areas are available on the LAS College website (http://www.las.iastate.edu/students/academics/general-education). Students may not apply the same course in more than one general education area.

Because students fulfill, in part, the learning goals of the area of their first major by taking courses in their programs of study, the minimum number of general education credits required in the area of the first major is reduced from that listed above by 3 credits. Students in Liberal Studies or Interdisciplinary Studies majors must complete the minimum requirements in all three areas.

Courses from the department of the first major may not be applied to general education requirements. Courses cross-listed with a course in the student's first major may be used to satisfy either major requirements or general education requirements, but may not be used more than once.

World Language Requirement

The faculty of the College of Liberal Arts and Sciences believes that undergraduate students should acquire elementary practical experience in a second language, should be introduced to the theoretical study of language structure, and should begin to develop an understanding of a second culture through study of that culture's language. Students meet this expectation by satisfying a graduation requirement equivalent to the first year of university-level study in one world language.

Students may meet this requirement through several pathways:

- completing three or more years of high-school world language study in a single language
- earning college credit for two semesters of a single world language
- passing the exam for credit at the 102 level
- receiving a passing grade in a 102 world language course
- receiving a passing grade in a world language course at the 200-level or higher
- being a native speaker of a language other than English
- completing a major in any world language
- earning a passing grade in SPAN 097 Accelerated Spanish Review.

Questions about the World Language Requirement and how to meet it should be directed to the College Academic Services office in 102 Catt Hall. Credits applied toward the World Language Requirement cannot be used to satisfy the general education requirements, but students who have fulfilled the World Language Requirement may apply approved courses in world languages toward the appropriate general education areas.

Advanced Communication Skills

The continued development of communication skills following the sophomore year is the responsibility of the student's major department. The department promotes this development by adopting measures to certify the communication proficiency of its own majors. Certification occurs upon satisfactory completion of a designated course in which communication is evaluated and is a significant component. This designated course may be either a course required in the student's program or an advanced communication course offered by the Department of English, such as:

ENGL 302	Business Communication	3
ENGL 305	Creative Writing: Nonfiction	3
ENGL 309	Proposal and Report Writing	3
ENGL 314	Technical Communication	3

Advanced Credit Requirements

To obtain a bachelor's degree from the College of Liberal Arts and Sciences, curriculum in liberal arts and sciences, a student must earn at least 45 credits at the 300 level or above taken at a four-year college. All such credits, including courses taken on a pass/not pass basis, may be used to meet this requirement.

The major must contain at least 8 credits in courses taken at Iowa State University that are numbered 300 or above and in which the student's grade is C or higher.

The Major

Students must show they have achieved depth in a specialized area by completing successfully the requirements and learning goals of a major. A major is comprised of 24 to 48 credits in a specific discipline as determined by the faculty. Tracks within a major must have a common 24 credit core. Some courses outside the major discipline may also be required as supporting work for the major. (See Index for page reference to individual department and program requirements.) Courses in the first major listed on the degree program may not be counted in the general education groups.

The average grade of all courses in the major (those courses listed under major on the degree audit) must be 2.0 or higher.

Courses meeting the requirement of additional majors may be counted in the general education groups. When choosing an additional major, students must confirm that the additional major is allowable (see list under "Double Majors").

The major in Interdisciplinary Studies (B.A., B.S.) is available for undergraduate students who have unique interdisciplinary educational goals. Such a major is designed by the faculty and the student and is approved only when the educational goals cannot be met by a reasonable combination of existing majors, minors, and electives.

Double Majors

Students may elect a second major from the departments and program areas in the College of Liberal Arts and Sciences, or from a major field offered for the bachelor's degree in another college of the university.

Double majors between the following are not allowed:

- Chemistry with Biochemistry and Agricultural Biochemistry;
- Biology with Animal Ecology, Agricultural Biochemistry, Biochemistry, Genetics, and Microbiology;
- Any combination of Journalism and Mass Communication, Advertising, and Public Relations.

A student in the Bachelor of Liberal Studies or Bachelor of Music curricula may not add a major from the Liberal Arts and Sciences curriculum, though they may work toward a second degree in the Liberal Arts and Sciences curriculum.

To be awarded a double major both major departments must approve the degree program, and if those majors involve two colleges, both colleges must approve. Such programs must fulfill the general education requirements of the college of the primary major. If one major leads to the B.A. degree and the other to the B.S. degree, the degree awarded will be the one offered by the department of the primary major.

If the primary major may lead to either a B.A. or a B.S., a student may choose to receive either degree. In all cases, the student must satisfy the requirements of each major and of the degree that is chosen for the primary major. Students with a primary major in another college who wish to take a second major in the College of Liberal Arts and Sciences must meet all requirements of the second major, but are exempt from the LAS College General Education, World Language and Advanced Credits requirements.

A student may earn two degrees in the Liberal Arts and Sciences curriculum with two appropriate majors and at least 30 additional credits. Any degree offered by this college may be earned together with a degree and a major in any other college of the university. For the requirements for two degrees, see Two Bachelor's Degrees in the Degree Planning section of the catalog.

Minors

In addition to earning a major a student may want to add a minor to the program of study. Minors are established by programs and must consist of at least 15 credits, with at least 6 credits in courses numbered 300 and above taken at ISU with a grade of C or higher. To earn a minor students must file paperwork to declare the minor and must complete the requirements specified by the program. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement. Completed minors will be recorded on the transcript.

A list of minors offered by the college of Liberal Arts and Sciences can be found on the University Minors page.

Courses applied toward the general education groups may be used to meet the requirements of a minor. See University Minors page for more information.

Bachelor of Music Curriculum

The Department of Music offers a Bachelor of Music degree (B.Mus.) as well as a Bachelor of Arts degree in music. In order to receive teacher certification in music, students must earn the Bachelor of Music degree. Bachelor of Music students must select one of the following options: music education [vocal or instrumental], performance [voice,piano, organ, string instruments, wind or percussion instrument], or composition. For details about both degrees, see Music, Undergraduate Study.

Bachelor of Liberal Studies Curriculum

The LAS College administers a bachelor's degree program in Liberal Studies. This degree, the Bachelor of Liberal Studies (B.L.S.), was established by the three Iowa Regent universities to meet the needs of Iowans who want to earn a college degree but whose circumstances present obstacles to completing a traditional on-campus degree program. The B.L.S. is a general studies degree in the liberal arts. There is no traditional major. Instead, students take coursework in three areas of distribution. These areas may be focused in a single discipline or diversified over several disciplines. With the assistance of a B.L.S. adviser, students can structure a program that meets their individual educational, vocational or personal goals. Students in the BLS program are not eligible to add majors or minors to their degree program, but they may earn a Certificate by completing all of the requirements of the certificate program.

For specific degree requirements, see Liberal Studies.

Software Engineering Curriculum

A Bachelor of Science degree in software engineering is jointly administered by the College of Liberal Arts and Sciences and the College of Engineering. The program is aimed at creating high-quality software in a systematic, controlled, and efficient manner. The specific objective of the program is to educate students on principles, processes, techniques, and tools for producing, analyzing, specifying, designing and evolving software. A broader objective is to cultivate among students intellectual curiosity, problem solving skills, good learning habits, effective communication skills, leadership, and teamwork.

This cross-college program enables students to take a range of Software Engineering courses, as well as elective courses from both Computer Science and Computer Engineering as part of their degree program.

For specific degree requirements, see Software Engineering.

Additional Curricular Policies

In addition to the policies outlined in the above discussion of the curricula of the LAS College:

- Elective courses as well as general education courses may be used to meet the requirements of a minor or of another major, provided that they are taken on a graded basis.
- Courses taken on a pass/not pass basis may be counted toward the required total of 120 credits and may be used to meet the advanced credit requirement, if appropriate, but may not be used to satisfy any other graduation requirement.
- No more than 9 credits of 490 (Independent Study) courses in a single discipline may be counted toward graduation.
- Students whose high school study of world languages meets the College World Language Requirement may not enroll in or receive credit for 101 or 102 in that language.
- Individual departments may use CLEP Subject Tests for testout of specific courses. Students in the College of Liberal Arts and Sciences may use CLEP General Test credits as free electives but not toward any of the general education area requirements.

Be sure to talk to your academic adviser and review other University polices that affect graduation in the Academics section of the catalog.

The Open Option

Students who enter Iowa State University and want time to explore the best match between their academic interests and abilities, may do so as Open Option students.

The Open Option experience is designed to help students explore majors and careers, become acquainted with the entire university, and make successful adjustments to the academic expectations of Iowa State. Open Option students are assigned academic advisers in the Liberal Arts and Sciences Student Academic Services Office and take LAS 101, an orientation class that introduces students to campus resources as well as to all of the colleges and majors on campus. An optional career development class (U ST 104), in the second semester guides students in selecting a major and career that match their academic and personal goals.

Aided by their adviser, Open Option students select courses that allow them to sample their academic interests before committing to a specific university major. Open Option students typically declare a major during their second or third semester. In addition, students who may have started in a specific field and have discovered it is not meeting their needs may transfer into Open Option for a semester or two while they decide on a new major.

Academic Enhancements in LAS

Certificate Programs

The LAS College also administers certificate programs in Latin American Studies and in Leadership Studies. Students interested in pursuing these certificates are advised to consult with their academic adviser and with the relevant program that administers the certificate. Completion of a certificate will be recorded on the transcript.

Honors Program

Students enrolled in the College of Liberal Arts and Sciences are encouraged to participate in the University Honors Program.

Liberal Arts and Sciences Honors is designed to add depth and breadth to students' programs of study and intellectual development. Students in Liberal Arts and Sciences Honors benefit from the resources and capabilities of a large and dynamic research university along with the small class sizes and intellectual community that characterize smaller, selective liberal arts colleges. Membership in LAS Honors offers specific benefits to students such as collaborations with individual faculty members on Honors projects, extended library loan privileges, 24-hour use of the Jischke Honors Building and priority registration for classes.

LAS Honors encourages freshmen as well as more advanced students to join. Graduation in the Honors Program is recognized by a special notation on the student's diploma and permanent record. Honors students wear white Honors cords at graduation.

Teacher Licensure

Teaching licenses are issued by the Iowa Board of Educational Examiners. The Recommending Officer for the ISU University Teacher Education Program submits each candidate file after that candidate is determined to be eligible for licensure. Teaching licenses are issued for a specific teaching level, e.g., grades 5-12. Subject area endorsements are listed on the candidate's license. The College of Liberal Arts and Sciences collaborates with the School of Education in approved licensure programs. Students who plan to teach in secondary schools (grades 5-12) may qualify for a license by completing an approved licensure program in one of the following majors:

- Biology
- Chemistry
- Earth Science
- English
- History
- Mathematics
- Music (through the Bachelor of Music curriculum)*
- Physics
- World Languages and Cultures (Endorsements are available in French, German, and Spanish.)

Students may also add these additional endorsements to their primary license:

- English as a Second Language
- General Science
- Physical Science
- Social Studies
- Speech Communication
- World Languages and Cultures (Chinese, Latin, and Russian)

*Students in the College of Liberal Arts and Sciences who complete the approved licensure program in music education (BM degree with Vocal K-12 option or Instrumental K-12 option) may apply for a teaching license that allows them to teach music in grades K-12.

For further information, see Teacher Education.

Preprofessional Programs

Students in the College of Liberal Arts and Sciences may participate in preprofessional programs by taking the courses required for admission to professional schools. Students may enter the college with the designation Premed, Prelaw, or Preprofessional Health Programs. Most will earn a bachelor's degree by choosing a major and meeting the requirements for the major while taking the preprofessional courses.

Others will spend one to three years as students in the college before transferring to a professional school to which they have applied and been accepted. For further information, see Opportunities for Preprofessional Study.

The College of Liberal Arts and Sciences participates in a 3+3 program with the Law Schools at Drake University and at the University of Iowa. Visit the Liberal Arts and Sciences Student Academic Services office for details.

Reserve Officers' Training Corps Programs (ROTC)

The College of Liberal Arts and Sciences also offers students the opportunity to combine their academic programs with ROTC programs in Military Science (Army), Naval Science, and Air Force Aerospace Studies.

Learning Communities

Students in the LAS College can participate in a variety of learning community options that support student success by supporting the

transition to college life. There are various kinds of learning communities both within and across majors. Most learning communities involve small groups of students who take one or more classes in common and have a staff person or peer mentor who supports students as they make connections and get engaged at ISU.

See http://www.lc.iastate.edu/ for more information.

Study Abroad and National Student Exchange

The LAS College offers many study abroad and domestic exchange program options to enhance the undergraduate experience. Every year hundreds of students expand their horizons through these programs while they stay on track for graduation. Visit the LAS Study Abroad office in Catt Hall or the National Student Exchange office in 1080 Hixson-Lied for more information.

Undergraduate Research

The LAS College has hundreds of faculty actively engaged in research and most majors have designated independent study and/or research courses. Students are encouraged to talk to faculty about how they can be involved in the process of discovery.

Career Services, Internships and Co-ops

LAS Career Services assists students in gaining career-related experience while going to school. Internships/Co-ops provide students with the opportunity to gain specific skills, apply academic knowledge in practical situations, pretest their career choice, and establish a network of professional contacts. Internships may be paid or unpaid.

Most internships last for a semester or a summer. Students wishing to receive academic credit for their internship must work with their departments and programs in advance of their internship experience to establish a plan to connect their work experience to the curriculum. Official ISU sanctioned co-op arrangements allow students to work full-time on an extended basis (such as working two semesters) or on an alternating basis (work, school, work, etc.) during any semester (fall, spring, summer) while keeping their student status.

Gaining work experience while in college is highly recommended. Students can find internship opportunities through the University CYHIRE system and through participation in any of the career fairs held on campus each Fall and Spring semester. Students must visit with their adviser to make plans for an internship experience and to understand what impact, if any, it may have on their four-year graduation plan.

For additional information, contact Liberal Arts and Sciences Career Services on the first floor of Carver Hall.

Academic Advising

Planning the Program of Study

Careful, comprehensive planning is important for meeting graduation requirements and taking advantage of the resources offered by the university. Each student is encouraged to work with his or her academic adviser in developing a four year plan as soon as possible after declaration of the major. A degree audit listing all completed courses and those remaining to be taken for fulfillment of the degree requirements in the student's chosen major is provided to the student and the adviser through AccessPlus. The student should review the audit each semester and consult with the adviser when changes are required. Any changes to the audit must be approved by the academic adviser and by the dean's office. Students are responsible for reviewing and updating their degree audits in a timely fashion in order to avoid delays in graduation.

During the first two years, students should meet proficiency requirements in ISU Comm Foundations (English 150,250) and Information Literacy (LIB 160) and make progress toward meeting the general education requirements. The third and fourth years should emphasize completion of the major (and minor, if elected) and general education requirements, and should give the student an opportunity to take electives.Students seeking the enhanced academic opportunities provided by Study Abroad,National Student Exchange, and Internships will want to engage in careful planning of the Program of Study.

Academic Advising Learning Outcomes

Through their experience with academic advising, students will:

- Develop an understanding of the structure, application, and goals of a liberal arts education in relation to their academic development.
- Be able to formulate appropriate questions,seek information, and evaluate and apply academic advice.
- Know the requirements, policies and protocol of the university, college,and department as they relate to their educational experience.
- Understand how degree programs can be enhanced by study and experiences tailored to their intellectual and personal goals.

Students will also be able to identify and utilize university resources effectively to:

- Satisfy degree requirements
- Plan programs of study, including selection of appropriate courses and registration
- Discover how interests, skills and goals connect to fields of study and careers
- Link curricular and co-curricular activities
- Research and prepare for advanced study and/or careers

- Share responsibility for a mentor-mentee relationship between advisee and adviser.

Departments of the College

Majors and minors in the College of Liberal Arts and Sciences are administered by the following departments:

- Air Force Aerospace Studies
- Biochemistry, Biophysics, and Molecular Biology
- Chemistry
- Computer Science
- Ecology, Evolution, and Organismal Biology
- Economics
- English
- Genetics, Development, and Cellular Biology
- Geological and Atmospheric Sciences
- Greenlee School of Journalism and Communication
- History
- Mathematics
- Military Science (Army Reserve Officers' Training Corps)
- Music and Theatre
- Naval Science
- Philosophy and Religious Studies
- Physics and Astronomy
- Political Science
- Psychology
- Sociology
- Statistics
- World Languages and Cultures

MAJORS:

- Advertising, B.A.
- Anthropology, B.A., B.S.
- Biochemistry, B.S.
- Bioinformatics and Computational Biology B.S.
- Biological/Pre-Medical Illustration, B.A.
- Biology, B.S.
- Biophysics, B.S.
- Chemistry, B.A., B.S.
- Communication Studies, B.A.
- Computer Science, B.S.
- Criminal Justice Studies, B.A.
- Earth Science, B.A., B.S.
- Economics, B.S.
- English, B.A., B.S.
- Environmental Science, B.S.
- Environmental Studies, B.A., B.S. (secondary major only)
- French (see World Languages and Cultures, below)
- Genetics, B.S.
- Geology, B.S.
- German (see World Languages and Cultures, below)
- History, B.A., B.S.
- Interdisciplinary Studies, B.A., B.S.
- International Studies, B.A., B.S. (secondary major only)
- Journalism and Mass Communication, B.A., B.S.
- Liberal Studies, B.L.S.(a general studies degree)
- Linguistics, B.A.
- Mathematics, B.S.
- Meteorology, B.S.
- Music, B.A., B.Mus.
- Performing Arts, B.A.
- Philosophy, B.A.
- Physics, B.S.
- Political Science, B.A.
- Psychology, B.A., B.S.
- Public Relations, B.S.
- Religious Studies, B.A.
- Sociology, B.A., B.S.
- Software Engineering, B.S.
- Spanish (See World Languages and Cultures, below)
- Speech Communication, B.A., B.S.
- Statistics, B.S.
- Technical Communication, B.S.
- Women's Studies, B.A., B.S.
- World Languages and Cultures B.A.:
  - French
  - German
  - Spanish

A secondary major must be taken in conjunction with a primary major.

MINORS:

- Advertising
- African American Studies
- American Indian Studies
- Anthropology
- Astronomy

- Biochemistry
- Bioinformatics and Computational Biology
- Biological Illustration
- Biology
- Chemistry
- Chinese Studies
- Classical Studies
- Communication Studies
- Computer Science
- Criminal Justice Studies
- Economics
- Emerging Global Disease*
- English
- Entrepreneurial Studies*
- Environmental Studies
- French
- Genetics
- Geology
- German
- Gerontology
- History
- International Studies
- Journalism and Mass Communication
- Latin
- Leadership Studies
- Linguistics
- Mathematics
- Meteorology
- Military Studies (Army Reserve Officers' Training Corps)*
- Music
- Music Technology
- Performing Arts
- Philosophy
- Physics
- Political Science
- Psychology
- Public Relations
- Religious Studies
- Russian Studies
- Sociology
- Spanish
- Speech Communication
- Statistics
- Sustainability*
- Teaching English as a Second Language
- Technical Communication
- Technology and Social Change
- U.S. Latino/a Studies
- Wind Energy*
- Women's Studies
- World Film Studies

*The College of Liberal Arts and Sciences participates in these interdepartmental minors.

Cross-disciplinary studies in the College of Liberal Arts and Sciences encompass a variety of interdisciplinary and cross-disciplinary areas of study as well as courses that cross established departmental lines. Students may enroll in Program courses; declare majors or minors where offered, or develop an Interdisciplinary Studies major built upon Program offerings. Certificates are also available as separate foci of studies beyond a student's major or minor. (see Index for Program courses).

Cross-Disciplinary Programs

African and African American Studies Program

(Minor only) African and African American Studies

American Indian Studies Program

(Minor only) American Indian Studies

Biological/Premedical Illustration Program

(Major or minor) Biological/Pre-Medical Illustration

Classical Studies

(Minor only) Classical Studies

Communication Studies

(Major or minor) Communication Studies

Environmental Science

(Major or minor) Environmental Science

Environmental Studies

(Secondary major or Secondary minor) Environmental Studies

Honors Program in Liberal Arts and Sciences

Honors Program

Interdisciplinary Studies Program (Major only)

(Degree Tracks: Classical Studies; U.S. Latino/a Studies)

Interdisciplinary Studies

International Studies Program

(Second major or minor) International Studies

Leadership Studies

(Minor, see below for Certificate) Leadership Studies

Linguistics Program

(Major or minor; graduate minor) Linguistics

Premedical and Preprofessional Health Programs

Preprofessional Study

Sustainability Program

(Minor only) Interdisciplinary Minor in Sustainability

Teacher Education Program

Teacher Education

Teaching English as a Second Language

(Minor) Teaching English as a Second Language

U.S. Latino/a Studies Program

(Minor) U.S. Latino/a Studies

Women's and Gender Studies Program

(Major or minor) Women's and Gender Studies Program

Certificate Programs

Latin American Studies

(Certificate only) Latin American Studies Certificate

Leadership Studies

(Certificate) Leadership Studies Certificate

Advertising

The Advertising Major

The advertising major prepares students for careers in business and industry or for graduate education. Students majoring in advertising find career opportunities in professions requiring applied communication expertise. Graduates are qualified for positions in the creative and account sides of advertising within businesses, agencies and media. The capstone professional internship experience, coupled with coursework that focuses heavily on writing, research, and professional abilities provide opportunities for students to practice and refine their skills.

To receive a bachelor of arts degree in advertising, a student must earn at least 120 credits. A minimum of 72 credits must come from courses other than ADVRT, P R or JL MC. At least 50 of these credits must come from the liberal arts and sciences. Overall, at least 45 credits must be from 300-level courses or above. Advertising majors are required to take:

MKT 340	Principles of Marketing	3
SP CM 212	Fundamentals of Public Speaking	3
STAT 101	Principles of Statistics (or another approved statistics course)	4

The degree requirements allow for a minimum of 34 credits and a maximum of 48 credits to be taken in ADVRT, JL MC, or P R. These include:

JL MC 101	Mass Media and Society	3
JL MC 110	Orientation to Journalism and Communication	1
JL MC 201	Reporting and Writing for the Mass Media (C+ or better)	3
ADVRT 230	Advertising Principles	3
ADVRT 301	Research and Strategic Planning for Advertising and Public Relations	3
One of the following two courses:		
ADVRT 334	Advertising Creativity (C+ or better)	
ADVRT 336	Advertising Account Management (C+ or better)	
One of the following two courses:		
ADVRT 434	Advertising Campaigns	
ADVRT 436	Advertising Portfolio Practicum	
JL MC 460	Law of Mass Communication	3
JL MC 462	Media Ethics, Freedom, Responsibility	3
ADVRT 499A	Professional Media Internship: Required	3

Additional recommended courses and requirements for the advertising major are available from the Greenlee School.

Students taking one major at the school may not seek a second major or minor in the school. All Greenlee School majors are required to take a second major or minor outside the school as an area of expertise. All Greenlee School majors are required to take 499A.

Minor in Advertising

Students cannot select more than one minor in the Greenlee School of Journalism and Communication. Minors in the Greenlee School are not available to Greenlee majors.

For a minor in advertising, students complete 15 credits.

JL MC 101	Mass Media and Society	3
ADVRT 230	Advertising Principles	3
ADVRT 301	Research and Strategic Planning for Advertising and Public Relations	3
6 credits from the following:		6
ADVRT 335	Advertising Media Planning	
JL MC 401	Mass Communication Theory	
JL MC 406	Media Management	

JL MC 474	Communication Technology and Social Change	
JL MC 476	World Communication Systems	
JL MC 477	Ethnicity, Gender, Class and the Media	
ADVRT 497	Special Topics in Communication	
Total Credits		15

Advertising, B.A.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	ECON 101	3
JL MC 110	1	LIB 160	1
JL MC 101	3	ADVRT 230	3
Arts and Humanities	3	Arts and Humanities	3
Natural Science	3	International Perspectives	3
Social Science	3	Natural Science	3
	16		16

Sophomore

Fall	Credits	Spring	Credits
ENGL 250	3	JL MC 201	3
STAT 101	4	ADVRT 301	3
Arts & Humanities/ U.S. Diversity	3	Arts and Humanities	3
World Languages and Cultures or Elective	4	World Languages and Cultures or Elective	4
Natural Science	2	Social Science	3
	16		16

Junior

Fall	Credits	Spring	Credits	Summer	Credits
MKT 340	3	ADVRT 334 or 336	3	ADVRT 499A	3
ADVRT/JL MC/P R-300 level choice	3	ADVRT/JL MC/ P R choice 300 level	3		
Arts & Humanities	3	Minor/ second major choice-300 level	3		
Minor/ second major choice	3	Minor/ second major choice-300 level	3		
Minor/ second major choice	3	SP CM 212	3		
	15		15		3

Senior

Fall	Credits	Spring	Credits
JL MC 462	3	JL MC 460	3
One of the following:	3	Elective or Minor/ second major choice-300 level or above	3
ADVRT 434		Elective or Minor/ second major choice-300 level or above	3
ADVRT 435		Elective or Minor/ second major choice-300 level or above	3
ADVRT 436			
Minor/ second major choice-300 level or above	3		

Elective or Minor/ second major choice-300 level or above	3	
	12	12

For JL MC 300 and 400-level choices, please choose from the list of selected courses available from an academic adviser. You may schedule an appointment with an adviser by either calling 515-294-4342 or visiting with our front office staff at 101 Hamilton Hall.

University Requirement: Students in all ISU majors must complete a three-credit course in U.S. Diversity, as well as a three-credit course in International Perspectives. The approved course lists are found at the following web addresses:(U.S. Diversity) http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses) and (International Perspectives) http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current.

College of LAS Requirement: Minimum of 120 credits, including a minimum of 45 credits at the 300-level and above. You must also complete the LAS Foreign Language requirement and any unmet ISU admission requirements.

Minor or Second Major: Students are required to fulfill a secondary area of expertise. This requirement can be met by declaring a minor or a second major outside of the Greenlee School of Journalism and Communication.

Courses primarily for undergraduates:

ADVRT 230: Advertising Principles
(3-0) Cr. 3.
Historical, social, economic and legal aspects of advertising. Evaluations of advertising research, media, strategy and appeals. Study of the creation of advertising.

ADVRT 301: Research and Strategic Planning for Advertising and Public Relations
(Cross-listed with P R). (3-0) Cr. 3.
Prereq: ADVRT 230 or P R 220
The use of primary and secondary research for situations, organizations and the public. Formation and development of strategic plans for public relations and advertising students.

ADVRT 334: Advertising Creativity
(2-2) Cr. 3.
Prereq: JL MC 110; Minimum of C+ in JL MC 201; ADVRT 301/P R 301
Development and execution of creative advertising materials. Copywriting, art direction and computer applications. Creative strategy development, execution and evaluation.

ADVRT 335: Advertising Media Planning
(3-0) Cr. 3.
Prereq: ADVRT/P R 301
Concepts of media planning and selection in the development, execution and evaluation of advertising campaigns. Characteristics and capabilities of the advertising media. Utilization of market segmentation, consumer buying and media audience databases.

ADVRT 336: Advertising Account Management
(3-0) Cr. 3.
Prereq: JL MC 110; Minimum of C+ in JL MC 201; ADVRT/P R 301
Fundamentals of account management with emphasis on leadership, sales techniques, relationship building, presentation skills, and strategic thinking. Includes aspects of agency communications, team building, client management, evaluating creative concepts and media plans, and developing strategic proposals and campaign recommendations.

ADVRT 390: Professional Skills Development
(Cross-listed with JL MC, P R). Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Minimum of C+ in JL MC 201; other vary by topic. Instructor permission for non-majors.
Check with Greenlee School for course availability.

ADVRT 434: Advertising Campaigns
(3-0) Cr. 3. F.S.
Prereq: Minimum of C+ in ADVRT 334 or ADVRT 336, and major status
Development of advertising campaigns for business and social institutions. Projects involve budgeting, media selection, market analysis, campaign strategy and creative execution.

ADVRT 435: Advertising Competition
Cr. 1-3. Repeatable, maximum of 3 credits. Alt. S., offered irregularly.
Prereq: Permission of instructor, Junior/senior standing strongly recommended
Preparation of materials for regional and national competitions.

ADVRT 436: Advertising Portfolio Practicum
(2-2) Cr. 3. S.
Prereq: Minimum of C+ in ADVRT 334, non-majors with instructor permission
Advanced advertising writing and design. Emphasis on creative strategy, problem solving and execution of creative materials in print, broadcast and online media for a variety of clients.

ADVRT 497: Special Topics in Communication
(Cross-listed with JL MC, P R). Cr. 1-3. Repeatable, maximum of 6 credits. *Prereq: Junior classification. See Schedule of Classes for possible pre-requisites.*
Seminars or one-time classes on topics of relevance to students in communication.

ADVRT 499: Professional Media Internship
Cr. 1-3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, junior classification, formal faculty adviser approval.
Required of all Greenlee School majors. A 400-hour (for 3 credits) internship in the student's journalism and mass communication or advertising or public relations specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

ADVRT 499A: Professional Media Internship: Required
Cr. 3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, junior classification, formal faculty adviser approval.
Initial, required internship. A 400-hour (for 3 credits) internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

ADVRT 499B: Professional Media Internship: Optional
Cr. 1-3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, junior classification, formal faculty adviser approval.
Optional internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

Anthropology

The ISU program in Anthropology is housed in the Department of World Languages and Cultures (http://catalog.iastate.edu/collegeofliberalartsandsciences/worldlanguagesandcultures/).

An undergraduate major in Anthropology can serve as the nucleus for a general liberal education, or as the prerequisite for graduate training qualifying a person for positions in (1) college and university teaching, (2) research, and (3) administrative and applied positions in government, development organizations, museums, and private businesses or corporations.

Anthropology students develop a well-rounded professional education in cultural anthropology, archaeology, and biological anthropology. They learn what it means to be human through the study of culture and society, the biology and evolution of humans and other primates, and through the study of past human communities and material culture. Students learn the important historical and contemporary issues of our subdisciplines, and they learn what it means to be an Anthropologist and acquire an anthropological perspective on global issues. Students develop an appreciation of the value of cultural difference at the local, national and global levels. Students may obtain experience in archaeological, ethnographic and biological research.

Anthropology majors may choose either a bachelor of arts or a bachelor of science degree, both of which require 33 credits in anthropology.
A bachelor of arts degree is obtained by fulfilling the college general education requirements plus 6 additional credits in Area I (Arts and Humanities) or III (Social Sciences) or a combination of both. A bachelor of science degree is obtained by fulfilling the college general education requirements plus 6 additional credits in Area IIA (Mathematics) or IIB (Natural Sciences) or a combination of both.

Undergraduate students with majors in anthropology are required to take the following anthropology core courses:

ANTHR 201	Introduction to Cultural Anthropology	3
ANTHR 202	Introduction to Biological Anthropology and Archaeology	3
ANTHR 306	Cultural Anthropology	3
ANTHR 307	Biological Anthropology	3
ANTHR 308	Archaeology	3
ANTHR 450	Historical and Theoretical Approaches in Anthropology	3
One course in statistics is required		3
In addition to the above, 15 ANTHR choice credits are required.		15

Communication Proficiency requirement: The LAS College requires that a student earn a grade of C or better in:

ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	
Additionally, the Anthropology Program requires a grade of C or better in one of the following courses:		
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	

ENGL 314	Technical Communication	

The principal sub-disciplines of anthropology are represented by the following:

1. Cultural anthropology:

ANTHR 201	Introduction to Cultural Anthropology	3
ANTHR 230	Globalization and the Human Condition	3
ANTHR 306	Cultural Anthropology	3
ANTHR 309	Introduction to Culture and Language	3
ANTHR 313	Kinship and Marriage in a Global Perspective	3
ANTHR 322	Peoples and Cultures of Native North America	3
ANTHR 323	Topics in Latin American Anthropology	3
ANTHR 332	Current Issues in Native North America	3
ANTHR 336	Global Development	3
ANTHR 340	Magic, Witchcraft, and Religion	3
ANTHR 354	War and the Politics of Humanitarianism	3
ANTHR 411	Anthropology for Global Professionals	3
ANTHR 418	Global Culture, Consumption and Modernity	3
ANTHR 431	Ethnographic Field School	4-6
ANTHR 434B	Internship: Cultural Anthropology	2-6
ANTHR 434D	Internship: Linguistic Anthropology	2-6
ANTHR 444	Sex and Gender in Cross-cultural Perspective	3
ANTHR 450	Historical and Theoretical Approaches in Anthropology	3
ANTHR 451B	Practicum in Anthropology: Cultural Anthropology	1-3
ANTHR 451D	Practicum in Anthropology: Linguistic Anthropology	1-3
ANTHR 490B	Independent Study: Cultural Anthropology	1-5
ANTHR 490D	Independent Study: Linguistic Anthropology	1-5

2. Archaeology:

ANTHR 202	Introduction to Biological Anthropology and Archaeology	3
ANTHR 308	Archaeology	3
ANTHR 315	Archaeology of North America	3
ANTHR 320	Great Plains Archaeology	3
ANTHR 321	World Prehistory	3
ANTHR 428	Topics in Archaeological Laboratory Methods and Techniques	3
ANTHR 429	Topics in Archaeological Laboratory Methods and Techniques: Archaeological Field School	4-6
ANTHR 434A	Internship: Archaeology	2-6
ANTHR 450	Historical and Theoretical Approaches in Anthropology	3
ANTHR 451A	Practicum in Anthropology: Archaeology	1-3
ANTHR 427I	Field Archaeology	4
ANTHR 490A	Independent Study: Archaeology	1-5

3. Biological Anthropology:

ANTHR 202	Introduction to Biological Anthropology and Archaeology	3
ANTHR 250	Primate Behavior	3
ANTHR 307	Biological Anthropology	3
ANTHR 319	Skeletal Biology	3
ANTHR 424	Forensic Anthropology	3
ANTHR 434C	Internship: Biological Anthropology	2-6
ANTHR 438	Primate Evolutionary Ecology and Behavior	3
ANTHR 445	Biological Field School	4-6
ANTHR 451C	Practicum in Anthropology: Biological Anthropology	1-3
ANTHR 490C	Independent Study: Biological Anthropology	1-5

A minor in anthropology consists of at least 15 credits.

ANTHR 201	Introduction to Cultural Anthropology	3
ANTHR 202	Introduction to Biological Anthropology and Archaeology	3
One of the following in cultural anthropology:		3
ANTHR 306	Cultural Anthropology	
or ANTHR 30	Introduction to Culture and Language	
or ANTHR 32	Peoples and Cultures of Native North America	
or ANTHR 32	Topics in Latin American Anthropology	
or ANTHR 34	Magic, Witchcraft, and Religion	
One of the following in archaeology or biological anthroplogy:		3
ANTHR 307	Biological Anthropology	
or ANTHR 30	Archaeology	
or ANTHR 31	Archaeology of North America	
or ANTHR 31	Skeletal Biology	
or ANTHR 32	World Prehistory	
or ANTHR 48	Topics in Biological Anthropology	
Three additional credits in ANTHR at the 300+ level		3

Anthropology B.S., B.A.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	ANTHR 202	3

LIB 160	1	Minor choice	3
ANTHR 201	3	Social science choice	3
Elective	3	Natural science choice	3
Arts & Humanities choice	3	Arts & Humanities choice	3
Social science choice	3		
	16		15

Sophomore

Fall	Credits	Spring	Credits
ANTHR 308	3	ANTHR 306	3
World Languages and Cultures/International Perspective	4	World Languages and Cultures/International Perspective	4
Humanities choice	3	ANTHR 300 choice	3
ENGL 250	3	Minor choice	3
ANTHR 300 choice	3	Natural science choice	3
	16		16

Junior

Fall	Credits	Spring	Credits
ANTHR 425	2	ANTHR 307	3
STAT 101	4	ENGL 300-level	3
Arts & Humanities choice	3	ANTHR 300	3
ANTHR 300 choice	3	Minor choice	3
Natural science choice	3	Additional Area requirement	3
		Summer: It is highly recommended that students complete a field school, internship, or study abroad experience during the summer between their junior and senior years however, this is not required for graduation.	
	15		15

Senior

Fall	Credits	Spring	Credits
ANTHR 450	3	ANTHR 300 choice	3
Minor choice	3	Minor choice	3
ANTHR 300 choice	3	Elective	3
Additional Area requirement	3	Elective	3
Electives	3		
	15		12

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 300/400 level. Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses.

Students in Anthropology have the option of pursuing a B.S. or a B.A. A B.S requires six additional group requirement credits in natural science or mathematics disciplines. A B.A. requires six additional group requirement credits in social or humanities disciplines.

Graduate Study

The department offers a master of arts degree with a major in anthropology. Graduate courses are offered in the areas of biological anthropology, archaeology, cultural anthropology, and anthropological history and theory. Competence in one foreign language and in statistics must be demonstrated. A thesis, based on original research, is required.

Courses primarily for undergraduates:

ANTHR 201: Introduction to Cultural Anthropology
(3-0) Cr. 3. F.S.SS.
Comparative study of culture as key to understanding human behaviors in different societies. Using a global, cross-cultural perspective, patterns of family life, economic and political activities, religious beliefs, and the ways in which cultures change are examined.
Meets International Perspectives Requirement.

ANTHR 202: Introduction to Biological Anthropology and Archaeology
(3-0) Cr. 3. F.S.
Human biological and cultural evolution; survey of the evidence from fossil primates, the human fossil record and the archaeological record, as well as living primates; introduction to research methods in archaeology and biological anthropology.

ANTHR 220: Globalization and Sustainability
(Cross-listed with ENV S, GLOBE, M E, MAT E, SOC, T SC). (3-0) Cr. 3. F.S.
An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.
Meets International Perspectives Requirement.

ANTHR 230: Globalization and the Human Condition
(3-0) Cr. 3. F.S.
An introduction to understanding key global issues in the contemporary world. Focuses on social relations, cultural practices and political-economic linkages among Africa, the Americas, Asia, Europe and the Pacific.
Meets International Perspectives Requirement.

ANTHR 250: Primate Behavior
(2-2) Cr. 3. F.S.SS.
Prereq: ANTHR 202 and/or basic biology course recommended
An introduction to the Order Primates with a focus on their behavior. Biological and social adaptations of monkeys, apes, and prosimians; basic evolutionary concepts, current trends and theories in the field of Primatology and issues related to primate conservation.

ANTHR 306: Cultural Anthropology
(2-2) Cr. 3. S.
Prereq: ANTHR 201
Survey of the major theoretical, methodological and empirical foundations of cultural anthropology. Participatory lab: focus on ethnographic methods through individual research projects.
Meets International Perspectives Requirement.

ANTHR 307: Biological Anthropology
(2-2) Cr. 3. S.
Prereq: ANTHR 202
Human evolution as known from fossil evidence, comparative primate studies, and genetic variations in living populations. Laboratory-tutorial sessions include study and discussion of human osteology, fossil hominids, simple Mendelian traits, and bio-ethics in applied biological anthropology.

ANTHR 308: Archaeology
(2-2) Cr. 3. F.
Prereq: ANTHR 202
Methods and techniques for the recovery and interpretation of archaeological evidence, its role in reconstructing human behavior and past environments. Laboratory sessions include experience in the interpretation of archaeological evidence, the use of classification systems, and prehistoric technologies such as ceramics and stone tools.

ANTHR 309: Introduction to Culture and Language
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: ANTHR 201 recommended
Introduction to study of language, culture and society from an anthropological perspective. Focus on language and thought, ethnography of speaking, discourse and narrative, writing and literacy, and media communication. Discussion of key theories and methods of linguistic anthropology.
Meets International Perspectives Requirement.

ANTHR 313: Kinship and Marriage in a Global Perspective
(Dual-listed with ANTHR 513). (3-0) Cr. 3. S.
Prereq: ANTHR 201 recommended
Comparative and historical overview of the family, marriage and kinship. Examination of cross-cultural differences in the construction and functioning of family and kin relations; role of kinship in structuring individual and collective activities; current critical and theoretical issues in kinship studies, especially integrating work on gender and sexuality.
Meets International Perspectives Requirement.

ANTHR 315: Archaeology of North America
(Dual-listed with ANTHR 515). (Cross-listed with AM IN). (3-0) Cr. 3. S.
Prereq: ANTHR 202
Prehistory and early history of North America as reconstructed from archaeological evidence; peopling of the New World; culture- historical sequences of major culture areas; linkages of archaeological traditions with selected ethnohistorically known Native American groups.
Meets U.S. Diversity Requirement

ANTHR 319: Skeletal Biology
(Dual-listed with ANTHR 519). (2-2) Cr. 3. F.
Prereq: ANTHR 307 or college level biology
Comprehensive study of the skeletal anatomy, physiology, genetics, growth, development and population variation of the human skeleton. Applications to forensic anthropology, paleopathology and bioarchaeology are introduced.

ANTHR 320: Great Plains Archaeology
(Dual-listed with ANTHR 520). (Cross-listed with AM IN). (3-0) Cr. 3. F.
Prereq: ANTHR 202
Prehistoric societies of the Great Plains region of North America, from initial occupation to European contact; emphasis on sociocultural changes, continuities, and adaptations to changing environments using archaeological, ecological, ethnographic information.
Meets U.S. Diversity Requirement

ANTHR 321: World Prehistory
(Dual-listed with ANTHR 521). (3-0) Cr. 3. S.
Prereq: ANTHR 202 recommended
An introduction to archaeological sites from around the world including the Near East, Africa, Europe, Mesoamerica, and North and South America. Emphasis is on the interpretation of material cultural remains in reconstructing past societies.

ANTHR 322: Peoples and Cultures of Native North America
(Dual-listed with ANTHR 522). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or AM IN 210
Origin, distribution, and pre-contact life of the indigenous peoples of North America. Survey of culture areas; language families, social and political systems, ecological and economic adaptations, religion and spirituality; impact of European contact; cultural resilience and revitalization in contemporary American Indian life.
Meets U.S. Diversity Requirement

ANTHR 323: Topics in Latin American Anthropology
(Dual-listed with ANTHR 523). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.

ANTHR 323A: Latin American Anthropology: Violence and Memory
(Dual-listed with ANTHR 523A). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 323B: Latin American Anthropology: Social movements and Democracy
(Dual-listed with ANTHR 523B). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 323C: Latin American Anthropology: Race, Class and Gender
(Dual-listed with ANTHR 523C). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 323D: Latin American Anthropology: Regional Focus
(Dual-listed with ANTHR 523D). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 323E: Latin American Anthropology: Culture and Sport.
(Dual-listed with ANTHR 523E). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 325: Peoples and Cultures of Africa.
(Cross-listed with AF AM). (3-0) Cr. 3.
Prereq: 201 or 306 recommended.
Survey of diverse African culture areas across the continent and globally; local level description and analysis of individuals as members of African communities; regional, national and global scales of identification.
Meets International Perspectives Requirement.

ANTHR 332: Current Issues in Native North America
(Dual-listed with ANTHR 532). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 332A: Current Issues in Native North America: Gender and Family
(Dual-listed with ANTHR 532A). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 332B: Current Issues in Native North America: Indigenous Ecologies and Geographies
(Dual-listed with ANTHR 532B). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 332C: Current Issues in Native North America: Cultural and Political Movements
(Dual-listed with ANTHR 532C). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 332D: Current Issues in Native North America: Regional Focus
(Dual-listed with ANTHR 532D). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 333: Asian American Material Cultures
(Cross-listed with HIST). (3-0) Cr. 3.
Examination of material objects made and used by Asian Americans with both historical and contemporary focuses; transnational and interdisciplinary lenses to interpret the material world; contemporary approaches to analysis of artifacts.
Meets U.S. Diversity Requirement

ANTHR 336: Global Development
(Dual-listed with ANTHR 536). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ANTHR 201 or ANTHR 306
Cross-cultural analysis of current development practices from an anthropological perspective; focus on international aid, development institutions, agrarian reform, indigenous knowledge, humanitarianism and human rights; introduction to main theories of political and economic anthropology.
Meets International Perspectives Requirement.

ANTHR 340: Magic, Witchcraft, and Religion
(Dual-listed with ANTHR 540). (Cross-listed with RELIG). (3-0) Cr. 3. S.
Prereq: ANTHR 201 or ANTHR 306
Survey of global religious belief and practice from an anthropological perspective. Emphasis on myth and ritual, shamanism, magic, witchcraft, beliefs in spirits, conceptions of the soul, mind and body relationships, and healing and therapeutic practices. Discussion of religious response to dramatic political and social change; effects of globalization on religious practice.
Meets International Perspectives Requirement.

ANTHR 354: War and the Politics of Humanitarianism
(Cross-listed with POL S). (3-0) Cr. 3. S.
Prereq: Pol S 235, Pol S 251, or Anthr 230
Humanitarianism as a system of thought and a system of intervention in conflict and post-conflict situations: role of humanitarian organizations and actors in addressing human suffering caused by conflict or war military action as a form of humanitarian intervention.
Meets International Perspectives Requirement.

ANTHR 376: Classical Archaeology
(Cross-listed with CL ST, RELIG). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

ANTHR 376A: Classical Archeology: Bronze Age and Early Iron Age Greece
(Cross-listed with CL ST, RELIG). (3-0) Cr. 3. S.
Bronze Age (Minoan and Mycenaean palatial cultures) and Early Iron Age Greece. (ca 3000-700 BCE). Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

ANTHR 376B: Classical Archeology: Archaic through Hellenistic Greece (ca 700-30 BCE)
(Cross-listed with CL ST, RELIG). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

ANTHR 376C: Classical Archaeology: Roman Archaeology (ca 1000 BCE-400 CE)
(Cross-listed with CL ST). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Roman world and the role of archaeological context in understanding the varied aspects of ancient Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

ANTHR 411: Anthropology for Global Professionals
(Dual-listed with ANTHR 511). (3-0) Cr. 3. F.
Prereq: ANTHR 201 or ANTHR 306
Theory and methods for conducting ethnographic research in academic and non-academic settings; application of anthropological knowledge to contemporary cultural, political, economic, environmental and spatial issues; development of skills necessary for professional practice as an anthropologist.
Meets International Perspectives Requirement.

ANTHR 418: Global Culture, Consumption and Modernity
(Dual-listed with ANTHR 518). (3-0) Cr. 3. F.
Prereq: ANTHR 201 or ANTHR 306 recommended
Cross-cultural study of the impact of globalization, with an emphasis on economic consumption and the movement of goods, ideas, and peoples across cultural and national boundaries.
Meets International Perspectives Requirement.

ANTHR 419: Topics in Cultural Anthropology
(3-0) Cr. 3.
Prereq: ANTHR 306
In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. Each section may be taken once for credit up to 9 credits. No more than 9 credits of ANTHR 419 courses may be applied towards graduation.

ANTHR 419A: Topics in Cultural Anthropology: Theory
(3-0) Cr. 3.
Prereq: ANTHR 306
In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. No more than 9 credits of ANTHR 419 courses may be applied towards graduation.

ANTHR 419B: Topics in Cultural Anthropology: Methods
(3-0) Cr. 3.
Prereq: ANTHR 306
In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. No more than 9 credits of ANTHR 419 courses may be applied towards graduation.

ANTHR 419C: Topics in Cultural Anthropology: Regional Focus
(3-0) Cr. 3.
Prereq: ANTHR 306
In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. No more than 9 credits of ANTHR 419 courses may be applied towards graduation.

ANTHR 419D: Topics in Cultural Anthropology: Others
(3-0) Cr. 3.
Prereq: ANTHR 306
In-depth study of current topics in cultural anthropology, such as recent theoretical trends, new methodologies, or new research on a specific region. Topics vary each time offered. No more than 9 credits of ANTHR 419 courses may be applied towards graduation.

ANTHR 424: Forensic Anthropology
(Dual-listed with ANTHR 524). (2-2) Cr. 3. S.
Prereq: ANTHR 202 or ANTHR 307; ANTHR 319 recommended
Comprehensive study of forensic anthropology, a specialized subfield of biological anthropology. Emphasis is placed on personal identifications from extremely fragmentary, comingled, burnt, cremated and incomplete skeletal remains. All parameters of forensic study are included as they pertain to anthropology, including human variation, taphonomy, entomology, archaeology, pathology, epidemiology; genetics and the non-biological forensic disciplines. An appreciation for the wide range of medicolegal and bioethical issues will also be gained.

ANTHR 425: Professional Preparation in Anthropology
(2-0) Cr. 2. F.
Prereq: Junior classification in anthropology or permission from the instructor
Instruction and guidance in the development of professional skills needed for success in academic and non-academic anthropological careers. Topics will include strategies for internship and job searches, creating resumes and CVs, composing personal statements and cover letters, and developing contacts and sources. Offered on a satisfactory-fail basis only.

ANTHR 427I: Field Archaeology
(Cross-listed with IA LL). Cr. 4. SS.
Nature of cultural and environmental evidence in archaeology and how they are used to model past human behavior and land use; emphasis on Iowa prehistory; basic reconnaissance surveying and excavation techniques.

ANTHR 428: Topics in Archaeological Laboratory Methods and Techniques
(Dual-listed with ANTHR 528). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition and organization, and computer applications.

ANTHR 428A: Topics in Archaeological Laboratory Methods and Techniques
(Dual-listed with ANTHR 528A). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 428B: Topics in Archaeological Laboratory Methods and Techniques: Ceramics
(Dual-listed with ANTHR 528B). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 428C: Topics in Archaeological Laboratory Methods and Techniques: Faunal remains
(Dual-listed with ANTHR 528C). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 428D: Topics in Archaeological Laboratory Methods and Techniques: General
(Dual-listed with ANTHR 528D). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 429: Topics in Archaeological Laboratory Methods and Techniques: Archaeological Field School
(Dual-listed with ANTHR 529). Cr. 4-6. SS.
Prereq: ANTHR 202 or ANTHR 308
Summer field school for training in archaeological reconnaissance and excavation techniques; documentation and interpretation of archaeological evidence.

ANTHR 431: Ethnographic Field School
(Dual-listed with ANTHR 531). Cr. 4-6.
Hands-on training in ethnographic field methods; students will carry out research projects in socio-cultural anthropology, learning a variety of investigative research techniques commonly used in social sciences.

ANTHR 434: Internship
Cr. 2-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior standing
Supervised practice in government agencies, museums, and business organizations. Offered on a satisfactory-fail basis only. Not more than 6 credits of internship experience may count towards the major. No credits in Anthr 434 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor.

ANTHR 434A: Internship: Archaeology
Cr. 2-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior standing
Supervised practice in government agencies, museums, and business organizations. Offered on a satisfactory-fail basis only. Not more than 6 credits of internship experience may count towards the major. No credits in Anthr 434 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor.

ANTHR 434B: Internship: Cultural Anthropology
Cr. 2-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior standing
Supervised practice in government agencies, museums, and business organizations. Offered on a satisfactory-fail basis only. Not more than 6 credits of internship experience may count towards the major. No credits in Anthr 434 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor.

ANTHR 434C: Internship: Biological Anthropology
Cr. 2-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior standing
Supervised practice in government agencies, museums, and business organizations. Offered on a satisfactory-fail basis only. Not more than 6 credits of internship experience may count towards the major. No credits in Anthr 434 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor.

ANTHR 434D: Internship: Linguistic Anthropology
Cr. 2-6. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Junior or senior standing
Supervised practice in government agencies, museums, and business organizations. Offered on a satisfactory-fail basis only. Not more than 6 credits of internship experience may count towards the major. No credits in Anthr 434 may be used to satisfy Anthropology core courses for majors or for the Anthropology minor.

ANTHR 438: Primate Evolutionary Ecology and Behavior
(Dual-listed with ANTHR 538). Cr. 3. S.
Prereq: ANTHR 202 or ANTHR 307
Primate behavior and ecology in evolutionary perspective: biological and social adaptations of prosimians, monkeys, and apes. Introduction to the Order Primates, basic evolutionary concepts, and techniques of behavioral observation. Focus on theory and methods current in Primatology, including applied conservation biology.

ANTHR 444: Sex and Gender in Cross-cultural Perspective
(Dual-listed with ANTHR 544). (Cross-listed with W S). (3-0) Cr. 3. S.
Prereq: ANTHR 201; ANTHR 306 recommended
Cross-cultural examination of the social construction of genders out of the biological fact of sex. Emphasis on non-western societies. Topics, presented through examination of ethnographic data, will include the range of gender variation, status and roles, the institution of marriage, and symbols of gender valuation.
Meets International Perspectives Requirement.

ANTHR 445: Biological Field School
(Dual-listed with ANTHR 545). Cr. 4-6. SS.
Prereq: ANTHR 202 or BIOL 101
Summer field school for training in behavioral and ecological methods for primatologists. Proposal, data collection and analyses, and presentation of research topic in primatology.

ANTHR 450: Historical and Theoretical Approaches in Anthropology
(3-0) Cr. 3. F.
Prereq: ANTHR 306
Survey of the historical foundations of anthropology and its interrelated four sub-fields; key figures in 19th and 20th century anthropology with a focus on major theoretical contributions.

ANTHR 451: Practicum in Anthropology
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: ANTHR 201 or ANTHR 202 or ANTHR 308
Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis.

ANTHR 451A: Practicum in Anthropology: Archaeology
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: ANTHR 201 or ANTHR 202 or ANTHR 308
Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis.

ANTHR 451B: Practicum in Anthropology: Cultural Anthropology
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: ANTHR 201 or ANTHR 202 or ANTHR 308
Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis.

ANTHR 451C: Practicum in Anthropology: Biological Anthropology
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: ANTHR 201 or ANTHR 202 or ANTHR 308
Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis.

ANTHR 451D: Practicum in Anthropology: Linguistic Anthropology
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: ANTHR 201 or ANTHR 202 or ANTHR 308
Application of methods under actual laboratory and field conditions, including basic data management, synthesis, and analysis.

ANTHR 482: Topics in Biological Anthropology
(Dual-listed with ANTHR 582). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 482A: Topics in Biological Anthropology: Paleoanthropology
(Dual-listed with ANTHR 582A). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 482B: Topics in Biological Anthropology: Primate Cognition
(Dual-listed with ANTHR 582B). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 482C: Topics in Biological Anthropology: Primate Conservation
(Dual-listed with ANTHR 582C). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 482D: Topics in Biological Anthropology: Population Genetics and Human Evolution
(Dual-listed with ANTHR 582D). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 490: Independent Study
Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology
No more than 9 credits of Anthr 490 may be counted toward graduation.

ANTHR 490A: Independent Study: Archaeology
Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology
No more than 9 credits of Anthr 490 may be counted toward graduation.

ANTHR 490B: Independent Study: Cultural Anthropology
Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology
No more than 9 credits of Anthr 490 may be counted toward graduation.

ANTHR 490C: Independent Study: Biological Anthropology
Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology
No more than 9 credits of Anthr 490 may be counted toward graduation.

ANTHR 490D: Independent Study: Linguistic Anthropology
(Cross-listed with LING). Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology.
No more than 9 credits of Anthr 490 may be counted toward graduation.

ANTHR 490H: Independent Study: Honors
Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology
No more than 9 credits of Anthr 490 may be counted toward graduation.

ANTHR 490I: Iowa Lakeside Laboratory
(Cross-listed with IA LL, NREM). Cr. 1-6. Repeatable, maximum of 9 credits.
Prereq: 8 credits in biology and permission of instructor
Research opportunities for undergraduate students in the biological sciences. No more than 9 credits in Biol 490 may be counted toward graduation and of those, only 6 credits may be applied to the major.

Courses primarily for graduate students, open to qualified undergraduates:

ANTHR 503: Biological Anthropology and Archaeology
(3-0) Cr. 3.
Prereq: ANTHR 307 and ANTHR 308
History of biological anthropology and archaeology, current developments and theoretical issues related to major events in human biocultural evolution and world prehistory.

ANTHR 509: Agroecosystems Analysis
(Cross-listed with AGRON, SOC, SUSAG). (3-4) Cr. 3. F.
Prereq: Senior or above classification
Experiential, interdisciplinary examination of Midwestern agricultural and food systems, emphasizing field visits, with some classroom activities. Focus on understanding multiple elements, perspectives (agronomic, economic, ecologic, social, etc.) and scales of operation.

ANTHR 510: Theoretical Dimensions of Cultural Anthropology
(3-0) Cr. 3. F.
Prereq: 6 credits in anthropology
Survey of historical and current developments in topical and theoretical approaches to sociocultural anthropology. Examination and assessment of controversies; new research directions and theoretical approaches.

ANTHR 511: Anthropology for Global Professionals
(Dual-listed with ANTHR 411). (3-0) Cr. 3. F.
Prereq: ANTHR 201 or ANTHR 306
Theory and methods for conducting ethnographic research in academic and non-academic settings; application of anthropological knowledge to contemporary cultural, political, economic, environmental and spatial issues; development of skills necessary for professional practice as an anthropologist.
Meets International Perspectives Requirement.

ANTHR 513: Kinship and Marriage in a Global Perspective
(Dual-listed with ANTHR 313). (3-0) Cr. 3. S.
Prereq: ANTHR 201 recommended
Comparative and historical overview of the family, marriage and kinship. Examination of cross-cultural differences in the construction and functioning of family and kin relations; role of kinship in structuring individual and collective activities; current critical and theoretical issues in kinship studies, especially integrating work on gender and sexuality.
Meets International Perspectives Requirement.

ANTHR 515: Archaeology of North America
(Dual-listed with ANTHR 315). (3-0) Cr. 3. S.
Prereq: ANTHR 202
Prehistory and early history of North America as reconstructed from archaeological evidence; peopling of the New World; culture- historical sequences of major culture areas; linkages of archaeological traditions with selected ethnohistorically known Native American groups.
Meets U.S. Diversity Requirement

ANTHR 518: Global Culture, Consumption and Modernity
(Dual-listed with ANTHR 418). (3-0) Cr. 3. F.
Prereq: ANTHR 201 or ANTHR 306 recommended
Cross-cultural study of the impact of globalization, with an emphasis on economic consumption and the movement of goods, ideas, and peoples across cultural and national boundaries.
Meets International Perspectives Requirement.

ANTHR 519: Skeletal Biology
(Dual-listed with ANTHR 319). (2-2) Cr. 3. F.
Prereq: ANTHR 307 or college level biology
Comprehensive study of the skeletal anatomy, physiology, genetics, growth, development and population variation of the human skeleton. Applications to forensic anthropology, paleopathology and bioarchaeology are introduced.

ANTHR 520: Great Plains Archaeology
(Dual-listed with ANTHR 320). (3-0) Cr. 3. F.
Prereq: ANTHR 202
Prehistoric societies of the Great Plains region of North America, from initial occupation to European contact; emphasis on sociocultural changes, continuities, and adaptations to changing environments using archaeological, ecological, ethnographic information.
Meets U.S. Diversity Requirement

ANTHR 521: World Prehistory
(Dual-listed with ANTHR 321). (3-0) Cr. 3. S.
Prereq: ANTHR 202 recommended
An introduction to archaeological sites from around the world including the Near East, Africa, Europe, Mesoamerica, and North and South America. Emphasis is on the interpretation of material cultural remains in reconstructing past societies.

ANTHR 522: Peoples and Cultures of Native North America
(Dual-listed with ANTHR 322). (3-0) Cr. 3.
Prereq: ANTHR 201 or AM IN 210
Origin, distribution, and pre-contact life of the indigenous peoples of North America. Survey of culture areas; language families, social and political systems, ecological and economic adaptations, religion and spirituality; impact of European contact; cultural resilience and revitalization in contemporary American Indian life.
Meets U.S. Diversity Requirement

ANTHR 523: Topics in Latin American Anthropology
(Dual-listed with ANTHR 323). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.

ANTHR 523A: Latin American Anthropology: Violence and Memory
(Dual-listed with ANTHR 323A). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 523B: Latin American Anthropology: Social movements and Democracy
(Dual-listed with ANTHR 323B). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 523C: Latin American Anthropology: Race, Class and Gender
(Dual-listed with ANTHR 323C). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 523D: Latin American Anthropology: Regional Focus
(Dual-listed with ANTHR 323D). (3-0) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 523E: Latin American Anthropology: Culture and Sport.
(Dual-listed with ANTHR 323E). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: ANTHR 201 or ANTHR 306 recommended
Exploration of key contemporary and historical issues in Latin American Anthropology; discussion of current anthropological approaches to studying Latin American social issues in a global context. Topics vary each time offered.
Meets International Perspectives Requirement.

ANTHR 524: Forensic Anthropology
(Dual-listed with ANTHR 424). (2-2) Cr. 3. S.
Prereq: ANTHR 202 or ANTHR 307; ANTHR 319 recommended
Comprehensive study of forensic anthropology, a specialized subfield of biological anthropology. Emphasis is placed on personal identifications from extremely fragmentary, comingled, burnt, cremated and incomplete skeletal remains. All parameters of forensic study are included as they pertain to anthropology, including human variation, taphonomy, entomology, archaeology, pathology, epidemiology; genetics and the non-biological forensic disciplines. An appreciation for the wide range of medicolegal and bioethical issues will also be gained.

ANTHR 528: Topics in Archaeological Laboratory Methods and Techniques
(Dual-listed with ANTHR 428). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 528A: Topics in Archaeological Laboratory Methods and Techniques
(Dual-listed with ANTHR 428A). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 528B: Topics in Archaeological Laboratory Methods and Techniques: Ceramics
(Dual-listed with ANTHR 428B). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 528C: Topics in Archaeological Laboratory Methods and Techniques: Faunal remains
(Dual-listed with ANTHR 428C). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 528D: Topics in Archaeological Laboratory Methods and Techniques: General
(Dual-listed with ANTHR 428D). (2-2) Cr. 3. Repeatable, maximum of 9 credits. S.
Prereq: ANTHR 308
Laboratory processing, analysis, and interpretation of archaeological materials such as lithics, ceramics, and faunal remains. Laboratory sessions emphasize analytical techniques including classification, data acquisition organization, and computer applications.

ANTHR 529: Topics in Archaeological Laboratory Methods and Techniques: Archaeological Field School
(Dual-listed with ANTHR 429). Cr. 4-6. SS.
Prereq: ANTHR 202 or ANTHR 308
Summer field school for training in archaeological reconnaissance and excavation techniques; documentation and interpretation of archaeological evidence.

ANTHR 530: Ethnographic Field Methods
Cr. 3. F.
Prereq: 6 credits in anthropology, permission of instructor
Field training experience in ethnography. Problems emphasizing field studies in the contemporary societies of the world. Focus on techniques of data gathering and analysis.

ANTHR 531: Ethnographic Field School
(Dual-listed with ANTHR 431). Cr. 4-6.
Hands-on training in ethnographic field methods; students will carry out research projects in socio-cultural anthropology, learning a variety of investigative research techniques commonly used in social sciences.

ANTHR 532: Current Issues in Native North America
(Dual-listed with ANTHR 332). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 532A: Current Issues in Native North America: Gender and Family
(Dual-listed with ANTHR 332A). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 532B: Current Issues in Native North America: Indigenous Ecologies and Geographies
(Dual-listed with ANTHR 332B). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 532C: Current Issues in Native North America: Cultural and Political Movements
(Dual-listed with ANTHR 332C). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 532D: Current Issues in Native North America: Regional Focus
(Dual-listed with ANTHR 332D). (Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

ANTHR 536: Global Development
(Dual-listed with ANTHR 336). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ANTHR 201 or ANTHR 306
Cross-cultural analysis of current development practices from an anthropological perspective; focus on international aid, development institutions, agrarian reform, indigenous knowledge, humanitarianism and human rights; introduction to main theories of political and economic anthropology.
Meets International Perspectives Requirement.

ANTHR 538: Primate Evolutionary Ecology and Behavior
(Dual-listed with ANTHR 438). Cr. 3. S.
Prereq: ANTHR 202 or ANTHR 307
Primate behavior and ecology in evolutionary perspective: biological and social adaptations of prosimians, monkeys, and apes. Introduction to the Order Primates, basic evolutionary concepts, and techniques of behavioral observation. Focus on theory and methods current in Primatology, including applied conservation biology.

ANTHR 540: Magic, Witchcraft, and Religion
(Dual-listed with ANTHR 340). (Cross-listed with RELIG). (3-0) Cr. 3. S.
Prereq: ANTHR 201 or ANTHR 306
Survey of global religious belief and practice from an anthropological perspective. Emphasis on myth and ritual, shamanism, magic, witchcraft, beliefs in spirits, conceptions of the soul, mind and body relationships, and healing and therapeutic practices. Discussion of religious response to dramatic political and social change; effects of globalization on religious practice.
Meets International Perspectives Requirement.

ANTHR 541: Seminar in Forensic Sciences
(1-0) Cr. 1. Repeatable. S.
Prereq: One 200-level science course or graduate classification
Seminars by professional criminalists, research scientists, Certificate students, and educators. Emphasis on opportunities for research and development, citizen involvement, and educational outreach related to forensic science. Weekly report required.

ANTHR 542: Independent Research and Presentation in Forensic Science
(1-0) Cr. 1. S.
Prereq: Enrollment in the Graduate Certificate in Forensic Sciences
Research topic approved by course instructor. Written and oral reports required. Oral report given in forensics seminar, Chem 540.

ANTHR 544: Sex and Gender in Cross-cultural Perspective
(Dual-listed with ANTHR 444). (Cross-listed with W S). (3-0) Cr. 3. S.
Prereq: ANTHR 201; ANTHR 306 recommended
Cross-cultural examination of the social construction of genders out of the biological fact of sex. Emphasis on non-western societies. Topics, presented through examination of ethnographic data, will include the range of gender variation, status and roles, the institution of marriage, and symbols of gender valuation.
Meets International Perspectives Requirement.

ANTHR 545: Biological Field School
(Dual-listed with ANTHR 445). Cr. 4-6. SS.
Prereq: ANTHR 202 or BIOL 101
Summer field school for training in behavioral and ecological methods for primatologists. Proposal, data collection and analyses, and presentation of research topic in primatology.

ANTHR 582: Topics in Biological Anthropology
(Dual-listed with ANTHR 482). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 582A: Topics in Biological Anthropology: Paleoanthropology
(Dual-listed with ANTHR 482A). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 582B: Topics in Biological Anthropology: Primate Cognition
(Dual-listed with ANTHR 482B). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 582C: Topics in Biological Anthropology: Primate Conservation
(Dual-listed with ANTHR 482C). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 582D: Topics in Biological Anthropology: Population Genetics and Human Evolution
(Dual-listed with ANTHR 482D). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.
Prereq: ANTHR 307
In-depth study of current topics in biological anthropology, such as new fossil specimens, research on the evolution of cognition, the emergence of applied primatology, and the dynamic field of population genetics as each relates to the Order Primates.

ANTHR 590: Graduate Independent Study
(Cross-listed with A ECL, EEOB, IA LL). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

ANTHR 590I: Special Topics: Graduate Independent Study
(Cross-listed with A ECL, EEOB, IA LL). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

ANTHR 591: Orientation to Anthropology
(1-0) Cr. 1. F.
Prereq: Admission to the Anthropology Graduate Program
Introduction to the Anthropology program, including the requirements for successful degree completion, department administrative procedures, ethics in anthropology and current trends in the four subfields of anthropology. Required of graduate students. Offered on a satisfactory-fail basis only.

Courses for graduate students:

ANTHR 610: Foundations of Sustainable Agriculture
(Cross-listed with A B E, AGRON, SOC, SUSAG). (3-0) Cr. 3. F.
Prereq: Graduate classification, permission of instructor
Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts.

ANTHR 699: Research
Cr. arr. Repeatable.

ANTHR 699I: Iowa Lakeside Laboratory (Same as Ia LL 699I.)
(Cross-listed with A ECL, EEOB, GDCB, IA LL). Cr. arr. Repeatable.

Biochemistry and Biophysics

The department of Biochemistry, Biophysics & Molecular Biology (http://www.bbmb.iastate.edu) offers majors in biochemistry or biophysics in the College of Liberal Arts and Sciences and a major in agricultural biochemistry in the College of Agriculture and Life Sciences.

Biochemists and biophysicists seek to understand life processes in terms of chemical and physical principles. They conduct research in the frontiers of biology such as metabolic networking; structure and function of enzymes, membranes, and hormones; computational approaches; genomic and proteomic technology; protein engineering; plant biotechnology; muscle structure and function; and the design and evaluation of drugs for the treatment of disease. Biochemistry, biophysics and molecular biology provide the basis for much of modern biotechnology. Graduates have opportunities in industry, especially the biotechnology sector, in universities, veterinary and medical schools, and government laboratories. Students who meet the necessary high scholastic standards have the opportunity to continue their education to pursue advanced degrees in graduate school, medicine, pharmacy or veterinary medicine.

Graduates of biochemistry, agricultural biochemistry and biophysics understand the chemical principles of biological systems including molecular biology. They have developed laboratory expertise in modern biochemical techniques, including the ability to analyze data and prepare scientific reports. Most have participated in undergraduate research and have developed the skills necessary for both written and oral presentations at a level that will serve the student both within the university and in postgraduate professional life. Graduates have the experience of interacting with persons of different disciplines and cultures. Students have the training in biological and physical science and mathematics to solve problems of broad scope in biological, biomedical and environmental sciences and to provide leadership in diverse scientific and technological arenas.

A program that combines a bachelor of science and masters of science in biochemistry or biophysics is offered.

Biochemistry or Biophysics Majors in the College of Liberal Arts and Sciences

For the undergraduate curriculum leading to the degree bachelor of science, see College of Agriculture, Agricultural biochemistry.

Biochemistry and biophysics are recommended to students whose career interests involve advanced graduate or medical study or employment in biochemistry or biophysics, or in related areas of the biological or medical sciences.

Biochemistry undergraduate major program of study

Total Degree Requirement: 120 cr.

BBMB 101	Introduction to Biochemistry	1
BBMB 102	Introduction to Biochemistry Laboratory	1
BBMB 201	Chemical Principles in Biological Systems	2
BBMB 404	Biochemistry I	3
or (4 credits)		
BBMB 504	Amino Acids and Proteins	
BBMB 505	Bioenergetics and Metabolism	
BBMB 405	Biochemistry II	3
or (4 credits)		
BBMB 506	Membrane Biochemistry	
BBMB 507	Biochemistry of Nucleic Acids	
BBMB 411	Techniques in Biochemical Research	4
BBMB 461	Molecular Biophysics	2
or BBMB 561	Molecular Biophysics	
BBMB 561L	Laboratory in Molecular Biophysics	2-3
or CHEM 322L	Laboratory in Physical Chemistry	
BBMB 490	Independent Study (Not required)	1-3
BBMB 499	Undergraduate Research (Not required but strongly encouraged)	1-5
Take one of the following:		5-7
CHEM 201	Advanced General Chemistry	
or CHEM 177 & CHEM 178	General Chemistry I and General Chemistry II	
Take one of the following:		
CHEM 201L	Laboratory in Advanced General Chemistry	
or CHEM 177	Laboratory in General Chemistry I	
or CHEM 177	Laboratory in General Chemistry I	
CHEM 211 & 211L	Quantitative and Environmental Analysis and Quantitative and Environmental Analysis Laboratory	4
CHEM 324	Introductory Quantum Mechanics	3
CHEM 325	Chemical Thermodynamics	3
CHEM 331 & CHEM 332	Organic Chemistry I and Organic Chemistry II	6
CHEM 333L	Laboratory in Organic Chemistry I (for Chemistry and Biochemistry Majors)	1-2
or CHEM 331L	Laboratory in Organic Chemistry I	
CHEM 334L	Laboratory in Organic Chemistry II (for Chemistry and Biochemistry Majors)	1-2
or CHEM 332L	Laboratory in Organic Chemistry II	
MATH 165	Calculus I	4
MATH 166	Calculus II	4
MATH 265	Calculus III	3-4
or MATH 266	Elementary Differential Equations	
or MATH 267	Elementary Differential Equations and Laplace Transforms	
PHYS 221 & PHYS 222	Introduction to Classical Physics I and Introduction to Classical Physics II	10
BIOL 211 & BIOL 212	Principles of Biology I and Principles of Biology II	6
BIOL 211L	Principles of Biology Laboratory I	1
or BIOL 212L	Principles of Biology Laboratory II	
or BIOL 313L	Genetics Laboratory	
BIOL 313	Principles of Genetics	3
BIOL 314	Principles of Molecular Cell Biology	3
Biological Science electives	from Biochemistry, Biology, Chemistry, Genetics, Microbiology	4
Total Credits		81-93

Communication Proficiency: A grade of C or better is required in ENGL 250. For students fulfilling the upper-level requirement with BBMB 411, a grade of 80% or better must be earned on two journal-style written reports.

LIB 160	Information Literacy	1
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
One course from the following:		
BBMB 411	Techniques in Biochemical Research	4
ENGL 305	Creative Writing: Nonfiction	3
ENGL 309	Proposal and Report Writing	3
ENGL 314	Technical Communication	3

General Education Area

Arts and Humanities	12
Social Sciences	9
International Perspectives	3
U.S. Diversity	3

Biophysics undergraduate major program of study

Total Degree Requirement: 120 cr,

BBMB 101	Introduction to Biochemistry	1
BBMB 102	Introduction to Biochemistry Laboratory	1
BBMB 201	Chemical Principles in Biological Systems	2
BBMB 404	Biochemistry I	3
or BBMB 420	Mammalian Biochemistry	
BBMB 411	Techniques in Biochemical Research	4
BBMB 461	Molecular Biophysics	2

or BBMB 561	Molecular Biophysics	
BBMB 561L	Laboratory in Molecular Biophysics	2-3
or CHEM 322L	Laboratory in Physical Chemistry	
Take one of the following:		5-7
CHEM 201	Advanced General Chemistry	
CHEM 177 & CHEM 178	General Chemistry I and General Chemistry II	
CHEM 201L	Laboratory in Advanced General Chemistry	1
or CHEM 177N	Laboratory in General Chemistry I	
or CHEM 177L	Laboratory in General Chemistry I	
CHEM 211 & 211L	Quantitative and Environmental Analysis and Quantitative and Environmental Analysis Laboratory	4
CHEM 324	Introductory Quantum Mechanics	3
CHEM 325	Chemical Thermodynamics	3
CHEM 331 & CHEM 332	Organic Chemistry I and Organic Chemistry II	6
MATH 165	Calculus I	4
MATH 166	Calculus II	4
MATH 265	Calculus III	4
MATH 266	Elementary Differential Equations	3
MATH 207	Matrices and Linear Algebra	3
or MATH 317	Theory of Linear Algebra	
PHYS 221 & PHYS 222	Introduction to Classical Physics I and Introduction to Classical Physics II	10
One course from the following:		
MATH 481	Numerical Methods for Differential Equations	
STAT 407	Methods of Multivariate Analysis	
STAT 430	Empirical Methods for the Computational Sciences	
COM S 207	Fundamentals of Computer Programming	3
STAT 305	Engineering Statistics	3-4
or STAT 231	Probability and Statistical Inference for Engineers	
BIOL 211 & BIOL 212	Principles of Biology I and Principles of Biology II	6
BIOL 211L	Principles of Biology Laboratory I	1
or BIOL 212L	Principles of Biology Laboratory II	
Additional 300+ or higher level courses in biochemistry, biophysics, biological sciences, chemistry or physics.		7
Total Credits		85-89

Communication Proficiency: A grade of C or better is required in ENGL 250. For students fulfilling the upper-level requirement with BBMB 411, a grade of 80% or better must be earned on two journal-style written reports.

LIB 160	Information Literacy	1
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
One course from the following:		
BBMB 411	Techniques in Biochemical Research	4
ENGL 305	Creative Writing: Nonfiction	3
ENGL 309	Proposal and Report Writing	3
ENGL 314	Technical Communication	3

General Education Area

Arts and Humanities	12
Social Sciences	9
U.S. Diversity	3
International Perspectives	3

Biochemistry minor is offered in both the College of Liberal Arts and Sciences and Agriculture and Life Sciences

BBMB 404	Biochemistry I	3
BBMB 405	Biochemistry II	3
BBMB 411	Techniques in Biochemical Research	4
One course from the following:		2-3
BBMB 461	Molecular Biophysics (2 crs)	
BBMB 561	Molecular Biophysics (2 crs)	
CHEM 325	Chemical Thermodynamics	
300+ level courses in BBMB or CHEM to 15 cr total		3-4
Total Credits		15-17

These lists of courses should not be regarded as statements of fixed requirements or as complete outlines of the work necessary for the major. They are given solely for the convenience of students or advisers who wish to estimate the amount of basic study that may be needed.

See also the B.S./M.S. program under Graduate Study.

Biochemistry, B.S.

Freshman

Fall	Credits	Spring	Credits
BBMB 101	1	BBMB 102	1
CHEM 201*	5	CHEM 211	2
CHEM 201L*	1	CHEM 211L	2
MATH 165**	4	MATH 166	4

ENGL 150	3	BIOL 211	3
LIB 160[1]	1	BIOL 211L[3]	1
		LAS General Education requirement[2]	3
	15		16

Sophomore

Fall	Credits	Spring	Credits
CHEM 331	3	BBMB 201	2
CHEM 331L or 333L	1-2	CHEM 332	3
MATH 265 or 266	3-4	CHEM 332L or 334L	1-2
BIOL 212	3	PHYS 222	5
PHYS 221	5	ENGL 250[1]	3
	15-17		14-15

Junior

Fall	Credits	Spring	Credits
BBMB 404[4]	3	BBMB 405[4]	3
BIOL 313	3	BIOL 314	3
LAS General Education Requirement[2]	3	LAS General Education Requirement[2]	3
LAS General Education Requirement[2]	3	LAS General Education Requirement[2]	3
LAS World Language Requirement[8]	4	LAS World Language Requirement[8]	4
	16		16

Senior

Fall	Credits	Spring	Credits
BBMB 411[1]	4	BBMB 461	2
CHEM 324	3	Biological Science Elective[6]	4
LAS General Education Requirement[2]	3	CHEM 325	3
LAS General Education Requirement[2]	3	BBMB 561L[7]	2
BBMB 499[5]	var	BBMB 499[5]	var
	13		11

Total Credits: 116-119

* General Chemistry I and II (177, 177N or 177L and 178) are acceptable substitutes for CHEM 201 and 201L.

** ALEKS assessment determines math placement.

1 Communication Proficiency: A grade of C or better is required in ENGL 250. For students fulfilling the upper-level requirement with BBMB 411, a grade of 80% or better must be earned on two journal-style written reports.

2 Liberal Arts and Sciences (LAS) General Education requirements include:
12cr. Arts and Humanities, 9 cr. Social Sciences and 11 cr. Natural Sciences (8 cr.) and Math (3 cr.).
Students in all ISU majors must complete a 3 cr. course in U.S. Diversity and a 3 cr. course in International Perspectives. Discuss with your adviser how the two courses you select can be applied to address general education requirements. Check for a list of approved courses at: http://www.registrar.iastate.edu/students/div-ip-guide

3 One Biology laboratory course is required. Choose Biol 211L, 212L or 313L.

4 Students have the option of choosing the senior level biochemistry sequence for 6 credits (BBMB 404 and BBMB 405) or the graduate-level biochemistry sequence for 8 credits (BBMB 504, 505 and BBMB 506, 507).

5 Undergraduate study or research, BBMB 490 or 499, is recommended but not required. Credit value is variable.

6 Four credits of electives in Biological Sciences are required.

7 CHEM322L may be taken as a substitute for BBMB 561L.

8 World Language Requirement: (www.las.iastate.edu/academics/learning_goals.shtml)

Biophysics, B.S.

Freshman

Fall	Credits	Spring	Credits
BBMB 101	1	BBMB 102	1
CHEM 201*	5	CHEM 211	2
or CHEM 177 and CHEM 178		CHEM 211L	2
CHEM 201L or 177L*	1	MATH 166	4
MATH 165**	4	BIOL 211	3
ENGL 150	3	BIOL 211L[3]	1
LIB 160[1]	1	COM S 207	3
	15		16

Sophomore

Fall	Credits	Spring	Credits
CHEM 331	3	BBMB 201	2
MATH 265	4	CHEM 332	3
BIOL 212	3	MATH 266	3
PHYS 221	5	PHYS 222	5
		ENGL 250[1]	3
	15		16

Junior

Fall	Credits	Spring	Credits
BBMB 404[4]	3	CHEM 325	3
CHEM 324	3	BBMB 461	2
LAS World Language Requirement[8]	4	BBMB 561L[7]	2
Science Elective [6]	3	MATH 317	4
		LAS General Education Requirement[2]	3
		LAS World Language Requirement[8]	4
	13		18

Senior

Fall	Credits	Spring	Credits
BBMB 411[1]	4	Science Elective[3]	
Science Elective 300+[5]	3	LAS General Educaton Requirement[2]	3
LAS General Education Requirement[2]	3	LAS General Educaton Requirement[2]	3
STAT 231 or 305	4	LAS General Education Requirement[2]	3
LAS General Education Requirement[2]	3	BBMB 499[5]	var
BBMB 499 or 490[5]	var		
	17		9

Total Credits: 119

* General Chemistry I and II (177, 177n or 177l and 178) are acceptable substitutes for CHEM 201 and 201L.

** ALEKS assessment determines math placement.

1 Communication Proficiency: A grade of C or better is required in ENGL 250. For students fulfilling the upper-level requirement with BBMB 411, a grade of 80% or better must be earned on two journal-style written reports.

2 Liberal Arts and Sciences (LAS) General Education Requirements include a minimum of: 12 cr. Arts and Humanities, 9 cr. Social Sciences and 11 cr Natural Sciences (8 cr.) and Math (3 cr.) Students in all ISU majors must complete a 3-cr. course in U.S. Diversity and a 3-cr. course in International Perspectives. Discuss with your adviser how the two courses you select can be applied to address general education requirements. Check for a list of approved courses at: http://www.registrar.iastate.edu/courses/div-ip-guide.html

3 One Biology laboratory course is required. Choose BIOL 211L or 212L.

4 Students have the option of choosing BBMB 405 or BBMB 420.

5 Undergraduate study or research, BBMB 490 or 499, is recommended but not required. Credit value is variable.

6 Seven additional science elective credits 300+; biochemistry, biophysics, biological sciences, chemistry or physics.

7 CHEM 322L can substitute for BBMB 561L.

8 World Language Requirement: (www.las.iastate.edu/academics/learning_goals.shtml)

Graduate Study

The department offers work for the degrees master of science and doctor of philosophy with majors in biochemistry and biophysics and with interdepartmental majors in bioinformatics and computational biology, genetics and genomics, immunobiology, molecular, cellular, and developmental biology, neuroscience, plant biology, and toxicology. Minor work is offered to students taking major work in other departments.

Prerequisite to graduate work is a sound undergraduate background in biology, chemistry, mathematics, and physics.

All graduate students are required by the department to teach as part of their training for an advanced degree.

The department offers a B.S./M.S. program in biochemistry and biophysics that allows students to obtain both the B.S. and M.S. degrees in five years. The program is open to students in the College of Liberal Arts and Sciences and in the College of Agriculture and Life Sciences. Students interested in this program should contact the department office for details. Application for admission to the Graduate College should be made near the end of the junior undergraduate (third) year. Students would begin research for the M.S. thesis during the summer semester after their junior year and are eligible for research assistantships.

Courses primarily for undergraduates:

BBMB 101: Introduction to Biochemistry
(1-0) Cr. 1. F.
Research activities, career opportunities in biochemistry and biophysics, and an introduction to the structure of biologically important compounds. For students majoring in biochemistry, agricultural biochemistry or biophysics or considering one of these majors.

BBMB 102: Introduction to Biochemistry Laboratory
(0-2) Cr. 1. S.
Prereq: Credit or enrollment in CHEM 177 and CHEM 177L or CHEM 201 and CHEM 201L
Topics in the scientific background of biochemistry, such as macromolecules, metabolism, and catalysis. Laboratory experimentation covers biochemical concepts and the study of bio-molecules including proteins, lipids and nucleic acids. A significant component is practice in scientific communication. For students majoring in biochemistry, agricultural biochemistry or biophysics or considering one of these majors.

BBMB 120: The Biochemistry of Beer
(Cross-listed with FS HN). (2-0) Cr. 2. F.
An introduction to the major classes of biomolecules, basic biochemical concepts, enzymology, metabolism and genetic engineering as they apply to the production and flavor of beer. All aspects of the biochemistry of beer will be covered, including the malting of barley, starch conversion, yeast fermentation and the chemical changes that occur during the aging of beer. Intended for non-majors. Natural science majors are limited to elective credit only.

BBMB 201: Chemical Principles in Biological Systems
(2-0) Cr. 2. S.
Prereq: Credit or enrollment in CHEM 332
Survey of chemical principles as they apply in biological systems including: water, organic chemistry of functional groups in biomolecules and biochemical cofactors, weak bonds and their contribution to biomolecular structure, oxidation-reduction reactions and redox potential, thermodynamic laws and bioenergetics, chemical equilibria and kinetics, inorganic chemistry in biological systems, data presentation. The subjects will be taught using molecules from biological systems as examples. Intended for majors in biochemistry, biophysics or agricultural biochemistry.

BBMB 221: Structure and Reactions in Biochemical Processes
(3-0) Cr. 3. F.S.
Prereq: CHEM 163, CHEM 167, or CHEM 177
Fundamentals necessary for an understanding of biochemical processes. Primarily for students in agriculture. Not acceptable for credit toward a major in biochemistry, biophysics, or agricultural biochemistry. Credit for both BBMB 221 and Chem 231 may not be applied toward graduation.

BBMB 301: Survey of Biochemistry
(3-0) Cr. 3. F.S.SS.
Prereq: CHEM 231 or CHEM 331
A survey of biochemistry: structure and function of amino acids, proteins, carbohydrates, lipids, and nucleic acids; enzymology; metabolism; biosynthesis; and selected topics. Not acceptable for credit toward a major in biochemistry, biophysics, or agricultural biochemistry.

BBMB 316: Principles of Biochemistry
(3-0) Cr. 3. F.
Prereq: CHEM 231 or CHEM 331; BIOL 212; BIOL 313 and BIOL 314 strongly recommended.
Understanding biological systems at the molecular level; chemistry of biological macromolecules, enzyme function and regulation, metabolic pathways; integration of metabolism in diverse living systems. For students in biology and related majors who do not require the more rigorous treatment of biochemistry found in BBMB 404/405. Not acceptable for credit toward a major in biochemistry, biophysics, or agricultural biochemistry.

BBMB 404: Biochemistry I
(3-0) Cr. 3. F.
Prereq: CHEM 332
A general overview for graduate and advanced undergraduate students in agricultural, biological, chemical and nutritional sciences. Chemistry of amino acids, proteins, carbohydrates, and lipids, vitamins; protein structure; enzymology; carbohydrate metabolism. Credit for both BBMB 420 and the BBMB 404 - 405 sequence may not be applied toward graduation.

BBMB 405: Biochemistry II
(3-0) Cr. 3. S.
Prereq: BBMB 404
A general overview for graduate and advanced undergraduate students in agricultural, biological, chemical, and nutritional sciences. Metabolism of carbohydrates, amino acids, nucleotides and lipids; formation, turnover, and molecular relationships among DNA, RNA, and proteins; genetic code; regulation of gene expression; selected topics in the molecular physiology of plants and animals. Credit for both BBMB 420 and the BBMB 404 - BBMB 405 sequence may not be applied toward graduation.

BBMB 411: Techniques in Biochemical Research
(2-8) Cr. 4. F.
Prereq: Credit or enrollment in BBMB 404 or BBMB 504 and BBMB 505; CHEM 211
Laboratory experimentation and techniques for studying biochemistry, including: chromatographic methods; electrophoresis; spectrophotometry; enzyme purification; enzyme kinetics; and characterization of carbohydrates, proteins, lipids, and nucleic acids. Scientific communication and technical writing are emphasized.

BBMB 420: Mammalian Biochemistry
(3-0) Cr. 3. F.
Prereq: CHEM 332, BIOL 314
Structure and function of proteins; enzymology; biological oxidation; chemistry and metabolism of carbohydrates, lipids, amino acids and nucleic acids; protein synthesis and the genetic code; relationship of biochemistry to selected animal diseases. Biochemistry of higher animals emphasized. Not acceptable for credit toward a major in agricultural biochemistry or biochemistry. Acceptable for credit toward a major in biophysics. Credit for both BBMB 420 and the BBMB 404 - 405 sequence may not be applied toward graduation.

BBMB 430: Procaryotic Diversity and Ecology
(Dual-listed with BBMB 530). (Cross-listed with MICRO). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MICRO 302, MICRO 302L
Survey of the diverse groups of procaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

BBMB 440: Laboratory in Microbial Physiology, Diversity, and Genetics
(Cross-listed with MICRO). (2-6) Cr. 4. F.
Prereq: MICRO 302, MICRO 302L, CHEM 332, BIOL 313L
Fundamental techniques and theory for studying the cellular mechanisms, genetic processes and diversity of microbial life. Experimental techniques will include isolation and physiological characterization of bacteria that inhabit different environments as well as an emphasis on genetic and molecular techniques to understand antibiotic resistance processes and mechanisms. Also included are techniques for phylogenetic characterization, measuring gene expression, and genetic manipulation of bacteria. Essential components for the effective communication of scientific results are also emphasized.

BBMB 461: Molecular Biophysics
(Dual-listed with BBMB 561). (2-0) Cr. 2. S.
Prereq: Credit or enrollment in MATH 166 and CHEM 178 and PHYS 222 or PHYS 112.
Physical methods for the study of molecular structure and organization of biological materials. X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy. Registration for the graduate credit commits the student to graduate-level examinations, which differ from undergraduate-level examinations in the number and/or difficulty of questions.

BBMB 490: Independent Study
Cr. 1-3. Repeatable. F.S.SS.
Prereq: College of Agriculture: junior or senior classification and permission of instructor; College of Liberal Arts and Sciences: permission of instructor.
Independent study with a faculty mentor. No more than 9 credits of BBMB 490 may count toward graduation.

BBMB 490H: Independent Study, Honors
Cr. 1-3. Repeatable. F.S.SS.
Prereq: College of Agriculture: junior or senior classification and permission of instructor; College of Liberal Arts and Sciences: permission of instructor
Independent study with a faculty mentor. No more than 9 credits of BBMB 490 may count toward graduation.

BBMB 499: Undergraduate Research
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of faculty member with whom student proposes to work.
Independent research under faculty guidance.

Courses primarily for graduate students, open to qualified undergraduates:

BBMB 504: Amino Acids and Proteins
(2-0) Cr. 2. F.
Prereq: CHEM 332 or equivalent
Review of amino acids and proteins, including atomic interactions, thermodynamics, structure and properties of amino acids, post-translational modifications, protein expression, purification and analysis, protein secondary, tertiary and quaternary structure, protein folding, oxygen transport and hemoglobin, models for equilibrium binding, elementary reactions and enzyme kinetics, biosynthesis of amino acids: pathways and mechanisms.

BBMB 505: Bioenergetics and Metabolism
(2-0) Cr. 2. F.
Prereq: CHEM 211, CHEM 332; a previous course in biochemistry is strongly recommended
Examination of catabolic pathways involved in the oxidation of organic and inorganic molecules, and energy metabolism involving inputs from light or other non-light sources. Central metabolism and glycolysis, fermentation, aerobic and anaerobic respiration, photosynthesis.

BBMB 506: Membrane Biochemistry
(2-0) Cr. 2.
Prereq: CHEM 332 or equivalent
Analysis of the structure, function, and synthesis of membranes. Bacterial and eukaryotic membrane characteristics. Membrane transport and signaling mechanisms. Analysis of the structure and function of lipids and membrane proteins.

BBMB 507: Biochemistry of Nucleic Acids
(2-0) Cr. 2. S.
Prereq: CHEM 332 or equivalent
Analysis of the chemical structure, function, synthesis, and metabolism of nucleic acids. Chemical characterization of nucleotides, polynucleotides, DNA, and RNA. Analysis of transcription, translation, and the genetic code.

BBMB 510: Molecular Biology and Biochemistry of RNA
(2-0) Cr. 2. F.
Prereq: BIOL 313, BBMB 405, BBMB 502, BBMB 506 and 507 or Gen 409, or equivalent
Biochemical processes that define structure and function of nucleic acids. Emphasis on the molecular processes that take place during synthesis, processing, and function of different RNA species; review of recent advances in RNA research.

BBMB 530: Procaryotic Diversity and Ecology
(Dual-listed with BBMB 430). (Cross-listed with MICRO). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MICRO 302, MICRO 302L
Survey of the diverse groups of procaryotes emphasizing important and distinguishing metabolic, phylogenetic, morphological, and ecological features of members of those groups.

BBMB 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

BBMB 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

BBMB 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

BBMB 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

BBMB 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

BBMB 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

BBMB 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

BBMB 552: Biomolecular NMR Spectroscopy
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: CHEM 325 or permission of instructor
Advanced solution state Nuclear Magnetic Resonance spectroscopy as applied to biological systems. Topics include theoretical principles of NMR, practical aspects of experimental NMR, methodologies for protein structure determination, NMR relaxation, recent advances in NMR spectroscopy.

BBMB 561: Molecular Biophysics
(Dual-listed with BBMB 461). (2-0) Cr. 2. S.
Prereq: Credit or enrollment in MATH 166 and CHEM 178 and PHYS 222 or PHYS 112.
Physical methods for the study of molecular structure and organization of biological materials. X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy. Registration for the graduate credit commits the student to graduate-level examinations, which differ from undergraduate-level examinations in the number and/or difficulty of questions.

BBMB 561L: Laboratory in Molecular Biophysics
(1-3) Cr. 2. S.
Prereq: Credit or enrollment in BBMB 461/BBMB 561
Practice in methods of X-ray diffraction, nuclear magnetic resonance, hydrodynamics and fluorescence spectroscopy as applied to macromolecules.

BBMB 569: Bioinformatics III (Structural Bioinformatics)
(Cross-listed with BCB, COM S, CPR E, GDCB). (3-0) Cr. 3. F.
Prereq: BCB 567, BBMB 316, GEN 409, STAT 430
Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution.

BBMB 590: Special Topics
Cr. arr.
By arrangement.

BBMB 593: Workshop in Biochemistry and Biophysics
Cr. 1. Repeatable. F.S.
Prereq: Permission and signature of course administrator required.
Workshops in selected topics in biochemistry and biophysics. Credit in this course does not meet the requirement for advanced graduate electives in Biochemistry. Spring only: BBMB Undergraduate Research Symposium participation. Scheduled class meetings are required in addition to attending the symposium.

Courses for graduate students:

BBMB 607: Plant Biochemistry
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Description of unique aspects of plant biochemistry including lipid metabolism, cell wall structure, secondary metabolism, phytoalexin biosynthesis, and plant defenses.

BBMB 615: Molecular Immunology
(Cross-listed with MICRO, V MPM). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function.

BBMB 622: Carbohydrate Chemistry
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: BBMB 404 or BBMB 504 and BBMB 505
Structure, occurrence, properties, function, and chemical and enzymatic modifications of monosaccharides, oligosaccharides, polysaccharides, and glycoproteins.

BBMB 632: Kinetics of Enzyme Action
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BBMB 504 and BBMB 505
Fundamental and advanced enzyme kinetics. Topics include integrated rate equations, methods for deriving initial-rate equations, inhibition, product effects, methods for verifying kinetic mechanisms, allostery, hysteresis, isotope effects, and complex kinetic mechanisms.

BBMB 642: Mechanisms of Enzymatic Catalysis
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: BBMB 404 or BBMB 420; or BBMB 504 and BBMB 505
The chemical basis of enzymatic catalysis with emphasis on mechanisms of substrate recognition, general acid-base catalysis and stereo-electronic factors.

BBMB 645: Molecular Signaling
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: BBMB 405 or BBMB 420; or BBMB 506 and BBMB 507
Molecular mechanisms of cellular signaling including receptor activation, desensitization and cross talk, signal transduction pathways, and nuclear receptors. Discussion includes a variety of cell surface receptors and their hormone; growth factor and extracellular matrix activators; protein kinases; caspase and transcription factor downstream signals; lipids, gases and cyclic nucleotides as regulators of cell signaling. Course content includes current literature, student and instructor presentations and research proposal writing.

BBMB 652: Protein Chemistry - Chemical Methods
(2-0) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: BBMB 404 or BBMB 504 and BBMB 505
First 8 weeks. Chemical reactions as a means of determining protein structure and biological function.

BBMB 653: Protein Chemistry - Physical Methods
(2-0) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: BBMB 404 or BBMB 504 and BBMB 505
Second 8 weeks. Protein structure determination as a means of understanding biological function.

BBMB 660: Membrane Biochemistry
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Protein and lipid constituents of biological membranes. Structure and topography of membrane proteins. Selected topics concerning the membrane proteins involved in diverse biochemical processes, such as energy transduction transport across membranes, neurotransmission and signal transduction.

BBMB 661: Current Topics in Neuroscience
(Cross-listed with GDCB, NEURO). (2-0) Cr. 2-3. Repeatable. Alt. S., offered even-numbered years.
Prereq: NEURO 556 (or comparable course) or permission of instructor
Topics may include molecular and cellular neuroscience, neurodevelopment, neuroplasticity, neurodegenerative diseases, cognitive neuroscience, sensory biology, neural integration, membrane biophysics, neuroethology, techniques in neurobiology and behavior.

BBMB 675: Nucleic Acid Structure and Function
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
In-depth discussion of nucleic acid properties, structures and structure/function relationships. Interactions between nucleic acids and proteins will be emphasized.

BBMB 676: Biochemistry of Gene Expression in Eucaryotes
(Cross-listed with MCDB). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: BBMB 404 and BBMB 504; and BBMB 506 and BBMB 507; or BBMB 405 or BBMB 505 and or GDCB 511
Analysis of the biochemical processes involved in expression of eucaryotic genes and the regulation thereof, including RNA polymerase, transcriptional regulatory proteins, enhancers and silencers, chromosome structure, termination, RNA processing, RNA transport, RNA turnover, small RNAs, translational regulation, protein turnover.

BBMB 681: Advanced Seminar
Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor
Student presentations.

BBMB 682: Departmental Seminar
Cr. R. F.S.
Prereq: Permission of instructor
Faculty, staff and invited guest research seminar.

BBMB 696: Research Seminar
(Cross-listed with AGRON, FOR, GDCB, HORT, PLBIO). Cr. 1. Repeatable.
Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

BBMB 698: Seminar in Molecular, Cellular, and Developmental Biology
(Cross-listed with GDCB, MCDB, MICRO, V MPM). (2-0) Cr. 1-2. Repeatable. F.S.
Student and faculty presentations.

BBMB 699: Research
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor

Bioinformatics and Computational Biology

Undergraduate study in BCBio is jointly administered by the Department of Computer Science, the Department of Genetics, Development, and Cell Biology, and the Department of Mathematics. The undergraduate B.S. degree is offered through the College of Liberal Arts and Sciences.

Bioinformatics and Computational Biology is an interdisciplinary science at the interfaces of the biological, informational and computational sciences. The science focuses on a variety of topics. These include gene identification, expression, and evolution; RNA, protein, and genome structure; and molecular and cellular systems and networks. The large group of participating faculty provides students with a multidimensional perspective on bioinformatics and computational biology and presents them with broad range of possibilities to get involved in research.

This major will prepare students for careers at the interfaces of biological, informational and computational sciences. BCBio graduates with a B.S. seeking direct employment will find ready markets for their talents in agricultural and medical biotechnology industries, as well as in academia, national laboratories, and clinics. Although some students find employment directly after their baccalaureate training, many students will continue their education in one of the many excellent graduate programs in bioinformatics and computational biology that now exist.

Participation in this field requires that students achieve a high level of competence not only in biology, but also in mathematics, computer science, and statistics. As a result, the program includes required courses from many different disciplines. Graduates demonstrate an above-average ability to synthesize methods from these different disciplines to solve problems.

In addition to basic degree requirements listed in the Curriculum in Liberal Arts and Sciences, BCBio majors must satisfy the following requirements:

A. Complementary Courses for the BCBio Major

CHEM 163	College Chemistry
& 163L	and Laboratory in College Chemistry
or	
CHEM 177	General Chemistry I
& 177L	and Laboratory in General Chemistry I
& CHEM 178	and General Chemistry II
or	
CHEM 201	Advanced General Chemistry
& 201L	and Laboratory in Advanced General Chemistry
CHEM 231	Elementary Organic Chemistry
& 231L	and Laboratory in Elementary Organic Chemistry

or		
CHEM 331 & 331L	Organic Chemistry I and Laboratory in Organic Chemistry I	
and		
CHEM 332 & 332L	Organic Chemistry II and Laboratory in Organic Chemistry II	
PHYS 111	General Physics	5
or		
PHYS 221	Introduction to Classical Physics I	
or		
PHYS 115 & 115L	Physics for the Life Sciences and Laboratory in Physics for the Life Sciences	
STAT 330	Probability and Statistics for Computer Science	3
STAT 430	Empirical Methods for the Computational Sciences	3
BIOL 211 & 211L	Principles of Biology I and Principles of Biology Laboratory I	4
BIOL 212 & 212L	Principles of Biology II and Principles of Biology Laboratory II	4
BIOL 314	Principles of Molecular Cell Biology	3
or		
BIOL 315	Biological Evolution	
or		
GEN 409	Molecular Genetics	
Total Credits		22

Complementary courses note:The following other STAT courses may be substituted for STAT 330 and STAT 430, with permission of the BCBio Major.
STAT 330: STAT 101, 104, 105, 201, 231, 305, or 341
STAT 430: STAT 301, 401, or 432

B. Core Courses Within the BCBio Major

6-7 credits:		6-7
GEN 313 & 313L	Principles of Genetics and Genetics Laboratory	
COM S 227 & COM S 228	Introduction to Object-oriented Programming and Introduction to Data Structures (recommended when developing course plan)	
or		
COM S 207 & COM S 208	Fundamentals of Computer Programming and Intermediate Computer Programming (allowed for students entering major who took these courses)	
COM S 230	Discrete Computational Structures	3
COM S 311	Design and Analysis of Algorithms	3
MATH 165 & MATH 166	Calculus I and Calculus II (recommended when developing course plan)	8
or		
MATH 181 & MATH 182	Calculus and Mathematical Modeling for the Life Sciences I and Calculus and Mathematical Modeling for the Life Sciences II (allowed for students entering major who took these courses)	
BCBIO 110	BCBIO Orientation	0.5
BCBIO 322	Introduction to Bioinformatics and Computational Biology	3
BCBIO 401	Fundamentals of Bioinformatics and Computational Biology	3
BCBIO 402	Fundamentals of Systems Biology and Network Science	3
BCBIO 490	Independent Study	1-5
or BCBIO 491	Team Research Projects.	
Total Credits		30.5-35.5

Core courses note: The Com S 227/228 and Math 165/166 core course series is required for BCBio majors. However, students transferring into the major who have already earned credit for Com S 207/208 and/or the Math 181/182 can substitute those courses for the respective Com S 227/228 and/or Math 165/166 series. Students will need permission of the instructors to enroll in any upper level course that requires a pre-req in Com S 227/228 and/or Math 165/166.

C. Support Electives

3-9 credits to be chosen from the following list:

BBMB 404	Biochemistry I	3
BBMB 405	Biochemistry II	3
BBMB 461	Molecular Biophysics	2
BIOL 328	Molecular and Cellular Biology of Human Diseases	3
BIOL 423	Developmental Biology	3
BIOL 451	Plant Evolution and Phylogeny	4
BIOL 462	Evolutionary Genetics	3
BIOL 487	Microbial Ecology	3
COM S 252	Linux Operating System Essentials	3
COM S 309	Software Development Practices	3
COM S 319	Software Construction and User Interfaces	3
COM S 327	Advanced Programming Techniques	3
COM S 363	Introduction to Database Management Systems	3
COM S 425	High Performance Computing for Scientific and Engineering Applications	3

COM S 426	Introduction to Parallel Algorithms and Programming	4
GEN 340	Human Genetics	3
GEN 410	Analytical Genetics	3
MATH 207	Matrices and Linear Algebra	3
or MATH 317	Theory of Linear Algebra	
MATH 265	Calculus III	4
MATH 266	Elementary Differential Equations	3
or MATH 267	Elementary Differential Equations and Laplace Transforms	
MATH 304	Combinatorics	3
MATH 314	Graph Theory	3
MATH 373	Introduction to Scientific Computing	3
MICRO 402	Microbial Genetics and Genomics	3
STAT 342	Introduction to the Theory of Probability and Statistics II	3
STAT 402	Statistical Design and the Analysis of Experiments	3
STAT 407	Methods of Multivariate Analysis	3
STAT 416	Statistical Design and Analysis of Gene Expression Experiments	3
STAT 444	Bayesian Data Analysis	3
STAT 480	Statistical Computing Applications	3

D. The communications and English proficiency requirements of the LAS college are met by:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	
And one of the following:		
ENGL 309	Proposal and Report Writing	3
or		
ENGL 312	Biological Communication	
or		
ENGL 314	Technical Communication	

BCBio majors must earn a minimum grade of C in ENGL 250 Written, Oral, Visual, and Electronic Composition or ENGL 250H Written, Oral, Visual, and Electronic Composition: Honors.

Minor in Bioinformatics and Computational Biology

The administering departments offer a minor in Bioinformatics and Computational Biology, which requires the following courses.

BIOL 211	Principles of Biology I	3
BIOL 212	Principles of Biology II	3
GEN 313	Principles of Genetics	3
COM S 227 & COM S 228	Introduction to Object-oriented Programming and Introduction to Data Structures	7
or		
COM S 207 & COM S 208	Fundamentals of Computer Programming and Intermediate Computer Programming	
STAT 330	Probability and Statistics for Computer Science	3
BCBIO 322	Introduction to Bioinformatics and Computational Biology	3
BCBIO 401	Fundamentals of Bioinformatics and Computational Biology	3
BCBIO 402	Fundamentals of Systems Biology and Network Science	3
Total Credits		28

Note: The following other STAT courses may be substituted for STAT 330, with permission of the BCBio Major: STAT 101, 104, 105, 201, 231, 305, or 341

2. The Com S 227/228 course series is required for the BCBio minor. However, students transferring into the minor who have already earned credit for Com S 207/208 can substitute those courses for the Com S 227/228 series. Students will need permission of the instructors to enroll in any upper level course that requires a pre-req in Com S 227/228.

Most students pursuing a minor in Bioinformatics and Computational Biology will be biology, genetics, computer science, computer engineering, statistics, or mathematics students who have already taken some of these courses for their major. However, a total of 9 credits must be used only to fulfill the requirements of the minor.

Bioinformatics and Computational Biology B.S.

Freshman

Fall	Credits	Spring	Credits
BCBIO 110	0.5	BIOL 212	3
BIOL 211	3	BIOL 212L	1
BIOL 211L	1	CHEM 231	3
CHEM 163	4	CHEM 231L	1
CHEM 163L	1	MATH 166	4
MATH 165	4	LIB 160	1
ENGL 150	3	Humanities choice	3
	16.5		16

Sophomore

Fall	Credits	Spring	Credits
BIOL 313	3	COM S 228	3

BIOL 313L	1	BIOL 314	3
BCBIO 322	3	PHYS 115	4
COM S 227	4	PHYS 115L	1
ENGL 250	3	Social Science choice	3
International Perspectives or U.S. Diversity	3		
	17		14

Junior

Fall	Credits	Spring	Credits
COM S 230 (or Cpr E 310)	3	COM S 311	3
STAT 330	3	STAT 430	3
ENGL 309 (or ENGL 312 or ENGL 314)	3	Bioinformatics Support Elective	3-9
MATH 265 (or other Support Elective)	4	Humanities choice	3
Humanites Choice	3	Social Science choice	3
	16		15-21

Senior

Fall	Credits	Spring	Credits
BCBIO 401 (or BCBIO 444)	3	BCBIO 402	3
Humanities choice	3	BCBIO 490 or 491	1-5
World Language if neeeded	4	World Language if needed or elective	4
COM S 363 (Recommended or other support elective)	3	International Perspectives or US Diversity	3
Social Science choice	3		
	16		11-15

Graduate Study

Work is offered for the master of science and doctor of philosophy degrees with a major in Bioinformatics and Computational Biology (BCB). Faculty are drawn from several departments: Agronomy; Animal Science; Astronomy and Physics; Biochemistry, Biophysics and Molecular Biology; Biomedical Sciences; Chemical and Biological Engineering; Chemistry; Computer Science; Ecology, Evolution, and Organismal Biology; Electrical and Computer Engineering; Entomology, Genetics, Development and Cell Biology; Materials Science and Engineering; Mathematics; Plant Pathology; Statistics; Veterinary Microbiology and Preventive Medicine; and Veterinary Pathology.

The BCB program emphasizes interdisciplinary training in nine related areas of focus: Bioinformatics, Computational Molecular Biology, Structural and Functional Genomics, Macromolecular Structure and Function, Metabolic and Developmental Networks, Integrative Systems Biology, information Integration and Data Mining, Biological Statistics, and Mathematical Biology. Additional information about research areas and individual faculty members is available at: www.bcb.iastate.edu (http://www.bcb.iastate.edu).

BCB students are trained to develop an independent and creative approach to science through an integrative curriculum and thesis research projects that include both computational and biological components. First year students are appointed as research assistants and participate in BCB 697 Graduate Research Rotation, working with three or more different research groups to gain experience in both “wet” (biological) and “dry” (computer) laboratory environments. In the second year, students initiate a thesis research project under the joint mentorship of two BCB faculty mentors, one from the biological sciences and one from the quantitative/computational sciences. The M.S. and Ph.D. degrees are usually completed in two and five years, respectively.

Before entering the graduate BCB program, prospective BCB students should have taken courses in mathematics, statistics, computer science, biology, and chemistry. A course load similar to the following list would be considered acceptable:

MATH 265	Calculus III	4
STAT 341	Introduction to the Theory of Probability and Statistics I	3
COM S 207	Fundamentals of Computer Programming	3
COM S 208	Intermediate Computer Programming	3
COM S 230	Discrete Computational Structures	3
CPR E 310	Theoretical Foundations of Computer Engineering	3
CHEM 163	College Chemistry	4
CHEM 231	Elementary Organic Chemistry	3
BBMB 301	Survey of Biochemistry	3
BIOL 313	Principles of Genetics	3
BIOL 315	Biological Evolution	3

During the first year, BCB students are required to address any background deficiencies in calculus, molecular genetics, computer science, statistics and discrete structures, with specific courses determined by prior training. Among the total course requirements for Ph.D. students are four core courses in Bioinformatics:

BCB 567	Bioinformatics I (Bioinformatics Algorithms)	3
BCB 568	Bioinformatics II (Statistical Bioinformatics)	3
BCB 569	Bioinformatics III (Structural Bioinformatics)	3
BCB 570	Bioinformatics IV (Systems Biology)	3

And also should include

GDCB 511	Advanced Molecular Genetics
BCB 690	Student Seminar in Bioinformatics and Computational Biology

BCB 691	Faculty Seminar in Bioinformatics and Computational Biology
BCB 593	Workshop in Bioinformatics and Computational Biology

M.S. students take the above background and core courses, take at least 6 credits of advanced coursework, and may elect to participate in fewer seminars and workshops. Additional coursework may be selected to satisfy individual interests or recommendations of the Program of Study Committee. All graduate students are encouraged to teach as part of their training for an advanced degree. (For curriculum details and sample programs of study, see: www.bcb.iastate.edu (http://www.bcb.iastate.edu).)

Courses primarily for undergraduates:

BCB 444: Bioinformatic Analysis
(Cross-listed with BCBIO, BIOL, COM S, CPR E, GEN). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

BCB 490: Independent Study
Cr. 1-5. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Permission of instructor

Courses primarily for graduate students, open to qualified undergraduates:

BCB 544: Fundamentals of Bioinformatics
(Cross-listed with COM S, CPR E, GDCB). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent
A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies.

BCB 567: Bioinformatics I (Bioinformatics Algorithms)
(Cross-listed with COM S, CPR E). (3-0) Cr. 3. F.
Prereq: COM S 228; COM S 330; credit or enrollment in BIOL 315, STAT 430
Biology as an information science. A review of the algorithmic principles that are driving the advances in bioinformatics and computational biology.

BCB 568: Bioinformatics II (Statistical Bioinformatics)
(Cross-listed with COM S, GDCB, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or (BIOL 315 and STAT 430), credit or enrollment in GEN 409
Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models.

BCB 569: Bioinformatics III (Structural Bioinformatics)
(Cross-listed with BBMB, COM S, CPR E, GDCB). (3-0) Cr. 3. F.
Prereq: BCB 567, BBMB 316, GEN 409, STAT 430
Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution.

BCB 570: Bioinformatics IV (Systems Biology)
(Cross-listed with COM S, CPR E, GDCB, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or COM S 311, COM S 228, GEN 409, STAT 430
Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration.

BCB 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor

BCB 593: Workshop in Bioinformatics and Computational Biology
(1-0) Cr. 1. Repeatable. F.S.
Current topics in bioinformatics and computational biology research. Lectures by off-campus experts. Students read background literature, attend preparatory seminars, attend all lectures, meet with lecturers.

BCB 598: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the program chair
Off-campus work periods for graduate students in the field of bioinformatics and computational biology.

BCB 599: Creative Component
Cr. arr.

Courses for graduate students:

BCB 660: Selected Topics in Bioinformatics and Computational Biology
(3-0) Cr. 1-4. Repeatable, maximum of 4 times. F.S.SS.
Prereq: Permission of Instructor
Topics of interest in the major research areas of computational molecular biology, including genomics, structural genomics, functional genomics, and computational systems biology.

BCB 690: Student Seminar in Bioinformatics and Computational Biology
Cr. 1. Repeatable. S.
Student research presentations.

BCB 691: Faculty Seminar in Bioinformatics and Computational Biology
(1-0) Cr. 1. Repeatable.
Faculty research series.

BCB 697: Graduate Research Rotation
Cr. arr. Repeatable. F.S.SS.
Graduate research projects performed under the supervision of selected faculty members in the Bioinformatics and Computational Biology major.

BCB 699: Research
Cr. arr. Repeatable.

Courses primarily for undergraduates:

BCBIO 110: BCBIO Orientation
(1-0) Cr. 0.5. F.
First 8 weeks. Orientation to the area of bioinformatics and computational biology. For students considering a major in BCBIO. Specializations and career opportunities. Offered on a satisfactory-fail basis only.

BCBIO 322: Introduction to Bioinformatics and Computational Biology
(Cross-listed with BIOL, GEN). (3-0) Cr. 3. F.
Prereq: BIOL 212
Genome sequencing, assembly, structural and functional annotation, and comparative genomics. Investigating these topics will develop skills in programming and scripting (Perl and/or Python), the use of biological databases, sequence alignment, similarity search, identification of sequence patterns, construction of phylogenetic trees, and comparative genomics.

BCBIO 401: Fundamentals of Bioinformatics and Computational Biology
(3-0) Cr. 3. F.
Prereq: BCBIO 322 and basic programming experience (e.g. COM S 207, COM S 227 or permission of instructor)
Application of computer science and engineering to molecular biology. String algorithms, sequence alignments, data structures, homology search methods, pattern recognition, fragment assembly, genome annotation, construction of bioinformatics databases, and gathering and distribution of biological information with the Internet.

BCBIO 402: Fundamentals of Systems Biology and Network Science
(3-0) Cr. 3. S.
Prereq: BIOL 212
Technologies: transcriptome, proteome, metabolome; Networks: Gene regulatory network, Protein-protein interaction network, Literature network; Theories: Graph theory, random network, scale-free network, evolving network, network robustness; Tools: Jmol, MeV, Cytoscape, Citespace.

BCBIO 442: Bioinformatics and Computational Biology Techniques
(0.2-0.5) Cr. 0.5. Repeatable, maximum of 2 credits. S.SS.
Prereq: BIOL 314 recommended
Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. Offered on a satisfactory-fail basis only.

BCBIO 442A: Bioinformatics and Computational Biology Techniques: Sequence Database Searching
(0.2-0.5) Cr. 0.5. Repeatable, maximum of 2 credits. S.SS.
Prereq: BIOL 314 recommended
Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. Offered on a satisfactory-fail basis only.

BCBIO 442B: Bioinformatics and Computational Biology: Protein Structure Databases, Visualization, and Prediction
(0.2-0.5) Cr. 0.5. Repeatable, maximum of 2 credits. S.SS.
Prereq: BIOL 314 recommended
Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. Offered on a satisfactory-fail basis only.

BCBIO 442C: Bioinformatics and Computational Biology Techniques: Phylogenetic Analysis
(0.2-0.5) Cr. 0.5. Repeatable, maximum of 2 credits. S.SS.
Prereq: BIOL 314 recommended
Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. Offered on a satisfactory-fail basis only.

BCBIO 442D: Bioinformatics and Computational Biology Techniques: Microarray Analysis
(0.2-0.5) Cr. 0.5. Repeatable, maximum of 2 credits. S.SS.
Prereq: BIOL 314 recommended
Modular minicourses consisting of guided tutorials and hands-on computer software exercises focused on fundamental problems, approaches, and software applications in bioinformatics and computational biology. Offered on a satisfactory-fail basis only.

BCBIO 444: Bioinformatic Analysis
(Cross-listed with BCB, BIOL, COM S, CPR E, GEN). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

BCBIO 490: Independent Study
Cr. 1-5. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: BCBIO 322, junior or senior classification, permission of instructor
Independent research projects for undergraduate students in bioinformatics and computational biology. Students in the College of Liberal Arts and Sciences may use no more than 9 credits of BCBIO 490 and 491 toward graduation.

BCBIO 491: Team Research Projects.
Cr. 1-5. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: BCBIO 322, junior or senior classification, permission of instructor
Research projects in bioinformatics and computational biology done by teams of students. Students in the College of Liberal Arts and Sciences may use no more than 9 credits of BCBIO 490 and 491 toward graduation.

Biology

Interdepartmental Undergraduate Program

Iowa State University is a major center for research and education in the biological sciences. With over 200 faculty in the life sciences, students have the opportunity to learn from some of the nation's leaders in biological research and teaching and to participate in innovative, meaningful research projects that explore frontiers of biology. Few other universities have such a wealth of faculty expertise available to undergraduate students, making Iowa State's Biology Program the logical choice for those who want to participate in a thriving academic community.

The faculties of the Department of Ecology, Evolution, and Organismal Biology and the Department of Genetics, Development, and Cell Biology jointly offer the undergraduate biology major. This high quality academic program has the flexibility to accommodate a range of career goals while taking advantage of the university's strengths in science and technology. A bachelor's degree in biology provides excellent preparation for graduate study in biological disciplines ranging from the molecular to the ecological levels, and for entrance into various professional schools, such as human medicine, physical therapy, or veterinary medicine. The major is well suited for those who plan to teach biology, who wish to enter government or industrial employment in health or environmental professions, or who prefer educational breadth as an end in itself. By working with our professional and faculty advisers, it is possible to design a unique program of study that will meet student needs and objectives.

Students with special interests and aptitudes should consider combining biology with a minor or a second major in another subject, such as chemistry, environmental studies, journalism, mathematics, music, statistics, or many other subjects offered by the university.

Customizing a degree

Biology encompasses an amazing diversity of disciplines and scales of study ranging from molecules to the biosphere. The Biology major offers a rich variety of coursework addressing most of the areas of biology. The major's curriculum requirements offer tremendous flexibility in creating an individualized program of study to facilitate achievement of a student's career goals, while simultaneously assuring some exposure to all areas of biology and providing complementary knowledge from supporting courses in chemistry, physics, and math/statistics.

While flexibility is the hallmark of the Biology major, the breadth of the field can also be challenging. Thus, in an effort to provide more guidance to students who desire such, the major also provides five advising tracks, or areas of specialization, for students who wish to focus on subfields of biology or who have specific career goals in mind. Course plans for each area of specialization are listed on the Biology web site. The areas are:

Pre-medical and Human Health Professions--This area emphasizes preparation for further study in medical school or allied human health professions such as dentistry, optometry, genetic counseling, physical therapy, occupational therapy, physician assistant, nursing, chiropractic, and others. It also will prepare students for a broad range of careers in the biological sciences. Students are urged to determine the specific entrance requirements for the professional schools where they might

study and to plan a program of study accordingly, in addition to following the basic plan.

Pre-veterinary--An eventual degree in Veterinary Medicine can lead to a wide variety of careers, including private clinical practice in small animal medicine or agricultural animal production. But, pre-veterinary students can also prepare themselves for careers in animal research, public health, laboratory animal medicine, food safety, regulatory medicine, and education. Specific requirements for entrance to the Iowa State Veterinary College or other schools should be consulted as programs of study are planned, in addition to following the basic plan.

Molecular and Cellular Biology--Students specializing in this field will explore the structure, function, and interactions of the molecules and sub-cellular features that make up living cells. This area is particularly designed for those who plan to pursue a career in research in molecular or cell biology or in related areas such as biochemistry, genetics, microbiology, developmental biology, human medicine, or veterinary medicine. Many students in this area will choose to go on to graduate school.

Ecology and Conservation Biology--Ecologists examine the interactions and relationships that living organisms have with each other and their environment. Conservation biologists study the nature and status of Earth's biodiversity with the aim of protecting species, their habitats, and ecosystems from excessive rates of extinction and loss. Students who choose this specialization may go on to work for a non-profit environmental group; an environmental consulting firm; a local, state, or federal agency; or other related organizations. Many students in this area will choose to go on to graduate school.

Evolution and Biodiversity--This area provides students with a sound understanding of evolutionary principles and the biological patterns that result from evolutionary change. Students have the opportunity to explore, in depth, the biodiversity found within a wide range of groups of organisms. Students who choose this specialization may go on to work for a non-profit environmental group; an environmental consulting firm; a local, state, or federal agency; or other related organizations. Many students in this area will choose to go on to graduate school.

Other opportunities

Teacher licensure--Biology majors seeking licensure to teach biology in secondary schools must meet requirements of the Teacher Education Program as well as those of the Biology Program. In addition, they must apply formally for admission to the teacher education program. See the section on Teacher Education for a list of licensure areas, degree requirements, and other information about this program.

Undergraduate research--Students who have interests in biological research are encouraged to become involved in the research projects of faculty members on campus. Those doing so may receive credit for the experience in BIOL 499 Undergraduate Research Experience. Making the effort to find a suitable research mentor and engaging in research work can be one of the most valuable experiences of an undergraduate education. Internship experiences are often available at other universities, zoos, museums, governmental and non-governmental entities focused on environmental issues, and industrial or government laboratories. Students participating in such projects may receive internship credit in BIOL 494 Biology Internship.

Field trip courses – The Biology Program offers two field trip courses: BIOL 393 (North American Field Trips in Biology) and BIOL 394 (International Field Trips in Biology). In recent years field trip opportunities to the Boundary Waters area of Minnesota, Honduras, and Spain have been available. These courses involve a pre-trip seminar followed by one-week to one-month long field trip at a time when academic year classes are not in session. The classes are low enrollment and allow extensive interaction between instructors and students in locations of biological interest.

International experience--Because major discoveries in science often result from global efforts, biology majors are encouraged to include an international or study abroad component in their degree programs. This can be done by participating in international field trips originating from the ISU campus in BIOL 394 International Field Trips in Biology. In addition, many students choose to study abroad, attending a university in another country for up to a year as an exchange student. Minors in a foreign language can also add an international emphasis to a degree in biology.

Courses offered at other locations

In addition to biological science courses taught on campus, students may take courses at various remote locations and arrange to have the credits count toward the advanced courses required in the biology major. Attending a summer field station adds an important component to an undergraduate program of study.

Gulf Coast Research Laboratory--The Gulf Coast Research Laboratory is affiliated with the University of Southern Mississippi. Iowa State students may register for marine biology courses and transfer credit to their degree programs under the number BIOL 480 Studies in Marine Biology. Written permission of the Biology Program Director is required for this arrangement.

Summer Biological Field Stations--Courses taken at summer field stations may be transferred to Iowa State University as credit in BIOL 481 Summer Field Studies. Such stations are found throughout the country and often offer courses that emphasize the adaptation of plants and animals to unique environments. See www.biology.iastate.edu (http://www.biology.iastate.edu) for links to Iowa Lakeside Laboratory and other

field stations in different biomes, e.g., marine/coastal, Great Lakes, taiga, deciduous forests, deserts, Rocky Mts., etc.

Organization for Tropical Studies–Iowa State students may register for courses in tropical biology taught in Costa Rica by the Organization for Tropical Studies. Credit is transferred to Iowa State as BIOL 482 Tropical Biology. For further information, contact the Biology Student Services Office in 103 Bessey Hall.

Undergraduate Study

Biology majors start their studies in the biological sciences by taking a two-semester long Principles of Biology course sequence:

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1

During the first year, students also take BIOL 110 Introduction to Biology and BIOL 111 Opportunities in Biology, which are half semester courses designed to introduce the student to the discipline of biology and opportunities for careers in biology. Students transferring into the Biology major take BIOL 112 in place of BIOL 110.

Students then explore, in any order depending on their interests, four upper-level core courses including: concepts of ecology in BIOL 312; the principles of genetics in BIOL 313 and BIOL 313L; cell and molecular biology in BIOL 314; and evolutionary biology in BIOL 315. Biology majors must take an additional 21 credits of advanced biological science courses at the 300 level, or above, from an approved list of courses. Many of these courses have as prerequisites BIOL 211/L and BIOL212/L, so students do not need to complete the four upper-level core courses before taking advanced courses. Of these advanced courses , at least 9 credits must be taken as BIOL courses, and a minimum of two BIOL laboratory or field courses must also be included.

Biology majors should carefully consider their selection of upper-level courses to allow them to emphasize one, or more, of the sub-disciplines of Biology relevant to their post-baccalaureate objectives. Most biology courses numbered 300 or above can be used to satisfy the additional credit requirement. Some courses taught in other departments can also be applied to the biology major. Advanced students should consider including 500 level courses in their programs. The Biology Program's web site has a complete listing of acceptable upper-level life science courses.

Biology majors must demonstrate competency in their understanding of the biological sciences. Thus, grades of C- or better in all biological science courses applied to the major are required. Furthermore, in order to graduate, a student must have a cumulative average in the major of at least 2.00.

General requirements

Students may earn the B.S. degree in Biology from either the College of Liberal Arts and Sciences or from the College of Agriculture and Life Sciences. Students in the College of Liberal Arts and Sciences must fulfill the foreign language and general education requirements for that college. Students in the College of Agriculture and Life Sciences must meet the general education requirements for that college. Contact the Student Services Office for details regarding differences in general education and course requirements that are specific to these colleges.

Supporting course requirements-- Understanding biology requires a basic understanding of the physical sciences and mathematics. Consequently, a minimum number of credits in general chemistry, organic chemistry, biochemistry, and physics is required. See the Biology Program Web Site for specific supporting science requirements.

The Math requirement is competency based. After demonstrating competency in algebra and trigonometry, biology majors must take two semesters of calculus; or two semesters of Statistics; or one semester of calculus and one semester of Statistics chosen from a list of approved courses available on the Biology Program Web Site and in the Biology Program Office.

Given the important role of communications in the modern sciences, biology majors must demonstrate communication competency by earning a minimum of C in ENGL 250 Written, Oral, Visual, and Electronic Composition or equivalent composition courses and in one advanced writing course numbered ENGL 302 through ENGL 316, or JL MC 347, or SP CM 212. (Students in the College of Agriculture and Life Sciences are required to earn a C or better in ENGL 150, as well.)

Curriculum in Biology

Administered by the Departments of Ecology, Evolution, and Organismal Biology; and Genetics, Development and Cell Biology. Students should consult the Biology Student Services Office, 103 Bessey (or biology@iastate.edu) for the appropriate course selections for professional or graduate school preparation.

Total Degree Requirement: 120 cr.
Only 65 cr. from a two-year institution may apply which may include up to 16 technical cr.; 9 P-NP cr. of free electives; 2.00 minimum GPA.

Biology: 23.5 cr.
All graded courses minimum C-; 2.00 GPA average required.

BIOL 110	Introduction to Biology	1
BIOL 111	Opportunities in Biology	0.5
BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1

BIOL 312	Ecology	4
BIOL 313	Principles of Genetics	3
BIOL 313L	Genetics Laboratory	1
BIOL 314	Principles of Molecular Cell Biology	3
BIOL 315	Biological Evolution	3
Total Credits		23.5

Advanced Biology: 21 cr.

All graded courses minimum C-; 2.00 GPA average required. See the Biology Program web site for list of approved Advanced Biology courses, or consult an adviser in the Biology Student Services office, 103 Bessey Hall.

Two Advanced BIOL courses with lab or field components (from approved list)	
Biology advanced courses (from approved list)	9
Additional approved biology advanced courses	12
Total Credits	21

Mathematical Sciences 7 cr.

Students in College of Agriculture and Life Sciences must have a Math and Statistics.

MATH 160 or 181 or 165 and STAT 101 or 104		
Or		
MATH 181 & MATH 182	Calculus and Mathematical Modeling for the Life Sciences I and Calculus and Mathematical Modeling for the Life Sciences II	8
Or		
MATH 165 & MATH 166	Calculus I and Calculus II	8
Or		
STAT 101 or 104 and STAT 301		4-7

Physical Sciences

General Chemistry: 5 cr. minimum		
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	5
Or		
CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	5
CHEM 178 & 178L	General Chemistry II and Laboratory in College Chemistry II	4
Organic Chemistry: 4 cr. minimum		
CHEM 231 & 231L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	4
Or		
CHEM 331 & 331L	Organic Chemistry I and Laboratory in Organic Chemistry I	4
Biochemistry: 3 cr.		
BBMB 316	Principles of Biochemistry	3
Or		
BBMB 404	Biochemistry I	3
Or		
BBMB 420	Mammalian Biochemistry	3
Physics: 5 cr. minimum		
PHYS 115 & 115L	Physics for the Life Sciences and Laboratory in Physics for the Life Sciences	5
Or		
PHYS 111 & PHYS 112	General Physics and General Physics	10

International Perspective: 3 cr.
U.S. Diversity: 3 cr.
Communication/Information Literacy

Students must earn a C or better in ENGL 250 and the advanced communication course. Additionally, students in the College of Agriculture and Life Sciences must earn a C or better in ENGL 150.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
SP CM 212 or ENGL 312	Fundamentals of Public Speaking Biological Communication	3
Total Credits		10

Humanities and Social Sciences

Chosen from approved lists.

LAS - Biology	
Note: Students must have completed 3 years of a single world language or take 4-8 credits of university level world language.	
Humanities	12
Social Sciences	9
Total Credits	21

Humanities and Social Sciences

Chosen from approved lists.

CALS - Biology	
Note: Students in CALS - Biology must take an approved speech course and an approved Math and Statistics course.	
Humanities	3
Social Sciences	3
Ethics	3

Total Credits	9

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
ENGL 150 or 250	3	BIOL 111	0.5	All Summers: Consider internship, study abroad, field stations, research, clinical observation	
BIOL 110	1	BIOL 212	3		
LIB 160	1	BIOL 212L	1		
BIOL 211	3	Chemistry *	4		
BIOL 211L	1	Social Science	3		
CHEM 163/ L or 177/L*	5	Math/Stat Choice*	4		
Humanity	3				
	17		15.5		0

Sophomore

Fall	Credits	Spring	Credits	Summer	Credits
ENGL 250, elective or Foreign Language	3-4	BIOL 313	3	All Summers: Consider internship, study abroad, field stations, research, clinical observation	
BIOL 312	4	BIOL 313L	1		
Chemistry or Biochemistry*	3-4	Biochemistry*	3		
Advanced Biology	3	Foreign Language/ Elective	4		
	13-15	Advanced Biology w/ Lab	4		
			15		0

Junior

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 314	3	BIOL 315	3	All Summers: Consider internship, study abroad, field stations, research, clinical observation	
PHYS 111 or 115X	5	PHYS 112* or electives	5		
Advanced Biology w/ Lab	4	Advanced Biology	3		
US Diversity/ Social Science	3	Int. Persp./ Humanity	3		
	15		14		0

Senior

Fall	Credits	Spring	Credits
Advanced Biology	3	Advanced Biology	4
Written Communication/ Speech	3	Humanity	3
Social Science	3	Elective or Minor	4
Humanity	3	Math/Stat choice*	4
Elective or Minor	4		
	16		15

Students must have 120 credits minimum to graduate.

This is only a suggested outline plan. Students may choose or be forced to deviate from this plan to satisfy unmet requirements, for scheduling reasons, or to add a minor or double major. We strongly suggest student involvement in internships, study abroad, summer field stations, Iowa Lakeside Lab, Field Trips in Biology or research opportunities at ISU. These will; enhance your program of study but may add credits or time to your degree plan.

Students are required to take 21 credits in advance biology of which 9 credits must be from the Biology Program, (BIOL), and 2 advanced BIOL courses must have a lab or field component.

* Students should meet with a Biology Program advisor to determine the proper plans for chemistry, math and physics before selecting those options above.

Graduate Study

Biology is an undergraduate major only. Persons interested in graduate study in the biological sciences should apply directly to one of the life science graduate programs at Iowa State University. Interdepartmental graduate offerings in Bioinformatics and Computational Biology; Ecology and Evolutionary Biology; Genetics; Molecular, Cellular and Developmental Biology; Neuroscience; Plant Biology; Toxicology; Immunobiology; and Environmental Science are also available. (See Index.)

A non-thesis master's degree in Interdisciplinary Graduate Studies (biological sciences) has been established particularly for those who wish to have a more diversified program of advanced study than that generally permitted by specific departments and programs.

Courses primarily for undergraduates:

BIOL 101: Introductory Biology
(3-0) Cr. 3. F.S.SS.
Life considered at cellular, organism, and population levels. Function and diversity of the living world. Presentation of basic biological principles as well as topics and issues of current human interest. Does not satisfy biology major requirements.

BIOL 110: Introduction to Biology
Cr. 1. F.
Orientation to the scope of the biological sciences, and discussion of professional opportunities. Required of first year biology majors. Offered on a satisfactory-fail basis only.

BIOL 111: Opportunities in Biology
(1-0) Cr. 0.5. S.
Introduction to biological science disciplines and professional opportunities through faculty presentations which examine a variety of current research topics. Offered on a satisfactory-fail basis only.

BIOL 112: Transfer Student Orientation
Cr. R. F.S.
Orientation to opportunities in Biology. Review of degree requirements and other information needed by students that have not participated in the first year Biology orientation courses. Offered on a satisfactory-fail basis only.

BIOL 155: Human Biology
(3-0) Cr. 3. F.S.
A survey course of human biology, including principal structures and functions of the body systems and the diseases and disorders associated with them. Designed to meet general education requirements in natural science. Not recommended for those seeking a career in the allied health professions or for students majoring in life science. Does not satisfy biology major requirements.

BIOL 173: Environmental Biology
(Cross-listed with ENV S). (3-0) Cr. 3. F.S.
An introduction to the structure and function of natural systems at scales from the individual to the biosphere and the complex interactions between humans and their environment. Discussions of human population growth, biodiversity, sustainability, resource use, and pollution. Does not satisfy biology major requirements.

BIOL 201: Introduction to Environmental Issues
(Cross-listed with ENSCI, ENV S). (2-0) Cr. 2. F.
Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change.

BIOL 204: Biodiversity
(Cross-listed with ENV S). (4-0) Cr. 2. S.
Prereq: One course in life sciences
Survey of the major groups of organisms and biological systems. Definition, measurements, and patterns of distribution of organisms. Sources of information about biodiversity. Does not satisfy biology major requirements. Half semester course.

BIOL 211: Principles of Biology I
(3-0) Cr. 3. F.S.
Prereq: High school biology
Introduction to the nature of life, including the diversity of microbial, plant, and animal life; the nature of heredity; evolution; and principles of ecology. Intended for life science majors.

BIOL 211L: Principles of Biology Laboratory I
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in BIOL 211
Laboratory to accompany 211.

BIOL 212: Principles of Biology II
(3-0) Cr. 3. F.S.
Prereq: High School Biology; high school chemistry or credit or enrollment in CHEM 163 or CHEM 177
Introduction to the chemical, molecular, and cellular basis of life; form and function of microbial, plant, and animal life. Intended for life science majors.

BIOL 212L: Principles of Biology Laboratory II
(0-3) Cr. 1. F.S.
Prereq: credit or enrollment in BIOL 212
Laboratory to accompany 212.

BIOL 251: Biological Processes in the Environment
(Cross-listed with ENSCI). (3-0) Cr. 3. S.
Plant and microbial processes in environmental systems including their interactions with human activities.

BIOL 255: Fundamentals of Human Anatomy
(3-0) Cr. 3. F.
Prereq: High School Biology and Chemistry, or BIOL 101
An introduction to human anatomy, beginning with cells and tissues, surveying all body systems, relating form to function. Systems covered include: integumentary, bones and joints, muscles, nervous, sensory, endocrine, circulatory, lymphatic, respiratory, digestive, urinary, and reproductive. Pre-Medical students should consider Biol 351 for their anatomy background. Does not satisfy biology major requirements.

BIOL 255L: Fundamentals of Human Anatomy Laboratory
(0-3) Cr. 1. F.
Prereq: Credit or enrollment in BIOL 255
Investigation of human anatomy using models and dissections of preserved organs and model mammals. Pre-Medical students should consider 351 for their anatomy background. Does not satisfy biology major requirements.

BIOL 256: Fundamentals of Human Physiology
(3-0) Cr. 3. S.
Prereq: High School Biology and Chemistry, or BIOL 101, or BIOL 255 (recommended)
An introduction to human physiology, studying the function of all body systems. Systems covered include: integumentary, bones and joints, muscles, nervous, sensory, endocrine, circulatory, lymphatic and immune, respiratory, digestive, urinary, and reproductive. Pre-Medical students should consider 335 for their physiology background. Does not satisfy biology major requirements.

BIOL 256L: Fundamentals of Human Physiology Laboratory
(0-3) Cr. 1. S.
Prereq: Credit or enrollment in BIOL 256
Student-conducted experiments investigating concepts of human physiology with computer data acquisition and analysis. Interpretation of experimental results and preparation of lab reports. Pre-Medical students should consider 335 for their anatomy and physiology background. Does not satisfy biology major requirements.

BIOL 307: Women in Science and Engineering
(Cross-listed with W S). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: a 200 level course in science, engineering or women's studies; ENGL 250
The interrelationships of women and science and engineering examined from historical, sociological, philosophical, and biological perspectives. Factors contributing to under-representation; feminist critiques of science; examination of successful strategies. Does not satisfy biology major advanced credit requirements.
Meets U.S. Diversity Requirement

BIOL 312: Ecology
(Cross-listed with A ECL, ENSCI). (3-3) Cr. 4. F.SS.
Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L
Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats.

BIOL 313: Principles of Genetics
(Cross-listed with GEN). (3-0) Cr. 3. F.S.SS.
Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L
Introduction to the principles of transmission and molecular genetics of plants, animals, and bacteria. Recombination, structure and replication of DNA, gene expression, cloning, quantitative genetics, and population genetics. Students may receive graduation credit for no more than one of the following: Gen 260, Gen 313 and 313L, Gen 320, Biol 313 and 313L, and Agron 320.

BIOL 313L: Genetics Laboratory
(Cross-listed with GEN). (0-3) Cr. 1. F.S.
Prereq: Credit or enrollment in BIOL 313
Laboratory to accompany 313. Students may receive graduation credit for no more than one of the following: Biol 313 and 313L, Gen 260, Gen 313, Gen 320, and Agron 320.

BIOL 314: Principles of Molecular Cell Biology
(3-0) Cr. 3. F.S.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L
Integration of elementary principles of metabolism, bioenergetics, cell structure, and cell function to develop a molecular view of how the cell works.

BIOL 315: Biological Evolution
(3-0) Cr. 3. F.S.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L.
The mechanisms of evolution. Topics in microevolution: population genetics, natural selection, genetic variation, and adaptation. Macroevolution: speciation, extinction, phylogeny, and major evolutionary patterns.

BIOL 322: Introduction to Bioinformatics and Computational Biology
(Cross-listed with BCBIO, GEN). (3-0) Cr. 3. F.
Prereq: BIOL 212
Genome sequencing, assembly, structural and functional annotation, and comparative genomics. Investigating these topics will develop skills in programming and scripting (Perl and/or Python), the use of biological databases, sequence alignment, similarity search, identification of sequence patterns, construction of phylogenetic trees, and comparative genomics.

BIOL 328: Molecular and Cellular Biology of Human Diseases
Cr. 3. F.
Prereq: BIOL 212
Survey of molecular, genetic, and cellular aspects of human diseases. Fundamental concepts of cell biology and how they are linked to the pathologies of different classes of human diseases. Recent scientific advances with an emphasis on new methods of diagnosis and treatment.

BIOL 334: Metabolic Physiology of Mammals
(3-0) Cr. 3. S.
Prereq: BIOL 211, BIOL 212
Introduction to physiology of metabolic function in mammals and other animals. Metabolic processes and their interactions with various subsystems, approached from an organismal perspective. Integration of cellular, gastrointestinal, cardiovascular, respiratory, and renal processes, relevant to their control and integration at the nervous and endocrine system levels. Functional aspects of organismal physiology, energy and water balances, physiology of rest exercise, and environmental stress. Students cannot receive credit for both BIOL 334 and BIOL 335.

BIOL 335: Principles of Human and Other Animal Physiology
(3-3) Cr. 4. F.
Prereq: BIOL 314
Introduction to systemic functions with emphasis on mammals. Students cannot receive credit for both BIOL 334 and BIOL 335.

BIOL 336: Ecological and Evolutionary Animal Physiology
Cr. 3.
Prereq: BIOL 211, BIOL 212
Study of mechanisms by which animals perform life-sustaining functions; the evolution and adaptive significance of physiology traits, the diversity of physiological mechanisms, and how physiology and ecology interact.

BIOL 344: Human Reproduction
(Cross-listed with W S). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 212
Biology of human reproduction, including reproductive systems, hormones, and endocrinology of pregnancy, presented from a clinically-oriented perspective. Reviews health-related conditions such as infertility, sexually-transmitted diseases, and complicated pregnancy.

BIOL 349: The Genome Perspective in Biology
(Cross-listed with GEN). (2-2) Cr. 3. S.
Prereq: GEN 313 or GEN 320
Analysis of genome, RNA, and protein data using computer technology to answer biological questions on topics ranging from microbial diversity to human health. An introduction for students in the life sciences to the fields of genomics, bioinformatics and systems.

BIOL 350: Comprehensive Human Anatomy
(3-0) Cr. 3. F.
Prereq: Credit in BIOL 211 and BIOL 212
Comprehensive survey of human anatomy, emphasizing structural and functional relationships of major organ systems. Compartmental study of normal anatomy; practical clinical application of anatomical regions.

BIOL 351: Comparative Chordate Anatomy
(3-4) Cr. 5. S.
Prereq: BIOL 212, junior classification
The evolution of chordates as reflected in the anatomy of extinct and living forms. Lecture topics include the history and diversity of chordates, comparisons of anatomic structures among major groups, and the adaptive significance of anatomic structures. Laboratory involves dissection of representative species.

BIOL 352: Vertebrate Histology
(3-3) Cr. 4. S.
Prereq: BIOL 212
Microscopic structure of vertebrate tissues and organs, with an introduction to histological techniques.

BIOL 353: Introductory Parasitology
(Cross-listed with MICRO, V PTH). (3-0) Cr. 3. S.
Prereq: BIOL 212
Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites.

BIOL 354: Animal Behavior
(3-0) Cr. 3. F.
Prereq: BIOL 212
Ethological and sociobiological approaches to animal behavior. Genetic and developmental aspects of behavior, biological rhythms, orientation (including navigation, migration), communication, and social behavior (mating, aggression, parental care).

BIOL 354L: Laboratory in Animal Behavior
(0-3) Cr. 1. F.
Prereq: Credit or enrollment in BIOL 354
Laboratory techniques for observation, description and analysis of animal activities; independent projects.

BIOL 355: Plants and People
(3-0) Cr. 3. S.
Prereq: Credit in BIOL 211 and BIOL 211L
Uses of plants and fungi by humans and the importance of plants in the past, present, and future. Discussion of fruits, vegetables, grains, herbs, spices, beverages, oils, fibers, wood, medicines, and drugs, in the context of their agricultural, cultural, and economic roles in modern societies. Emphasis on origins and worldwide diversity of culturally important plants, their characteristics, and uses.

BIOL 356: Dendrology
(Cross-listed with FOR). (2-4) Cr. 4. F.
Prereq: BIOL 211
Identification and ecology of North American woody plant species. Importance of woody plants in timber production and wildlife habitat. Natural disturbances, human impacts, management and restoration concerns for major North American forest regions will be addressed.

BIOL 364: Invertebrate Biology
Cr. 3-4. F.
Prereq: BIOL 211, 212
Emphasis on diversity, development, physiology, and behavior of invertebrate organisms- the "spineless wonders" of the world. Laboratory involves hands-on study and investigation of living invertebrates.

BIOL 365: Vertebrate Biology
(Cross-listed with A ECL). (3-2) Cr. 4. F.
Prereq: BIOL 211, BIOL 211L, BIOL 212, BIOL 212L
Evolution, biology, and classification of fish, amphibians, reptiles, birds, and mammals. Emphasis on a comparative analysis of the structure and function of organ systems. Laboratory exercises concentrate on morphology and identification of orders of vertebrates.

BIOL 366: Plant Systematics
(2-4) Cr. 4. S.
Prereq: BIOL 211
Introduction to plant phylogenetic systematics, plant classification, survey of flowering plant families, and identification and field study of local plants.

BIOL 370: GIS for Ecology and Environmental Science
(Cross-listed with ENSCI). Cr. 1-6. Repeatable. F.S.
Prereq: Six credits in biological and /or physical sciences, and permission of instructor.
Introduction to geographic information systems (GIS) with emphasis on ecological and environmental applications. No prior GIS experience required. Guided, individualized study of topics based on student background and interest. For students with prior experience, topics and activities are selected to build upon any previous experience and minimize duplication to previous GIS coursework. Potential topics include: basic concepts of GIS, data structures, database management, spatial analysis, modeling and visualization of ecological and environmental data. Case studies in ecological and environmental applications using ArcGIS. Offered on a satisfactory-fail basis only.

BIOL 371: Ecological Methods
(Cross-listed with A ECL). (2-3) Cr. 3. S.
Prereq: A ECL 312; STAT 101 or STAT 104
Quantitative techniques used in management of natural resources with emphasis on inventory and manipulation of habitat and animal populations.

BIOL 381: Environmental Systems I: Introduction to Environmental Systems
(Dual-listed with EEOB 581). (Cross-listed with ENSCI, ENV S, MICRO). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

BIOL 382: Environmental Systems II: Analysis of Environmental Systems
(Dual-listed with EEOB 582). (Cross-listed with ENSCI). (2-2) Cr. 3. S.
Prereq: ENSCI 381
Continuation of EnSci 381. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

BIOL 393: North American Field Trips in Biology
Cr. 1-4. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Extended field trips, usually during break periods, to North American locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule.

BIOL 393A: North American Field Trips in Biology: Pre-trip Seminar
(1-0) Cr. 1. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Discussion of relevant biological and cultural topics during semester preceding extended field trips to North American locations of interest to biologists.

BIOL 393B: North American Field Trips in Biology: North American Field trip
Cr. 1-3. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Extended field trip under supervision of faculty member, usually during break periods, to North American locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule. Report required.

BIOL 394: International Field Trips in Biology
Cr. 1-4. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Extended field trips, usually during break periods, to international locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule.
Meets International Perspectives Requirement.

BIOL 394A: International Field Trips in Biology: Pre-trip Seminar
(1-0) Cr. 1. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Discussion of relevant biological and cultural topics during semester preceding extended field trip to international locations of interest to biologists.
Meets International Perspectives Requirement.

BIOL 394B: International Field Trips in Biology: Field Trip to International Location
Cr. 1-3. Repeatable.
Prereq: Two courses in the biological sciences and by approval of application
Extended field trips, under supervision of faculty member, usually during break periods, to international locations of interest to biologists. Inquire in the Biology Program Office, 103 Bessey Hall, for trip schedule.
Meets International Perspectives Requirement.

BIOL 402: Introduction to Pathology
(Cross-listed with V PTH). (3-0) Cr. 3. S.
Prereq: BIOL 211 and BIOL 212 with labs
Introductory exploration of pathology as a medical discipline. This includes study of disease mechanisms via an introduction to general pathology topics (cell degeneration, necrosis, disturbances of growth, disturbances of blood flow, inflammation, neoplasia) and organ system-specific response to injury.

BIOL 414: Life History and Reproductive Strategies
(Dual-listed with EEOB 514). (3-0) Cr. 3. F.
Prereq: BIOL 315 or equivalent recommended.
Evolution of ecological adaptations at the individual, population, and species level. Emphasis is on evolutionary mechanisms and adaptive strategies related to life histories and reproduction; age and size at maturity; lifespan and senescense; offspring size/number trade-offs; sex and mating systems; sex determination and sex ratios.

BIOL 423: Developmental Biology
(3-0) Cr. 3. S.
Prereq: BIOL 313
Principles of embryogenesis and animal development. Establishment of body axes, organ and limb development, and specification of cell fates. Emphasis on cell signaling and the control of gene expression within the context of a developing organism. Medically relevant subjects will be discussed, including stem cells, cancer biology, fertilization, and cloning.

BIOL 423L: Developmental Biology Laboratory
(0-3) Cr. 1. S.
Prereq: Credit or enrollment in BIOL 423 or permission of the instructor.
Experiments and explorations illustrating fundamental principles of multicellular development.

BIOL 428: Topics in Cell Biology
(3-0) Cr. 3. S.
Prereq: BIOL 314
Selected topics on biological structure and function at the cellular level. Emphasis on dynamic nature and regulation of cellular organization and the integration of cellular processes (systems biology). Original research articles will demonstrate interdisciplinary research strategies and how scientific investigation leads to knowledge and understanding of cell biology.

BIOL 430: Principles of Plant Physiology
(3-0) Cr. 3.
Prereq: BIOL 313 or GEN 320; BIOL 314 or BBMB 301; CHEM 231 or CHEM 332; PHYS 106, PHYS 115, or PHYS 111
An overview of classical and current concepts, principles, and approaches regarding the basic mechanisms of plant function underlying growth, development, and survival of plants. Topics covered include environmental and developmental signals, plant hormone action, signal transduction, mineral nutrition, water relations, metabolism, and photosynthesis.

BIOL 434: Endocrinology
(Dual-listed with EEOB 534). (3-0) Cr. 3. S.
Prereq: BIOL 211, BIOL 212
Chemical integration of vertebrate organisms. The structure, development, and evolution of the endocrine glands and the function and structure of their hormones.

BIOL 436: Neurobiology
(3-0) Cr. 3. F.
Prereq: BIOL 212
Basic principles of brain function and development. Signaling of nerve cells, synaptic transmission, structure/function of ion channels and receptors, memory and synaptic plasticity, movement and central control, sensation and sensory processing, construction of neural circuits, early brain development, complex brain functions in health and disease.

BIOL 439: Environmental Physiology
(Dual-listed with EEOB 539). Cr. 3-4. Alt. S., offered even-numbered years.
Prereq: BIOL 335; physics recommended
Physiological adaptations to the environment with an emphasis on vertebrates.

BIOL 444: Bioinformatic Analysis
(Cross-listed with BCB, BCBIO, COM S, CPR E, GEN). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

BIOL 451: Plant Evolution and Phylogeny
(Dual-listed with EEOB 551). (3-3) Cr. 4. F.
Prereq: BIOL 315 or equivalent.
Survey of land plant evolution; phylogenetic comparison of anatomical, reproductive, and life history specializations. Relationships among bryophytes, lycophytes, pteridophytes, gymnosperms, and angiosperms emphasizing significant evolutionary changes documented by paleobotanical, morphological, and molecular studies.

BIOL 454: Plant Anatomy
(3-3) Cr. 4. F.
Prereq: BIOL 212L; BIOL 366 recommended
Characteristics of cell and tissue types in vascular plants. Anatomy of developing and mature stems, roots, and leaves, including secondary (woody) growth. Introduction to the special anatomy of flowers and seeds.

BIOL 455: Bryophyte and Lichen Biodiversity
(Dual-listed with EEOB 555). Cr. 3.
Prereq: BIOL 211, BIOL 211L
Introduction to the biology and ecology of mosses, liverworts, and lichens. Emphasis on identification and diversity of local representatives of these three groups of organisms. Required field trips and service-learning.

BIOL 456: Principles of Mycology
(Cross-listed with MICRO). (2-3) Cr. 3. F.
Prereq: 10 credits in biological sciences
Morphology, diversity and ecology of fungi; their relation to agriculture and industry and human health.

BIOL 457: Herpetology
(Cross-listed with A ECL). (2-0) Cr. 2. F.
Prereq: BIOL 351 or BIOL 365
Biology, ecology, and evolution of amphibians (salamanders, frogs, caecilians) and reptiles (lizards, snakes, tuatara, turtles, crocodilians). Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of amphibians and reptiles in ecosystems, and conservation. Laboratory focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

BIOL 457L: Herpetology Laboratory
(Cross-listed with A ECL). (0-3) Cr. 1. F.
Prereq: BIOL 351 or BIOL/A ECL 365; concurrent registration in BIOL 457 or A ECL 457
Laboratory to accompany Biology/Animal Ecology 457. Focus on survey methods, identification, relationships, distribution, habits, and habitats of amphibians and reptiles.

BIOL 458: Ornithology
(Cross-listed with A ECL). (2-0) Cr. 2. S.
Prereq: A ECL 365 or BIOL 351
Biology, evolution, ecology and taxonomy of birds. Emphasis on structure, physiology, behavior, communication, navigation, reproduction, and conservation.

BIOL 458L: Ornithology Laboratory
(Cross-listed with A ECL). (0-3) Cr. 1. S.
Prereq: BIOL 351 or AECL/BIOL 365. Concurrent enrollment in AECL/BIOL 458 is required.
Laboratory complements lecture topics with emphasis on external anatomy, identification and distribution of Midwest birds, and field trips.

BIOL 459: Mammalogy
(Dual-listed with EEOB 559). (Cross-listed with A ECL). (2-0) Cr. 2. S.
Prereq: BIOL 351 or A ECL 365
Biology, ecology, and evolution of mammals. Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of mammals in ecosystems, and conservation.

BIOL 459L: Mammalogy Laboratory
(Cross-listed with A ECL). (0-3) Cr. 1. S.
Prereq: BIOL 351 or BIOL/AECL 365; concurrent enrollment in AECL 459 or BIOL 459 required.
Laboratory focus on identification, survey methods, distribution, habits, and habitats of mammals. Several field trips.

BIOL 462: Evolutionary Genetics
(Cross-listed with GEN). (3-0) Cr. 3. F.
Prereq: BIOL 315
The genetic basis of evolutionary processes in higher organisms. The role of genetic variation in adaptation, natural selection, adaptive processes, and the influence of random processes on evolutionary change.

BIOL 464: Wetland Ecology
(Dual-listed with EEOB 564). (Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: 15 credits in biological sciences.
Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands.

BIOL 471: Introductory Conservation Biology
Cr. 3.
Prereq: BIOL 312
Examination of conservation issues from a population and community perspective. The role of genetics, demography, and environment in determining population viability, habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology.

BIOL 472: Community Ecology
(3-0) Cr. 3. S.
Prereq: BIOL 312
The effect of interspecific interactions on the structure and dynamics of natural and managed communities; including concepts of guild structure and trophic web dynamics and their importance to the productivity, diversity, stability, and sustainability of communities. The implications of interspecifc interactions in the management of wild species will be emphasized with illustrative case histories of interactions between plants, invertebrates, and vertebrates.

BIOL 474: Plant Ecology
(3-0) Cr. 3. S.
Prereq: BIOL 312
Principles of plant population and community ecology.

BIOL 476: Functional Ecology
(Dual-listed with EEOB 576). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312
The nature of adaptations to physical and biotic environments. Biophysical, biomechanical, and physiological bases of the structure, form, growth, distribution, and abundance of organisms.

BIOL 480: Studies in Marine Biology
Cr. 1-8. Repeatable.
Courses taken at Gulf Coast Research Laboratory and other marine biological stations are transferred to Iowa State University under this number.

BIOL 481: Summer Field Studies
Cr. 1-8. Repeatable.
Courses taken at summer biological field stations are transferred to Iowa State University under this number. See www.biology.iastate.edu for links to field stations located in different biomes: coastal, Great Lakes, taiga, deciduous forests, deserts, Rocky Mountains.

BIOL 482: Tropical Biology
Cr. 1-4. Repeatable, maximum of 8 credits.
Prereq: One year of college biology; knowledge of Spanish desirable but not required
Students registering for courses taught by the Organization for Tropical Studies will receive credit for this ISU course when requesting a transfer of credits.

BIOL 484: Ecosystem Ecology

(Cross-listed with ENSCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: Combined 12 credits in biology, chemistry, and physics.

Introduction of the study of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations for ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues.

BIOL 486: Aquatic Ecology

(Dual-listed with EEOB 586). (Cross-listed with A ECL, ENSCI). (3-0) Cr. 3. F.

Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301

Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

BIOL 486L: Aquatic Ecology Laboratory

(Dual-listed with EEOB 586L). (Cross-listed with A ECL, ENSCI). (0-3) Cr. 1. F.

Prereq: Concurrent enrollment in BIOL 486

Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

BIOL 487: Microbial Ecology

(Dual-listed with EEOB 587). (Cross-listed with ENSCI, MICRO). (3-0) Cr. 3. F.

Prereq: Six credits in biology and 6 credits in chemistry

Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

BIOL 488: Identification of Aquatic Organisms

(0-3) Cr. 1. F.S.

On-line taxonomic and identification exercises to accompany 486. Instruction and practice in the identification of algae, aquatic macrophytes, zooplankton, and benthos.

BIOL 489: Population Ecology

(Dual-listed with EEOB 589). (Cross-listed with A ECL). (2-2) Cr. 3. F.

Prereq: BIOL 312, STAT 101 or STAT 104, a course in calculus, or graduate standing

Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation.

BIOL 490: Independent Study

Cr. 1. Repeatable, maximum of 9 credits. F.S.SS.

Prereq: Permission of instructor.

Independent study opportunities for undergraduate students in the biological sciences. No more than 9 credits in Biol 490 may be counted toward graduation and, of those, only 2 credits may be applied toward the Biology advanced course requirement.

BIOL 491: Undergraduate Teaching Experience

Cr. 1-2. Repeatable.

Prereq: Permission of supervising staff

For students registering to be undergraduate teaching assistants. Offered on a satisfactory-fail basis only. A maximum of 2 credits of BIOL 491 may be applied toward the Biology advanced course requirement.

BIOL 492: Preparing for Graduate School in the Biological Sciences

(1-0) Cr. 1. F.

Prereq: For life science majors; Minimum requirement: sophomore standing.

For students considering pursuing a graduate degree in the biological sciences. Professional development topics including the defining of academic and career areas of interest, finding and evaluating appropriate programs of graduate study, the graduate school application process, and developing a curriculum vita. Exploration of learning opportunities at field stations, research internships, and independent research activities.

BIOL 494: Biology Internship

Cr. 1-3. Repeatable. F.S.SS.

Prereq: 8 credits in biology and permission of instructor

Professional experiences in biological sciences. Intended for Biology majors. No more than 9 credits in BIOL 494 may be counted toward graduation and, of those, only 6 credits may be applied toward the Biology advanced course requirement.

BIOL 495: Undergraduate Seminar

Cr. 1-3. Repeatable. F.S.

Prereq: Permission of instructor

Content varies from year to year and may include detailed discussion of special topics in biology, current issues in biology, or careers in biology.

BIOL 498: Cooperative Education

Cr. R. Repeatable. F.S.SS.

Prereq: Permission of the Biology Program cooperative education coordinator

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

BIOL 499: Undergraduate Research Experience
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Permission of instructor.
Research opportunities for undergraduate students in the biological sciences. Intended for Biology majors. No more than 9 credits in Biol 499 may be counted toward graduation and, of those, only 6 credits may be applied toward the Biology advanced course requirement.

Chemistry

Undergraduate Study

For undergraduate curricula in liberal arts and sciences leading to the degrees Bachelor of Science and Bachelor of Arts, see Liberal Arts and Sciences, Curriculum.

Graduates holding the B.S. degree in Chemistry qualify in many fields as: teachers of Chemistry, supervisors in industry, technical sales personnel, and research chemists in federal, state, municipal, academic, or industrial laboratories. Students with high scholastic standing often continue with graduate work, where they may explore more thoroughly the specialized areas of chemistry in which they are interested.

The B.A. degree is useful for students who intend to pursue studies in parallel areas, such as secondary school teaching, or to obtain additional majors or strong minors. The B.A. degree does not prepare students as well for graduate study or professional employment in chemistry.

Graduates have firm foundations in the fundamentals and application of current chemical theories. They are able to design, carry-out, record, and analyze the results of chemical experiments. They are able to use modern instrumentation and classical techniques to identify and solve chemical problems as well as explore new areas of research. Graduates are able to communicate the results of their work to chemists, as well as non-chemists. They understand the ethical and environmental dimensions of problems and issues facing chemists. They follow the proper procedures and regulations for safe storage, labeling, use of chemicals, and disposal of chemicals. Graduates are skilled in problem solving, critical thinking, and analytical reasoning. These skills may be applied to careers in education and industry; in professions such as law, medicine, environmental sciences, and forensic sciences.
The curricula in Chemistry are approved by the American Chemical Society (ACS). Students who complete the program obtain an ACS certified baccalaureate degree provided they also take one Biochemistry course, typically BBMB 301 Survey of Biochemistry, BBMB 316 (http://catalog.iastate.edu/azcourses/bbmb) Principles of Biochemistry or BBMB 404 Biochemistry I and BBMB 405 (http://catalog.iastate.edu/azcourses/bbmb) Biochemistry II.

Liberal arts majors who wish to transfer into Chemistry at the end of their second year may still complete all degree requirements and graduate within five years.

Undergraduate students seeking the B.S. degree in Chemistry usually take courses essential to the degree program according to the following schedule:

First year

CHEM 101	Chemistry Learning Community Orientation	1
CHEM 177 & CHEM 178	General Chemistry I and General Chemistry II	5-7
or CHEM 201	Advanced General Chemistry	
CHEM 177L	Laboratory in General Chemistry I	1
or CHEM 177N	Laboratory in General Chemistry I	
or CHEM 201L	Laboratory in Advanced General Chemistry	
CHEM 211	Quantitative and Environmental Analysis	2
CHEM 211L	Quantitative and Environmental Analysis Laboratory	2
MATH 165	Calculus I	4
MATH 166	Calculus II	4
ENGL 150	Critical Thinking and Communication	3
LIB 160	Information Literacy	1

Second year

CHEM 110	Cutting-Edge Chemistry: Research and Career Opportunities	1
CHEM 331	Organic Chemistry I	3
CHEM 332	Organic Chemistry II	3
CHEM 333L	Laboratory in Organic Chemistry I (for Chemistry and Biochemistry Majors)	2
CHEM 334L	Laboratory in Organic Chemistry II (for Chemistry and Biochemistry Majors)	2
MATH 265	Calculus III	4
PHYS 221	Introduction to Classical Physics I	5
PHYS 222	Introduction to Classical Physics II	5
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	

Third year

CHEM 324	Introductory Quantum Mechanics	3
CHEM 325	Chemical Thermodynamics	3
CHEM 322L	Laboratory in Physical Chemistry	3
CHEM 316	Instrumental Methods of Chemical Analysis	2
CHEM 316L	Instrumental Analysis Laboratory	2
CHEM 301	Inorganic Chemistry	2

CHEM 550	Safety in the Chemical Laboratory	1

Plus a foreign language requirement.

Fourth year

CHEM 402	Advanced Inorganic Chemistry	3
CHEM 401L	Inorganic Chemistry Laboratory	1
ENGL 314	Technical Communication	3
Two advanced Chemistry courses (min 4 credits)		4-6

Communication Proficiency requirement: The LAS College requires a C or better in ENGL 250. The Department requires a grade of C– or better in ENGL 314.

ENGL 150 & ENGL 250	Critical Thinking and Communication and Written, Oral, Visual, and Electronic Composition	3-6
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	
ENGL 314	Technical Communication	3

CHEM 399 Undergraduate Research or CHEM 499 Senior Research is strongly recommended. Credits earned in 399/499/490 may only be used to meet one of the advanced course requirements.

Chemistry majors seeking certification to teach Chemistry in secondary schools must meet the requirements of the College of Human Sciences as well as those of the Chemistry program. In addition, they must apply formally for admission to the teacher education program.

Undergraduate students seeking the B.A. degree in Chemistry have the following courses in their degree programs as minimum requirements:

One of the following sequences:		6-8
CHEM 177 & CHEM 178 & 177L	General Chemistry I and General Chemistry II and Laboratory in General Chemistry I	
or CHEM 177	Laboratory in General Chemistry I	
CHEM 167 & CHEM 178 & 167L	General Chemistry for Engineering Students and General Chemistry II and Laboratory in General Chemistry for Engineering	
CHEM 201 & 201L	Advanced General Chemistry and Laboratory in Advanced General Chemistry	
CHEM 211	Quantitative and Environmental Analysis	2
CHEM 211L	Quantitative and Environmental Analysis Laboratory	2
CHEM 301	Inorganic Chemistry	2
CHEM 316	Instrumental Methods of Chemical Analysis	2
CHEM 316L	Instrumental Analysis Laboratory	2
CHEM 324	Introductory Quantum Mechanics	3
CHEM 321L	Laboratory in Physical Chemistry	2-3
or CHEM 322L	Laboratory in Physical Chemistry	
CHEM 325	Chemical Thermodynamics	3
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
CHEM 332	Organic Chemistry II	3
CHEM 332L	Laboratory in Organic Chemistry II	1
The following are required as supporting work:		12
MATH 165	Calculus I	
MATH 166	Calculus II	
PHYS 221	Introduction to Classical Physics I	
PHYS 222	Introduction to Classical Physics II	

Minor

The Department offers a minor in chemistry which may be earned by credit in:

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
or		
CHEM 167 & 167L	General Chemistry for Engineering Students and Laboratory in General Chemistry for Engineering	5
CHEM 178	General Chemistry II	3
CHEM 211	Quantitative and Environmental Analysis	2
CHEM 211L	Quantitative and Environmental Analysis Laboratory	2
CHEM 324	Introductory Quantum Mechanics	3
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
And one of the following:		2-5
CHEM 301	Inorganic Chemistry	
CHEM 316 & 316L	Instrumental Methods of Chemical Analysis and Instrumental Analysis Laboratory	
CHEM 325 & CHEM 321L	Chemical Thermodynamics and Laboratory in Physical Chemistry	
or CHEM 322L	Laboratory in Physical Chemistry	
CHEM 332 & 332L	Organic Chemistry II and Laboratory in Organic Chemistry II	

The total minimum credits in Chemistry thus will be 20 to 23 depending on which advanced courses are selected.

Chemistry, B.A.

Freshman

Fall	Credits	Spring	Credits
CHEM 177(F) or CHEM 201(F)[1,2]	4-5	CHEM 178[2]	3
CHEM 177N or CHEM 201L[2,F]	1	CHEM 101	1
CHEM 101[3]	1	CHEM 211	2
MATH 165	4	CHEM 211L	2
ENGL 150	3	MATH 166	4
LIB 160	1	Electives	3
Electives			
	14-15		15

Sophomore

Fall	Credits	Spring	Credits
CHEM 331	3	CHEM 332	3
CHEM 333L[F,2]	2	CHEM 334L[2,5]	2
PHYS 221[2]	5	PHYS 222[2]	5
CHEM 110	1	ENGL 250	3
Electives	3	Electives	3
	14		16

Junior

Fall	Credits	Spring	Credits
CHEM 324 (or CHEM 325)	3	CHEM 325 (or CHEM 324)	3
Foreign Language - first semester of any foreign language accepted[4]	4	CHEM 321L[S]	2
Electives	9	CHEM 301[S]	2
		Foreign Language - second semester[4]	4
		CHEM 550 (strongly recommended)[S]	1
		Electives	3
	16		15

Senior

Fall	Credits	Spring	Credits
CHEM 316[F]	2	BBMB 301 (strongly recommended)	3
CHEM 316L[F]	2	CHEM 399 (strongly recommended)	
ENGL 314	3	Electives	12
Electives	8		
	15		15

1 Advanced high school chemistry and strong algebra skills are necessary for success in CHEM 201. Math ACT of 24 or greater is strongly recommended.

2 Students may substitute the following courses, if necessary:

- CHEM 201 for 177 and 178;
- CHEM 177L for 177N or 201L.
- CHEM 331L and 332L for 333L and 334L; however, this substitution may result in a program which is deficient in the laboratory experience recommended by the American Chemistry Society.
- CHEM 321L for 322L; however this substitution may result in a program which is deficient in the laboratory experience recommended by the American Chemistry Society.
- PHYS 111 and 112 for PHYS 221 and 222, however PHYS 221 and 222 are highly recommended.

3 Required of Chemistry Learning Community Members.

4 Completion of three years of foreign language in high school fulfills this requirement.

F Class offered Fall Semester only.

S Class offered Spring Semester only.

Individuals earning a B.A. degree in Chemistry who have taken 331L, 334L and 322L can obtain American Chemical Society certification by taking an additional advanced chemistry lecture course of BBMB 301 or 404. CHEM 550 may not be used to satisfy the Advanced Chemistry requirement.

Chemistry, B.S.

Freshman

Fall	Credits	Spring	Credits
CHEM 177 or CHEM 201(F)[1,2]	4-5	CHEM 178[1,2]	3
CHEM 177N or CHEM 201L[2,F]	1	CHEM 211	2
CHEM 101 (required for LC members)	1	CHEM 211L	2
MATH 165	4	CHEM 101	1
ENGL 150	3	MATH 166	4
LIB 160	1	Electives	3
Electives			
	14-15		15

Sophomore

Fall	Credits	Spring	Credits
CHEM 331	3	CHEM 332	3
CHEM 333L[2,F]	2	CHEM 334L[2,S]	2
CHEM 110[F]	1	PHYS 222	5
MATH 265	4	ENGL 250	3
PHYS 221	5	Electives	3

Electives			
	15		16

Junior

Fall	Credits	Spring	Credits
CHEM 325 or CHEM 324	3	CHEM 325 or CHEM 324	3
CHEM 316[F]	2	CHEM 322L[S]	3
CHEM 316L[F]	2	CHEM 301[S]	2
Foreign Language - first semester of any foreign language accepted[3]	4	Foreign Language - second semester[3]	4
Electives	5	CHEM 550 (strongly recommended)[S]	1
		Electives	3
	16		16

Senior

Fall	Credits	Spring	Credits
CHEM 402[F]	3	CHEM 401L[S]	1
ENGL 314	3	Advanced Chemistry[5,6]	4-5
Electives	9	BBMB 301 (strongly recommended)	3
		CHEM 399 (strongly recommended) crs-variable	
		Electives	6
	15		14-15

1 Advanced high school chemistry and strong algebra skills are necessary for success in CHEM 201. Math ACT of 24 or greater is strongly recommended.

2 Students may substitute the following courses, if necessary:

- CHEM 201 for 177 and 178;
- CHEM 177l for 177N or 201L
- CHEM 331l and 332L for 333L and 334L; however, this substitution may result in a program which is deficient in the laboratory experience recommended by the American Chemistry Society.

3 Completion of three years of foreign language in high school fulfills this requirement.

4 The completion of two courses (minimum of 2 credits each) are required to meet this requirement. (In addition to advanced Chemistry courses, certain courses in Biochemistry-Biophysics, Chemical Engineering, Computer Science, Mathematics and Materials Science and Engineering are acceptable.) Up to four credits in undergraduate research (CHEM 339 and/or 499) can be counted as one of the two advanced chemistry courses. CHEM 550 may not be used to satisfy the Advanced Chemistry requirement.

5 The program as listed above meets the standard for a certified degree of the American Chemical Society's Committee on Professional Training if BBMB 301 or 404 is one of the Advanced Chemistry Courses.

F Class offered Fall Semester only.

S Class offered Spring Semester only.

Graduate Study

The Department offers work for the degrees Master of Science and Doctor of Philosophy with majors in Chemistry, Analytical, Inorganic, Organic, and Physical chemistry. Co-majors may be taken between areas within Chemistry or between one of the areas in Chemistry and another department. Courses in other areas of Chemistry as well as courses in other departments may be used to satisfy the requirement for coursework outside the major field. A Ph.D. student in Chemistry may choose an additional specialty in one of six areas: Materials Chemistry, Industrial Chemistry, Biomolecular Sciences, Chemistry Education, Chemical Instrumentation, and Forensic Chemistry. A minimum of ten credits is required for each additional specialty. A course which counts towards an additional specialty may also count toward the outside course requirement. A minor in Chemistry is available to students in other departments. The Department participates in the interdepartmental major in Toxicology.

The Department of Chemistry requires all graduate students majoring in Chemistry to teach as part of their training for an advanced degree. Prerequisite to major graduate work is the completion of undergraduate work in Chemistry, Mathematics, and Physics substantially equivalent to that required of undergraduate Chemistry majors at this institution.

The course numbers for general Chemistry courses include 163-178, and 201.

Index to field of work for 200 level courses and above is given by the second and third digits of course numbers:

1. Inorganic Chemistry 00-09
2. Analytical Chemistry 10-19
3. Physical Chemistry 20-29 and 60-69
4. Organic Chemistry 30-39
5. Chemical Education 50-59
6. Interdisciplinary Chemistry 70-89
7. Research 99

Courses primarily for undergraduates:

CHEM 050: Preparation for College Chemistry
(3-0) Cr. 0. F.S.
Prereq: 1 year high school algebra
An in-depth active learning experience designed to impart the fundamental concepts and principles of chemistry, with an emphasis on mathematics skills and logical thinking. For students intending to enroll in general chemistry and who have not taken high school chemistry or who have not had a high school college preparatory chemistry course who need a review of chemical problem solving and chemical concepts. Credit for Chem 50 does not count toward graduation.

CHEM 101: Chemistry Learning Community Orientation
(1-0) Cr. 1. F.S.
Prereq: Member of the Chemistry Learning Community.
Integration of first year and transfer students into the chemistry program. Introduction and overview of degree requirements and support services on campus, assistance with transition to college and community life, and team-building and leadership activities. Offered on a satisfactory-fail basis only.

CHEM 101A: Chemistry Learning Community Orientation: On-Campus Orientation
(1-0) Cr. 1. F.
Prereq: Member of the Chemistry Learning Community.
Integration of first year and transfer students into the chemistry program. Introduction and overview of degree requirements and support services on campus, assistance with transition to college and community life, and team-building and leadership activities. Offered on a satisfactory-fail basis only.

CHEM 101B: Chemistry Learning Community Orientation: Professional Development Opportunities
(1-0) Cr. 1. S.
Prereq: Member of the Chemistry Learning Community.
Integration of first year and transfer students into the chemistry program. Introduction and overview of degree requirements and support services on campus, assistance with transition to college and community life, and team-building and leadership activities. Offered on a satisfactory-fail basis only.

CHEM 102L: Physical Sciences for Elementary Education
(Cross-listed with PHYS). (1-4) Cr. 3. F.S.
Prereq: MATH 195 or MATH 140
Physical science principles for future elementary teachers. Emphasis on experiments that address current elementary science education standards and that are appropriate for their future students to do, such as measurements of mass, length, time, light from atoms, charge and current, motion due to forces, energy and work, heat, waves, optics, building bridges and making musical instruments, studying states of matter and chemical reactions.

CHEM 110: Cutting-Edge Chemistry: Research and Career Opportunities
(1-0) Cr. 1. F.
Overview of careers in chemistry: industrial, governmental, and academic careers; literature and compound search instruction; professional ethics; and an introduction to joining a research lab. For students majoring or minoring in chemistry or chemistry-related fields. Offered on a satisfactory-fail basis only.

CHEM 160: Chemistry in Modern Society
(3-0) Cr. 3. F.S.
Aspects of chemistry visible to a non-scientist in our society. A survey of selected areas of chemistry with emphasis on the interface between chemistry and other fields of human activity.

CHEM 163: College Chemistry
(4-0) Cr. 4. F.S.SS.
Prereq: 1 year of high school algebra and geometry and Chem 50 or 1 year of high school chemistry; and credit or enrollment in CHEM 163L
A general survey of chemistry with an emphasis on conceptual problems for those who are not physical and biological science or engineering majors. Nomenclature, chemical reactions, stoichiometry, atomic structure, periodic properties, chemical bonding, states of matter, solutions, thermochemistry, acid-base theory, oxidation-reduction reactions, basic chemical kinetics, and chemical equilibrium. Only one of Chem 163, 167, 177, or 201 may count toward graduation.

CHEM 163L: Laboratory in College Chemistry
(0-3) Cr. 1. F.S.SS.
Prereq: Credit or enrollment for credit in CHEM 163
Laboratory to accompany CHEM 163. Must be taken with CHEM 163. Only one of Chem 163L, CHEM 167L, and CHEM 177L may count toward graduation.

CHEM 167: General Chemistry for Engineering Students
(4-0) Cr. 4. F.S.
Prereq: 1 year of high school chemistry or CHEM 50 and Math 143 pre-calculus or high school equivalent.
Principles of chemistry and properties of matter explained in terms of modern chemical theory with emphasis on topics of general interest to the engineer. Only one of Chem 163, 167, 177, or 201 may count toward graduation.

CHEM 167L: Laboratory in General Chemistry for Engineering
(0-3) Cr. 1. F.S.
Prereq: Credit or enrollment for credit in CHEM 167
Laboratory to accompany 167. Only one of Chem 163L, 167L, and 177L may count toward graduation.

CHEM 177: General Chemistry I

(4-0) Cr. 4. F.S.SS.

Prereq: MATH 140 or high school equivalent, and CHEM 50 or 1 year high school chemistry, and credit or enrollment in CHEM 177L. Chemistry and biochemistry majors may consider taking CHEM 201

The first semester of a two semester sequence which explores chemistry at a greater depth and with more emphasis on concepts, problems, and calculations than 163. Recommended for physical and biological science majors, chemical engineering majors, and all others intending to take 300-level chemistry courses. Principles and quantitative relationships, stoichiometry, chemical equilibrium, acid-base chemistry, thermochemistry, rates and mechanism of reactions, changes of state, solution behavior, atomic structure, periodic relationships, chemical bonding. Only one of Chem 163, 167, 177, or 201 may count toward graduation.

CHEM 177L: Laboratory in General Chemistry I

(0-3) Cr. 1. F.S.SS.

Prereq: Credit or enrollment for credit in CHEM 177

Laboratory to accompany 177. 177L must be taken with 177. Only one of Chem 163L, 167L, and 177L may count toward graduation.

CHEM 177N: Laboratory in General Chemistry I

(0-3) Cr. 1. F.

Prereq: Credit or enrollment for credit in CHEM 177. For chemistry and biochemistry majors

Laboratory to accompany CHEM 177. CHEM 177N must be taken with CHEM 177. Only one of Chem 163L, CHEM 167L, and CHEM 177N may count toward graduation.

CHEM 178: General Chemistry II

(3-0) Cr. 3. F.S.SS.

Prereq: CHEM 177, CHEM 177L

Continuation of 177. Recommended for physical or biological science majors, chemical engineering majors, and all others intending to take 300-level chemistry courses.

CHEM 178L: Laboratory in College Chemistry II

(0-3) Cr. 1. F.S.SS.

Prereq: CHEM 177L and credit or enrollment for credit in CHEM 178

Laboratory to accompany 178. 178L is not a necessary co-requisite with 178.

CHEM 201: Advanced General Chemistry

(5-0) Cr. 5. F.

Prereq: Co-enrollment in MATH 165 or credit, one year of high school chemistry, and one year high school physics or advanced chemistry. Co-enrollment in CHEM 201L.

A one-semester course in general chemistry designed to give students an in-depth, broad-based view of modern chemistry, and, in part, to facilitate participation in independent undergraduate research. Topics include stoichiometry, atomic and molecular structure, chemical bonding, kinetics, chemical equilibria, and thermodynamics. Discussion of current trends in various chemical disciplines, which may be given by guest experts in chemistry, biochemistry, and chemical engineering, will help the student appreciate the scope of the chemical sciences and how research is carried out. Only one of Chem 163, 167, 177, or 201 may count toward graduation.

CHEM 201L: Laboratory in Advanced General Chemistry

(0-3) Cr. 1. F.

Prereq: Credit or enrollment for credit in CHEM 201

Laboratory to accompany 201. Introductory lab experience in synthesis and analysis to prepare students for research activities. 201L must be taken with 201. Only one of 163L, 167L, 177L, 177N or 201L may count toward graduation.

CHEM 211: Quantitative and Environmental Analysis

(2-0) Cr. 2. F.S.

Prereq: CHEM 163 and CHEM 163L, CHEM 201 and CHEM 201L; or credit or enrollment in CHEM 178; and concurrent enrollment in CHEM 211L

Theory and practice of elementary volumetric, chromatographic, electrochemical and spectrometric methods of analysis. Chemical equilibrium, sampling, and data evaluation. Emphasis on environmental analytical chemistry; the same methods are widely used in biological and materials sciences as well.

CHEM 211L: Quantitative and Environmental Analysis Laboratory

(0-6) Cr. 2. F.S.

Prereq: Credit or enrollment for credit in CHEM 211

Introductory laboratory experience in volumetric, spectrometric, electrochemical and chromatographic methods of chemical analysis.

CHEM 231: Elementary Organic Chemistry
(3-0) Cr. 3. F.S.SS.
Prereq: CHEM 163, CHEM 163L, or CHEM 177, CHEM 177L; credit or enrollment in CHEM 231L
A survey of modern organic chemistry including nomenclature, structure and bonding, and reactions of hydrocarbons and important classes of natural and synthetic organic compounds. For students desiring only an elementary course in organic chemistry. Students in physical or biological sciences and premedical or preveterinary curricula should take the full year sequence 331 and 332 (with the accompanying laboratories 331L and 332L). Only one of Chem 231 and 331 or BBMB 221 may count toward graduation.

CHEM 231L: Laboratory in Elementary Organic Chemistry
(0-3) Cr. 1. F.S.SS.
Prereq: Credit or enrollment for credit in CHEM 231; CHEM 163L or CHEM 177L
Laboratory to accompany 231. 231L must be taken with 231. Only one of Chem 231L and 331L may count toward graduation.

CHEM 298: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the Department cooperative education coordinator; sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

CHEM 299: Undergraduate Research (for Freshmen and Sophomores)
Cr. arr. Repeatable, maximum of 6 credits.
Prereq: Permission of staff member with whom student proposes to work

CHEM 301: Inorganic Chemistry
(2-0) Cr. 2. S.
Prereq: CHEM 324
Atomic and molecular structure and bonding principles; molecular shapes and symmetry; acids and bases; solid-state structures and properties; inorganic chemistry of H, B, C.

CHEM 316: Instrumental Methods of Chemical Analysis
(2-0) Cr. 2. F.
Prereq: CHEM 211, CHEM 211L, Math 166, and concurrent enrollment in CHEM 316L; PHYS 222 recommended
Quantitative and qualitative instrumental analysis. Operational theory of instruments, atomic and molecular absorption and emission spectroscopy, electroanalysis, mass spectrometry, liquid and gas chromatography, electrophoresis, literature of chemical analysis.

CHEM 316L: Instrumental Analysis Laboratory
(0-6) Cr. 2. F.
Prereq: Credit or enrollment in CHEM 316
Advanced laboratory experience in UV-visible spectrophotometry, atomic absorption and emission spectrometry, electrochemistry, gas and liquid chromatography, electrophoresis, mass spectrometry, and other instrumental methods.

CHEM 321L: Laboratory in Physical Chemistry
(1-3) Cr. 2. S.
Prereq: Credit or enrollment in CHEM 324 or CHEM 325.
Error analysis; use of computers for interfacing to experiments and for data analysis; thermodynamics, infrared and optical spectroscopy, lasers. Not applicable towards the B.S. degree in Chemistry. Only one of Chem 321L and 322L may count toward graduation.

CHEM 322L: Laboratory in Physical Chemistry
(1-6) Cr. 3. S.
Prereq: CHEM 324 or CHEM 325.
Error analysis; use of computers for interfacing to experiments and for data analysis; thermodynamics, surface science, infrared and optical spectroscopy, lasers. Only one of Chem 321L and 322L may count toward graduation.

CHEM 324: Introductory Quantum Mechanics
(3-0) Cr. 3. F.S.
Prereq: CHEM 178, MATH 166; PHYS 222 recommended.
Quantum mechanics, atomic and molecular structure, spectroscopy, kinetic theory of gases, chemical kinetics.

CHEM 325: Chemical Thermodynamics
(3-0) Cr. 3. F.S.
Prereq: CHEM 178, MATH 166; PHYS 222 recommended
Classical thermodynamics 1st, 2nd, and 3rd laws with applications to gases and interfacial systems, multicomponent, multiphase equilibrium of reacting systems, surface chemistry, and electrochemical cells. Students taking a two-semester physical chemistry sequence are advised to take 324 first; in the spring semester, a molecular-based section of this course, stressing statistical thermodynamics, is offered for which knowledge of 324 is useful.

CHEM 331: Organic Chemistry I
(3-0) Cr. 3. F.S.SS.
Prereq: CHEM 178 or CHEM 201, enrollment in CHEM 331L highly recommended
The first half of a two semester sequence. Modern organic chemistry including nomenclature, synthesis, structure and bonding, reaction mechanisms. For students majoring in physical and biological sciences, premedical and pre-veterinary curricula, chemistry and biochemistry. Students desiring only one semester of organic chemistry should take 231 and 231L, not 331. Only one of Chem 231 and 331 may count toward graduation.

CHEM 331L: Laboratory in Organic Chemistry I
(0-3) Cr. 1. F.S.SS.
Prereq: CHEM 177L; credit or enrollment for credit in CHEM 331
Laboratory to accompany 331. Chemistry and biochemistry majors are encouraged to take 333L. Only one of Chem 231L and 331L may count toward graduation.

CHEM 332: Organic Chemistry II
(3-0) Cr. 3. F.S.SS.
Prereq: CHEM 331; enrollment in CHEM 332L highly recommended
Continuation of 331. Modern organic chemistry including nomenclature, synthesis, structure and bonding, reaction mechanisms, natural products, carbohydrates and proteins. For students majoring in physical and biological sciences, premedical and pre-veterinary curricula, chemistry and biochemistry.

CHEM 332L: Laboratory in Organic Chemistry II
(0-3) Cr. 1. F.S.SS.
Prereq: CHEM 331L; credit or enrollment for credit in CHEM 332
Laboratory to accompany 332. Chemistry and biochemistry majors are encouraged to take 334L.

CHEM 333L: Laboratory in Organic Chemistry I (for Chemistry and Biochemistry Majors)
(0-6) Cr. 2. F.
Prereq: Credit or enrollment for credit in CHEM 331
Laboratory to accompany 331 for chemistry and biochemistry majors.

CHEM 334L: Laboratory in Organic Chemistry II (for Chemistry and Biochemistry Majors)
(0-6) Cr. 2. S.
Prereq: CHEM 333L, credit or enrollment for credit in CHEM 332
Laboratory to accompany 332 for chemistry and biochemistry majors.

CHEM 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the Department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

CHEM 399: Undergraduate Research
Cr. arr.
Prereq: Permission of instructor with whom student proposes to work and junior or senior classification
Undergraduate research. No more than six total credits of Chem 399 and Chem 499 may count toward graduation. Credits earned in 399/499/490 may only be use to meet one of the advanced course requirements for the B.S. degree.

CHEM 401L: Inorganic Chemistry Laboratory
(0-3) Cr. 1. S.
Prereq: CHEM 402
Preparation and characterization of inorganic and organometallic compounds by modern techniques. For students majoring in chemistry or biochemistry.

CHEM 402: Advanced Inorganic Chemistry
(3-0) Cr. 3. F.
Prereq: CHEM 301; CHEM 331 recommended
Chemistry of the d and f metals. Structure, bonding, electronic spectra, and reaction mechanisms. Aspects of organometallic solid state and bioinorganic chemistry.

CHEM 490: Independent Study
Cr. arr.
Prereq: Completion of 6 credits in chemistry at the 300 level or higher and permission of instructor
No more than 9 credits of Chem 490 may count toward graduation.

CHEM 498: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the Department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

CHEM 499: Senior Research
Cr. 2-3. Repeatable, maximum of 6 credits.
Prereq: Permission of instructor with whom student proposes to work; B average in all chemistry, physics, and mathematics courses
Research in chosen area of chemistry, with final written report as senior thesis. This course should be elected for two consecutive semesters. For students majoring in chemistry. No more than six total credits for Chem 399 and 499 may count toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

CHEM 501L: Inorganic Preparations
(0-3) Cr. 1. F.
Prereq: CHEM 402
Preparation and characterization of inorganic and organometallic compounds by modern research techniques.

CHEM 502: Advanced Inorganic Chemistry
(3-0) Cr. 3. F.
Prereq: CHEM 402; CHEM 331 recommended
Chemistry of the main group (s, p) and transition (d, f) metals. Structure, bonding, electronic spectra, and reaction mechanisms. Aspects of organometallic, solid state, bioinorganic, and nano chemistry.

CHEM 505: Physical Inorganic Chemistry
(3-0) Cr. 3. F.
Prereq: CHEM 402 or CHEM 502 and CHEM 324
Elementary group theory and molecular orbital theory applied to inorganic chemistry. Spectroscopic methods of characterization of inorganic compounds and organometallic compounds.

CHEM 511: Advanced Analytical Chemistry
(3-0) Cr. 3. F.
Prereq: CHEM 316 and CHEM 316L
General methods of quantitative inorganic and organic analysis. Aqueous and nonaqueous titrimetry; selective reagents; sampling and sample dissolution; modern instrumentation; sensors; atomic and molecular microscopy; bioanalytical methods; data evaluation; chemometrics; and analytical literature.

CHEM 512: Electrochemical Methods of Analysis
(3-0) Cr. 3. F.
Prereq: CHEM 316 and CHEM 316L; Recommended but not Required CHEM 324, and CHEM 322L
Principles of convective-diffusional mass transport in electroanalysis. Applications of potentiometry, voltammetry, and coulometry. Introduction to heterogeneous and homogeneous kinetics in electroanalysis. Analog and digital circuitry. Interfacing.

CHEM 513: Analytical Molecular and Atomic Spectroscopy
(3-0) Cr. 3. S.
Prereq: CHEM 316 and CHEM 316L, CHEM 324, CHEM 322L
Introduction to physical optics and design of photometric instruments. Principles of absorption, emission, fluorescence, and Raman spectroscopy. Error and precision of optical methods. Ultraviolet, visible, and infrared methods of qualitative and quantitative organic and inorganic analysis.

CHEM 516: Analytical Separations
(3-0) Cr. 3. F.
Prereq: CHEM 316 and CHEM 316L, CHEM 324, CHEM 322L
Principles and examples of inorganic and organic separation methods applied to analytical chemistry. Solvent extraction, volatilization, ion exchange, liquid and gas chromatography, and electrophoresis.

CHEM 531: Organic Synthesis I
(2-0) Cr. 2. S.
Prereq: CHEM 332
Survey of organic functional group transformations.

CHEM 532: Organic Synthesis II
(2-0) Cr. 2. F.
Prereq: CHEM 531
Synthesis of complex organic compounds including natural products.

CHEM 537: Physical Organic Chemistry I
(3-0) Cr. 3. F.
Prereq: CHEM 332
Survey of reactive intermediates including cations, anions, carbenes, and radicals.

CHEM 538: Physical Organic Chemistry II
(3-0) Cr. 3. S.
Prereq: CHEM 537
Molecular structure, stereochemistry, introduction to reaction mechanisms, thermodynamic and kinetic data, linear free energy relationships, isotope effects, orbital symmetry.

CHEM 550: Safety in the Chemical Laboratory
(1-0) Cr. 1. S.
Prereq: CHEM 332L
Introduction to laboratory safety and chemical hygiene. Use of engineering controls and personal protective equipment. Chemical storage and waste disposal practices. Handling hazardous chemicals. Radiation safety and laser safety. Offered on a satisfactory-fail basis only.

CHEM 555: Teaching College Chemistry
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: Graduate or senior classification.
Methods of instruction, strategies and techniques for effective teaching and learning along with practice teaching in undergraduate chemistry recitation and laboratory courses. Cooperative learning, guided-inquiry, learning cycles, conceptual change, models and modeling, concept maps, visualization, computer simulations, web-based delivery systems, and learning theories.

CHEM 561: Fundamentals of Quantum Mechanics
(4-0) Cr. 4. F.
Prereq: CHEM 324
Schroedinger equation and exact solutions; square wells and barriers; harmonic oscillator; the hydrogen atom; atomic orbitals; operators including angular momenta; time-independent and time-dependent perturbation theory; Schroedinger and Heisenberg representations; unitary operators; interaction picture, density matrix.

CHEM 562: Fundamentals of Atomic and Molecular Quantum Mechanics
(3-0) Cr. 3. S.
Prereq: CHEM 561, credit or enrollment in CHEM 583
Variational method, many electron atoms; addition of angular momentum, self-consistent field method for open and closed shells, linear combinations of atomic orbitals, origin of chemical bonding, many-electron diatomic and polyatomic molecules, treatments of electron correlation, approximation methods.

CHEM 563: Statistical Mechanics
(3-0) Cr. 3. S.
Prereq: CHEM 325
Microscopic and macroscopic properties, laws of thermodynamics, ensembles and distribution functions, applications to gases, solids, and chemical equilibrium.

CHEM 564: Molecular Spectroscopy and Structure
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: CHEM 505 or CHEM 562
Maxwell's field equations, interaction of light with matter including time-dependent perturbation theory, microwave, vibrational (infra-red, Raman) and electronic spectroscopies, symmetry derived selection rules, special lineshapes and introduction to nonlinear and coherent laser spectroscopies.

CHEM 571: Solid-State Chemistry
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: CHEM 301, CHEM 324
Structural principles, synthetic strategies, analytical methods, and chemical bonding issues applied to solids. Atomic packings and networks, short-range vs. long-range order, defects; phase diagrams, reactive fluxes, chemical transport; diffraction, spectroscopy; energy bands and their bonding interpretations.

CHEM 572: Spectrometric Identification of Organic Compounds
(2-3) Cr. 3. F.
Prereq: CHEM 332
Principles of infrared, ultraviolet, nuclear magnetic resonance, and mass spectroscopy as applied to organic chemistry.

CHEM 573: Nanochemistry
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: CHEM 301, CHEM 324
Synthesis, characterization, properties and applications of nanoscale materials (≈ 0.5-500 nm), relationship with molecular, meso and bulk compounds. Chemistry of solid surfaces, zero-, one- and two-dimensional (0D, 1D, 2D) nanostructures , semiconductor quantum dots, plasmonic nanoparticles, carbon nanomaterials, porous nanomaterials, potential health and safety impacts.

CHEM 574: Organometallic Chemistry of the Transition Metals
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: CHEM 301, CHEM 332
Transition metal complexes with ligands such as cyclopentadienyl, olefins, acetylenes, benzenes, and carbon monoxide. Coverage of structure, bonding, reactivity, fundamental mechanisms, and homogeneous catalysis.

CHEM 576: Surface Chemistry
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: CHEM 324
Gas-surface interactions and techniques of characterization. Idealized surface lattices, surface tension, Wulff plots, work function, adsorbate-adsorbate interactions, 2D phase diagrams, diffusion, thin film growth, adsorption and desorption mechanisms/energetics/kinetics, adsorption isotherms, vacuum techniques, electron- and ion-based spectroscopies for surface analysis (including AES, FIM, XPS, UPS, EXAFS, EELS, SIMS, LEED and STM).

CHEM 577: Mass Spectrometry
(3-0) Cr. 3. S.
Basic physics, instrumentation, chemical and biological applications of mass spectrometry.

CHEM 578: Chemical Kinetics and Mechanisms
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: CHEM 324
Rates and mechanisms; reversible, consecutive, and competing reactions; chain mechanisms; kinetic isotope effects; very rapid reactions; acid-base catalysis, theories of unimolecular reactions; transition state and Marcus theories.

CHEM 579: Introduction to Research in Chemistry
Cr. R. F.
Introduction to the various areas of research in chemistry at Iowa State University.

CHEM 580: Introduction to Computational Quantum Chemistry
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CHEM 324
Basic principles of quantum mechanics, schrodinger equation. Hartree-Fock/molecular orbital theory, introduction to group theory, introduction to modern methods of computational chemistry; applications include molecular structure, potential energy surfaces and their relation to chemical reactions; molecular spectroscopy, photochemistry, solvent effects and surface chemistry.

CHEM 583: Chemical Group Theory
(1-0) Cr. 1. F.
Prereq: CHEM 324
Basic concepts and theorems, representation theory; point groups, molecular orbitals, molecular states, molecular vibrations, rotation group and angular momenta; space groups and crystals; permutation group, antisymmetry, and spin states.

CHEM 599: Nonthesis Research
Cr. arr.
Prereq: Permission of instructor concerned

Courses for graduate students:

CHEM 600: Seminar in Inorganic Chemistry
(1-0) Cr. 1. Repeatable, maximum of 3 times. F.S.
Prereq: Permission of instructor

CHEM 601: Selected Topics in Inorganic Chemistry
(2-0) Cr. 1-2. F.S.
Prereq: Permission of instructor
Topics such as molecular structure and bonding; organometallic compounds; physical techniques of structure determination; nonaqueous solutions; Zintl phases; transition-metal oxides; free-radical reactions; electron transfer reactions; metal-metal bonding; and bioinorganic chemistry of nucleic acids.

CHEM 611: Seminar in Analytical Chemistry
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor

CHEM 619: Special Topics in Analytical Chemistry
(2-0) Cr. 1-2. Repeatable. F.S.
Prereq: Permission of instructor
Raman spectroscopy, sensors, spectroelectrochemistry, capillary electrophoresis, analytical plasmas, chemometrics and bioanalytical chemistry.

CHEM 631: Seminar in Organic Chemistry
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor

CHEM 632: Selected Topics in Organic Chemistry
(2-0) Cr. 1-2. Repeatable. F.S.
Prereq: CHEM 537
Topics of current interest in organic chemistry such as spectroscopy, physical organic chemistry, photochemistry, organometallic chemistry, mechanisms of oxidations and reductions, modern organic synthesis, reactive intermediates, bioorganic chemistry, and polymers.

CHEM 660: Seminar in Physical Chemistry
(1-0) Cr. 1. Repeatable. S.
Prereq: Permission of instructor

CHEM 667: Special Topics in Physical Chemistry
(2-0) Cr. 1-2. F.S.
Prereq: Permission of instructor
Advanced and recent developments in physical chemistry are selected for each offering.

CHEM 699: Research
Cr. arr. Repeatable.
Prereq: Permission of instructor

Classical Studies

The cross-disciplinary program in Classical Studies engages students with the civilizations of ancient Greece and Rome and their influence, both past and present, on western and world cultures. The Classical Studies minor and interdisciplinary-studies major include an integrated curriculum of courses in the cultures, literatures, history, languages, archaeology, and art of ancient Greece and Rome from prehistoric times to the reign of the Emperor Constantine. Current information about the Program may be found at: http://language.iastate.edu/academic-programs/classical-studies/

Courses in Classical Studies provide a classical context for students whose major fields of study or career interests include History, Anthropology, English, World Languages and Cultures, Philosophy,

Women's Studies, material culture, law, medicine, political science, the life sciences, and related fields.

Interdisciplinary Studies Major in Classical Studies

Students interested in pursuing an interdisciplinary studies major in Classical Studies should consult the Program Chair (see "Program Faculty" at http://language.iastate.edu/academic-programs/classical-studies/) or the Academic Adviser in the Department of World Languages and Cultures (http://language.iastate.edu/students/).

A student who wishes to declare a minor must successfully complete the following requirements:

a) One of the following sets of courses in ancient language:

GREEK 101 & GREEK 102	Elementary Ancient and New Testament Greek I and Elementary Ancient and New Testament Greek II	
or		
LATIN 101 & LATIN 102	Elementary Latin I and Elementary Latin II	
b) One of the following introductory courses:		3
CL ST 273	Greek and Roman Mythology (or)	3
CL ST 275	The Ancient City	3

c). One course in ancient history (not used to meet other requirements) from those listed below or approved by the program committee (3 crs.):

CL ST 304	Cultural Heritage of the Ancient World	3
CL ST 402	Greek Civilization.	3
CL ST 403	Roman Civilization.	3
d) Two additional courses (not used to meet other requirements) from those listed below or approved by the program committee. One of these classes (3 crs.) must be at the 300-level or above.		6
CL ST 273	Greek and Roman Mythology	
CL ST 275	The Ancient City	
CL ST 304	Cultural Heritage of the Ancient World	
CL ST 310	Ancient Philosophy	
CL ST 350	Rhetorical Traditions	
CL ST 353	World Literature: Western Foundations through Renaissance	
CL ST 367	Christianity in the Roman Empire	
CL ST 372	Greek and Roman Tragedy and Comedy	3
CL ST 373	Heroes of Greece, Rome, and Today	
CL ST 374	Sex, Gender, and Culture in the Ancient Mediterranean World	
CL ST 376A	Classical Archeology: Bronze Age and Early Iron Age Greece	
CL ST 376B	Classical Archeology: Archaic through Hellenistic Greece (ca 700-30 BCE)	
CL ST 376C	Classical Archaeology: Roman Archaeology (ca 1000 BCE-400 CE)	3
CL ST 383	Greek and Roman Art	
CL ST 384	Roman Italy: An Introduction	2
CL ST 385	Study Abroad: Roman Italy: Building the Empire	3
CL ST 394	The Archaeology of Greece: An Introduction	
CL ST 395	Study Abroad: The Archaeology of Greece	
CL ST 402	Greek Civilization.	
CL ST 403	Roman Civilization.	
CL ST 430	Foundations of Western Political Thought	
CL ST 480	Seminar in Classical Studies	
CL ST 490	Independent Study	
CL ST 512A	Proseminar in European History, Ancient	
CL ST 594A	Seminar in European History: Ancient	
GREEK 201	Intermediate Classical Greek	
GREEK 332	Introduction to Classical Greek Literature	
GREEK 490	Independent Study	
LATIN 201	Intermediate Latin	
LATIN 332	Introduction to Latin Literature	
LATIN 490	Independent Study	

Courses primarily for undergraduates:

CL ST 201: Technical Terminologies in the Professions
(3-0) Cr. 3. F.S.
Essential vocabulary and concepts in English that are derived from Latin and Ancient Greek. Formation and usage of technical terminology. Cultural influence of the classical languages. Analysis of technical writing.

CL ST 273: Greek and Roman Mythology
(3-0) Cr. 3. F.SS.
Survey of the legends, myths of the classical world with emphasis on the principal gods, and heroes, and their relation to ancient social, psychological, and religious practices; some attention may be given to important modern theories.
Meets International Perspectives Requirement.

CL ST 273H: Greek and Roman Mythology: Honors
(4-0) Cr. 4. F.SS.
Survey of the legends, myths of the classical world with emphasis on the principal gods, and heroes, and their relation to ancient social, psychological, and religious practices; some attention may be given to important modern theories.
Meets International Perspectives Requirement.

CL ST 275: The Ancient City
(3-0) Cr. 3. F.S.
Examination of ancient urban life, including historical context, physical space, material culture, religion, literature, and art; examination of civic identity (the "polis"). Contrast between the concepts of urban and rural. Examples drawn from specific ancient cities; some attention to modern methods of recovering the conditions of ancient urban life and the fundamental concept of the city in European history.
Meets International Perspectives Requirement.

CL ST 275H: The Ancient City: Honors
(4-0) Cr. 4. F.S.
Examination of ancient urban life, including historical context, physical space, material culture, religion, literature, and art; examination of civic identity (the "polis"). Contrast between the concepts of urban and rural. Examples drawn from specific ancient cities; some attention to modern methods of recovering the conditions of ancient urban life and the fundamental concept of the city in European history.
Meets International Perspectives Requirement.

CL ST 304: Cultural Heritage of the Ancient World
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
Historical examination of art, literature, thought, and religious beliefs of major civilizations of the ancient Mediterranean countries until the end of the 8th century.

CL ST 310: Ancient Philosophy
(Cross-listed with PHIL). (3-0) Cr. 3. F.
Prereq: PHIL 201
Survey of ancient Greek philosophy, focusing on the pre-Socratics, Plato, and Aristotle. Questions concerning being, knowledge, language, and the good life are treated in depth.

CL ST 350: Rhetorical Traditions
(Cross-listed with ENGL, SP CM). (3-0) Cr. 3. S.
Prereq: ENGL 250
Ideas about the relationship between rhetoric and society in contemporary and historical contexts. An exploration of classical and contemporary rhetorical theories in relation to selected topics that may include politics, gender, race, ethics, education, science, or technology.

CL ST 353: World Literature: Western Foundations through Renaissance
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.
Prereq: ENGL 250
Representative works from the drama, epics, poetry, and prose of the Ancient World through the late sixteenth century. May include Homer, Aeschylus, Sappho, Catullus, Dante, Marie de France, Boccaccio, Christine de Pizan, Cervantes, and others.
Meets International Perspectives Requirement.

CL ST 367: Christianity in the Roman Empire
(Cross-listed with RELIG). (3-0) Cr. 3.
An historical introduction to the rise of Christianity in the Roman empire, with special attention to the impact of Greco-Roman culture on the thought and practice of Christians and the interaction of early Christians with their contemporaries.

CL ST 372: Greek and Roman Tragedy and Comedy
(3-0) Cr. 3. S.
Prereq: CL ST 273 or CL ST 275 or one course in Latin or Greek or ENGL 250
Greek and Roman drama from the beginnings until today. Readings in English from authors such as Aeschylus, Sophocles, Euripides, Aristophanes, Menander, Plautus, Terence, Seneca. Course may cover performance, theories of comedy and tragedy, recent and current expressions of the comic and tragic in film and other media.
Meets International Perspectives Requirement.

CL ST 372H: Greek and Roman Tragedy and Comedy: Honors
(4-0) Cr. 4. S.
Prereq: CL ST 273 or CL ST 275 or one course in Latin or Greek or ENGL 250
Greek and Roman drama from the beginnings until today. Readings in English from authors such as Aeschylus, Sophocles, Euripides, Aristophanes, Menander, Plautus, Terence, Seneca. Course may cover performance, theories of comedy and tragedy, recent and current expressions of the comic and tragic in film and other media.
Meets International Perspectives Requirement.

CL ST 373: Heroes of Greece, Rome, and Today
(3-0) Cr. 3. F.
Prereq: CL ST 273 or CL ST 275 or one course in Latin or Greek or ENGL 250.
Cultural and political significance of ancient epic, especially in Greece and Rome. Course may include study of the heroic code in antiquity and its modern expressions including in film. Readings in English from authors such as Homer and Vergil.
Meets International Perspectives Requirement.

CL ST 373H: Heroes of Greece, Rome, and Today: Honors
(4-0) Cr. 4. F.
Prereq: CL ST 273 or CL ST 275 or one course in Latin or Greek or ENGL 250.
Cultural and political significance of ancient epic, especially in Greece and Rome. Course may include study of the heroic code in antiquity and its modern expressions including in film. Readings in English from authors such as Homer and Vergil.
Meets International Perspectives Requirement.

CL ST 374: Sex, Gender, and Culture in the Ancient Mediterranean World
(Cross-listed with HIST, W S). (3-0) Cr. 3. S.
Prereq: Any one course in Cl St, W S, Latin, or Greek
Chronological and topical survey of the status of women and men, focusing on sex and gender issues in the Ancient Mediterranean world; study of constructs of the female and the feminine. Readings from ancient and modern sources. Emphasis on ancient Greece, Rome, and Egypt.
Meets International Perspectives Requirement.

CL ST 376: Classical Archaeology
(Cross-listed with ANTHR, RELIG). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

CL ST 376A: Classical Archeology: Bronze Age and Early Iron Age Greece
(Cross-listed with ANTHR, RELIG). (3-0) Cr. 3. S.
Bronze Age (Minoan and Mycenaean palatial cultures) and Early Iron Age Greece. (ca 3000-700 BCE). Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

CL ST 376B: Classical Archeology: Archaic through Hellenistic Greece (ca 700-30 BCE)
(Cross-listed with ANTHR, RELIG). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

CL ST 376C: Classical Archaeology: Roman Archaeology (ca 1000 BCE-400 CE)
(Cross-listed with ANTHR). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Roman world and the role of archaeological context in understanding the varied aspects of ancient Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

CL ST 383: Greek and Roman Art
(Cross-listed with ART H). (3-0) Cr. 3.
Greek art from Neolithic to Hellenistic periods. Roman art from the traditional founding to the end of the empire in the West.

CL ST 383H: Greek and Roman Art: Honors
(Cross-listed with ART H). (3-0) Cr. 3-4.
Greek art from Neolithic to Hellenistic periods. Roman art from the traditional founding to the end of the empire in the West.

CL ST 384: Roman Italy: An Introduction
(Cross-listed with HIST). Cr. 2.
Prereq: Enrollment limited to students participating in CL ST 385/HIST 385. Instructor permission required.
Introduction to the topography, history, archaeology, monuments, and art of Rome from the Regal period through late Antiquity; attention given to the culture of modern Italy, preparatory to study abroad in Rome.
Meets International Perspectives Requirement.

CL ST 385: Study Abroad: Roman Italy: Building the Empire
(Cross-listed with HIST). Cr. 3.
Prereq: CL ST 384/HIST 384 and instructor's permission.
Supervised on-site instruction in the history, archaeology, monuments, and art of Rome and environs from the 8th center BCE to the 5th century CE; attention given to the culture of modern Italy.
Meets International Perspectives Requirement.

CL ST 394: The Archaeology of Greece: An Introduction
(2-0) Cr. 2. Repeatable, maximum of 4 credits. S.
Introduction to the topography, history, archaeology, monuments and art of Greece from the Bronze Age through the Ottoman period; attention given to the culture of modern Greece, preparatory to study abroad in Greece (Cl St 395).
Meets International Perspectives Requirement.

CL ST 395: Study Abroad: The Archaeology of Greece
Cr. 2-6. Repeatable, maximum of 9 credits. SS.
Prereq: CL ST 394
Supervised on-site instruction in the archaeology, monuments, and art of Greece from the Bronze Age through the Ottoman period; attention given to the culture of modern Greece.
Meets International Perspectives Requirement.

CL ST 402: Greek Civilization.
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
Ancient Greece from the Bronze Age to the Hellenistic period; evolution of the Greek polis and its cultural contributions with a particular emphasis on the writings of Herodotus and Thucydides.

CL ST 403: Roman Civilization.
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
Ancient Rome from the Regal Period to the Fall of the Western Empire; evolution of Roman institutions and Rome's cultural contributions studied through original sources.

CL ST 430: Foundations of Western Political Thought
(Cross-listed with POL S). (3-0) Cr. 3.
Prereq: 6 credits in political science, philosophy, or European history
Study of original texts in political thought ranging from the classical period to the renaissance. Topics such as justice, freedom, virtue, the allocation of political power, the meaning of democracy, human nature, and natural law.

CL ST 480: Seminar in Classical Studies
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 30 credits in Classical Studies or related courses, permission of Program Chair
Advanced study of a selected topic in Classical Studies. Research paper or project selected by the student.

CL ST 490: Independent Study
Cr. 1-6. Repeatable, maximum of 9 credits.
Prereq: 7 credits in classical studies at the 200 level or higher; permission of the Program Chair
Designed to meet the needs of students who wish to study specific topics in classical civilization in areas where courses are not offered, or to pursue such study beyond the limits of existing courses.

Courses primarily for graduate students, open to qualified undergraduates:

CL ST 512: Proseminar in European History
(3-0) Cr. 3.
Prereq: Permission of instructor.
Readings in European history.

CL ST 512A: Proseminar in European History, Ancient
(Cross-listed with HIST). (3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in European history.

CL ST 594: Seminar in European History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

CL ST 594A: Seminar in European History: Ancient
(Cross-listed with HIST). (3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

Communication Studies

The Communication Studies Major

www.commstudies.las.iastate.edu (http://www.commstudies.las.iastate.edu)

The Communication Studies Program focuses on human communication, exploring the ways humans create and negotiate meaning. Communication Studies majors master a focused course of inquiry into interpersonal processes as they create and sustain relationships and impact individuals, groups, and organizations. The Communication Studies curriculum builds primarily on social science traditions in developing a liberal arts education emphasizing human communication. Students in the Communication Studies major study applied communication theory and research in interpersonal, small group, organizational, intercultural, and other contexts.

The Communication Studies (ComSt) major teaches students how to think critically, giving them the ability to examine complex communication issues, and develop and implement strategies grounded in evidence-based research. This prepares students for careers in business and industry and graduate education. Students majoring in ComSt will find their career opportunities enhanced in professions requiring applied communication expertise, e.g., human resource management, public relations, training and development, sales management, recruitment, event planning, sales, management, organizational development, business communication, law, and international and intercultural relations.

ComSt majors must earn at least 120 credits, with 45 credits at the 300-400 levels, and a minimum of 33 credits in ComSt.

Communication Studies majors will...

- Develop foundational knowledge of human communication
- Apply human communication strategies in a diverse world
- Evaluate and utilize evidence-based research
- Cultivate communication competence

Communication Proficiency Requirement

To meet the University's Communication Proficiency requirement students are required to take:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	
Plus one of the following:		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
ENGL 415	Business and Technical Editing	

A C is required in ENGL 250 Written, Oral, Visual, and Electronic Composition (or ENGL 250H Written, Oral, Visual, and Electronic Composition, Honors).

The Communication Studies Major

Core Requirements (15 credits)

COMST 101	Introduction to Communication Studies	3
COMST 102	Introduction to Interpersonal Communication	3
COMST 203	Introduction to Communication Research Methods	3
COMST 301	Human Communication Theory	3
Plus one of the following:		3
COMST 214	Professional Communication	
COMST 218	Conflict Management	
COMST 210	Communication and U.S. Diversity	
Total Credits		15

Upper Division Requirements (15 credits). Select five courses from the following

COMST 310	Intercultural Communication	3
COMST 311	Studies in Interpersonal Communication	3
COMST 313	Leadership Communication Theories	3
COMST 314	Organizational Communication	3
COMST 317	Small Group Communication	3
COMST 319	Communication Training and Development	3
COMST 325	Nonverbal Communication	3
COMST 330	Computer Mediated Communication	3
SP CM 323	Gender and Communication	3
Total Credits		15

Capstone Course Requirement (3 credits)

COMST 404	Research Seminar	3

Credits in COMST 384 Applied Organizational Communication, may not be applied toward the upper division requirements.

In accordance with college requirements, an overall average in Communication Studies courses of C (2.0) or better is required.

Enhancement Requirement (4 credits)

COM S 103	Computer Applications	4

Additional Recommended Courses

STAT 101	Principles of Statistics	4
SP CM 212	Fundamentals of Public Speaking	3
COMST 450	Special Topics in Communication Studies	3

The Communication Studies Minor (18 credits)

The requirements for a minor in ComSt may be fulfilled by credit in:

COMST 101	Introduction to Communication Studies	3
COMST 102	Introduction to Interpersonal Communication	3
COMST 203	Introduction to Communication Research Methods	3
COMST 301	Human Communication Theory	3
Plus six credits in 300-level ComSt courses.		6
Credits in COMST 384 Applied Organizational Communication, may not be applied toward the minor. Students must earn an overall average of C (2.0) or better in all courses taken for the minor.		
Total Credits		18

Communication Studies, B.A.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	COM S 103	4
COMST 101	3	Social Science Choice	3
Social Science Choice	3	Humanities Choice	3
Humanities Choice	3	Natural Science Choice	3
Natural Science Choice	3	Elective	3
LIB 160	1		
	16		16

Sophomore

Fall	Credits	Spring	Credits
COMST 102	3	COMST 214 or 218	3
Foreign Language/Elective	3-4	Foreign Language/Elective	3-4
ENGL 250	3	Elective	3

Humanities Choice	3	Math Choice (STAT 101 recommended)	3-4
Social Science Choice	3	Elective(s) (if STAT 101 and/or For. Lang. is not taken)	1-2
	15-16		13-16

Junior

Fall	Credits	Spring	Credits
COMST 203	3	Upper Division Comm. Requirement	3
COMST 301	3	Upper Division Comm. Requirement	3
U.S. Diversity Choice	3	Humanities Choice	3
Natural Science Choice	3	Elective - 300+	3
Elective 300+	3	Elective - 300+	3
	15		15

Senior

Fall	Credits	Spring	Credits
Upper Division Comm Requirement	3	COMST 404	3
Upper Division Comm Requirement	3	Upper Division Comm Requirement	3
Any Elective	3	Verbal Comm--ENGL 302, 309, or 314	3
Electives 300+	3	Elective 300+	3
Elective 300+	3	Elective 300+	3
	15		15

To meet Upper Division Comm Requirements students select from among the following:

- COMST 301
- COMST 310
- COMST 311
- COMST 313
- COMST 314
- COMST 317
- COMST 319
- COMST 325
- COMST 330
- SP CM 323

Students in all majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. (COMST 310 fulfills the international perspective requirement/ COMST 210 and SP CM 323 fulfill the U.S. diversity requirement). Approved courses are listed at: http://www.registrar.iastate.edu/courses/div-ip-guide.html. Discuss with your adviser how the two courses that you select can be applied to to your graduation plan.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 300/400 level. You must also complete the LAS foreign language requirement.

The LAS College requires all students to have a 2.0 in the major to graduate. This means students need a 2.0 GPA in the 33 hours taken to fulfill the major requirements in Communication Studies.

Courses primarily for undergraduates:

COMST 101: Introduction to Communication Studies
(3-0) Cr. 3.
An introduction to communication theory, the development and functions of communication, and a survey of verbal, nonverbal, interpersonal, small group, organizational, and intercultural communication.

COMST 101L: Introduction to Communication Studies: Laboratory
(0-2) Cr. 1.
Prereq: Concurrent enrollment in COMST 101.
Laboratory component of COMST 101. Skill building, experiential activities, and in-depth discussions relevant to the study of communication.

COMST 102: Introduction to Interpersonal Communication
(3-0) Cr. 3.
Application of communication principles, theory, and research to the process of interpersonal communication; includes verbal and nonverbal communication, listening, and conflict management. Particular emphasis given to using communication to manage interpersonal relationships.

COMST 104: Orientation to Communication Studies
(1-0) Cr. 1.
Prereq: Available only for Communication Studies majors
Orientation to Communication Studies discipline, program requirements and career opportunities. Required of communication studies majors. Offered on a satisfactory-fail basis only.

COMST 203: Introduction to Communication Research Methods
(3-0) Cr. 3.
Prereq: COMST 101
An introduction to analyzing and conducting communication research. Provides an overview of quantitative and qualitative approaches to communication research.

COMST 210: Communication and U.S. Diversity
(3-0) Cr. 3. F.S.SS.
Introduction to the role of diversity in communication. Developing competent communication with diverse social groups within interpersonal and organizational contexts in the United States. Topics may include structured reflection of one's role in diverse communication experiences, cultural variations in communication mores, impacts of racial/ethnic/gender identities on communication, workplace policies regarding cultural diversity, the intersection of communication and cultural privilege, communication practices that can reduce prejudice/discrimination, and communication characteristics of advocates for diversity.
Meets U.S. Diversity Requirement

COMST 214: Professional Communication
(3-0) Cr. 3.
Communication theory and skill development in organizational settings. Emphasis on interpersonal skill development, team and meeting facilitation, informational interviewing, individual and team presentations, and self-assessment.

COMST 218: Conflict Management
(3-0) Cr. 3.
Exploration of communication theories, principles and methods associated with effective conflict management.

COMST 301: Human Communication Theory
(3-0) Cr. 3.
Prereq: COMST 101
Examination of the major theories related to human communication; with particular emphasis on theories underlying interpersonal, small group, organizational, and intercultural communication.

COMST 310: Intercultural Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Examines the theories, principles and research on intercultural communication to enhance cultural sensitivity and to recognize, accept, and adapt to cultural diversity. Interactive assignments.
Meets International Perspectives Requirement.

COMST 311: Studies in Interpersonal Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
This class focuses on studies of contemporary interpersonal communication concepts and theories. Emphasis on research that examines issues central to communication in interpersonal relationships.

COMST 313: Leadership Communication Theories
(3-0) Cr. 3. F.S.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Investigation of theories, research and principles of leadership communication. Exploration of the contexts in which leadership and communication occurs, with emphasis on the connection between communication and leadership and the dyadic linkage of leader and follower.

COMST 314: Organizational Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Theory and research in organizational communication. Provides strategies for assessing and improving individual and organizational communication effectiveness. Addresses issues such as technology, diversity, work-life negotiation, emotional labor, conflict, socialization, and socially responsible organizations. Explores how organizational meaning is created and sustained through human communication.

COMST 317: Small Group Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Theory and research in small group communication; application to group decision-making and leadership. Includes communication analyses of groups and teams.

COMST 319: Communication Training and Development
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Theories and approaches to communication training and development; includes adult learning theory. Emphasis on the design, presentation and assessment of communication skills in organizational contexts.

COMST 325: Nonverbal Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Approaches to studying nonverbal communication. Foci include topics such as emotion, gestures, gaze, use of space, and parsing intention in social interaction.

COMST 330: Computer Mediated Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102, COMST 203, COMST 301
Theories and approaches related to mediated communication in interpersonal and organizational settings. Focus on how new technology impacts human interaction and relationships.

COMST 384: Applied Organizational Communication
(3-0) Cr. 3.
Prereq: COMST 101, COMST 102 or equivalent course.
Theory and research of micro-level organizational communication, including interpersonal and small group interactions taking place in a professional setting. Topics include interpersonal dynamics in such areas as conflict, generational communication, negotiation, superior/subordinate communication, external communication, and virtual communication. Not available for major credit.

COMST 404: Research Seminar
(Dual-listed with COMST 504). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: COMST 301 plus 3 additional communication studies classes from the following list: COMST 310, COMST 311, COMST 313, COMST 314, COMST 317, COMST 319, COMST 325, or COMST 330.
Capstone communication studies course. Students develop an original research study linked to the study of communication. Data are collected and analyzed. Results are presented in a final research paper and a presentation.

COMST 450: Special Topics in Communication Studies
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.
Research and theory related to special topics and issues in communication studies.

COMST 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 9 credits in communication studies and junior classification
Application must be submitted for approval the semester prior to the independent study.

COMST 491: Research Practicum
Cr. arr. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: COMST 203, COMST 301 plus permission of instructor.
Providing research assistance on projects conducted by Communication Studies faculty.

COMST 497: Professional Internship
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 12 hours in Communication Studies including COMST 203, COMST 301, and one other 300-level COMST class. Junior Classification. Application required.
100 hours of on-site professional work per credit hour plus completion of the academic requirement set by the internship committee. Application should be submitted in the term prior to the term in which the internship will be served. Internship cannot be used to meet degree requirement in Communication Studies.

Courses primarily for graduate students, open to qualified undergraduates:

COMST 504: Research Seminar
(Dual-listed with COMST 404). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: COMST 301 plus 3 additional communication studies classes from the following list: COMST 310, COMST 311, COMST 313, COMST 314, COMST 317, COMST 319, COMST 325, or COMST 330.
Capstone communication studies course. Students develop an original research study linked to the study of communication. Data are collected and analyzed. Results are presented in a final research paper and a presentation.

COMST 590: Special Topics
Cr. 1-4. Repeatable.
Application must be submitted for approval the semester prior to the independent study.

Computer Science

http://www.cs.iastate.edu

The undergraduate curriculum in computer science leading to the degree Bachelor of Science is accredited by the Computing Accreditation Commission of ABET, http://www.abet.org, and equips students with a sound knowledge of the foundations of computer science, as well as the problem solving and system design skills necessary to create robust, efficient, reliable, scalable, and flexible software systems. The B.S. degree in Computer Science prepares students for graduate study in computer science, and for various business, industry, and government positions including computer scientists, information technologists, and software developers. The main educational objectives of the computer science program at Iowa State University are that its graduates demonstrate expertise, engagement, and learning within three to five years after graduation.

•Expertise: Graduated students should have the ability to establish peer-recognized expertise in the discipline. They should have the ability to articulate this expertise by formulating and solving problems of interest, by creating or deriving value through the application of technology, and by using mathematical foundations, algorithmic principles, and computer science theory in designing, implementing, and evaluating computer-based systems and processes which meet the desired needs of their employers.

•Engagement: Graduated students should have the ability to be engaged in the profession through the practice of computer science in industry, academia, or the public sector. They should demonstrate effective teaming and commitment to working with others by applying communications skills and professional knowledge.

•Learning: Graduated students should have the ability to engage in sustained learning through graduate work, professional improvement opportunities, and self study so that they can adapt to the role played by information processing in ever-changing areas of science, technology, and society.

Curriculum in Computer Science

Students wishing to pursue the B.S. degree in computer science must first successfully complete the pre-major program consisting of Com S 227, Com S 228, and Math 165; all with a grade of C- or above.

A student seeking a B.S. degree in computer science must satisfy the requirements of the University and College of Liberal Arts and Sciences (see Liberal Arts and Sciences, Curriculum) and the departmental requirements.

The departmental requirements consist of a minimum of 44 credits in computer science and satisfaction of written and oral requirements. Students must earn at least a C- in Math 165, Math 166, Cpr E 281, and each Computer Science course taken to fulfill the Degree Program.

The following courses are required:

COM S 101	Orientation	R
COM S 203	Careers in Computer Science	R
COM S 227	Introduction to Object-oriented Programming	4
COM S 228	Introduction to Data Structures	3
COM S 230	Discrete Computational Structures	3
CPR E 281	Digital Logic	4
COM S 309	Software Development Practices	3
COM S 311	Design and Analysis of Algorithms	3
COM S 321	Introduction to Computer Architecture and Machine-Level Programming	3
COM S 327	Advanced Programming Techniques	3
COM S 331	Theory of Computing	3
COM S 342	Principles of Programming Languages	3
COM S 352	Introduction to Operating Systems	3
COM S 362	Object-Oriented Analysis and Design	3

In addition to the above courses, at least 6 credits of 400-level courses are required, with a grade of C- or better. At least 3 credits must be from courses in Group 1 (oral and written reports) and the remaining credits from courses in Group 1 or 2. Com S 402 may be applied towards the Group 1 requirement, provided 3 or more credits of 402 are taken. Com S 414 may not be applied towards fulfilling the 400-level electives.

Group 1 courses: Com S 402, 409, 417, 425, 430, 437, 453, 461, 487, S E/ CprE 416

Group 2 courses: Com S 407, 412, 418, 426, 433, 435, 440, 444, 454, 455, 472, 474, 477, 486, Math 481, CprE 431, 458, 489

Group 1 (courses in this group require oral and written reports):

COM S 402	Computer Science Senior Project	2-3
COM S 409	Software Requirements Engineering	3
COM S 417	Software Testing	3
COM S 425	High Performance Computing for Scientific and Engineering Applications	3
COM S 430	Advanced Programming Tools	3
COM S 437	Computer Game and Media Programming	3
COM S 461	Principles and Internals of Database Systems	3
COM S 487	Network Programming, Applications, and Research Issues	3
S E 416	Software Evolution and Maintenance	3

Group 2:

COM S 412	Formal Methods in Software Engineering	3
COM S 418	Introduction to Computational Geometry	3
COM S 426	Introduction to Parallel Algorithms and Programming	4
COM S 433	Computational Models of Nanoscale Self-Assembly	3
COM S 435	Algorithms for Large Data Sets: Theory and Practice	3
COM S 440	Principles and Practice of Compiling	3
COM S 444	Bioinformatic Analysis	4
COM S 454	Distributed Systems	3
COM S 455	Simulation: Algorithms and Implementation	3
COM S 472	Principles of Artificial Intelligence	3
COM S 474	Introduction to Machine Learning	3
COM S 477	Problem Solving Techniques for Applied Computer Science	3
COM S 486	Fundamental Concepts in Computer Networking	3
MATH 481	Numerical Methods for Differential Equations	3
CPR E 431	Basics of Information System Security	3
CPR E 458	Real Time Systems	3
CPR E 489	Computer Networking and Data Communications	4

Toward satisfying requirements of the College of Liberal Arts and Sciences, the following courses should be included:

PHIL 343	Philosophy of Technology	3

SP CM 212	Fundamentals of Public Speaking	3
14 credits of Math and Statistics		14
MATH 165	Calculus I	4
MATH 166	Calculus II	4
One Statistics course from:		
STAT 305	Engineering Statistics	3
STAT 330	Probability and Statistics for Computer Science	3
STAT 341	Introduction to the Theory of Probability and Statistics I	3
At least one Math course from:		
MATH 207	Matrices and Linear Algebra	3
MATH 265	Calculus III	4
MATH 266	Elementary Differential Equations	3
MATH 267	Elementary Differential Equations and Laplace Transforms	4
MATH 304	Combinatorics	3
MATH 314	Graph Theory	3
MATH 317	Theory of Linear Algebra	4
13 credits of Natural Science:		13
This should include at least one of the following 2-course sequences and their labs:		
BIOL 211 & 211L	Principles of Biology I and Principles of Biology Laboratory I	4
BIOL 212 & 212L	Principles of Biology II and Principles of Biology Laboratory II	4
CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	5
CHEM 178 & 178L	General Chemistry II and Laboratory in College Chemistry II	4
PHYS 221	Introduction to Classical Physics I	5
PHYS 222	Introduction to Classical Physics II	5
In addition, courses from the following list can be taken to bring the natural science credits to a minimum of 13:		
ANTHR 202	Introduction to Biological Anthropology and Archaeology	3
ANTHR 307	Biological Anthropology	3
BBMB 221	Structure and Reactions in Biochemical Processes	3
BIOL 204	Biodiversity	2
BIOL 312	Ecology	4
BIOL 355	Plants and People	3
CHEM 163	College Chemistry *	4
ENT 370	Insect Biology	3
ENV S 324	Energy and the Environment	3
FS HN 167	Introduction to Human Nutrition	3
GEN 313	Principles of Genetics	3
GEN 313L	Genetics Laboratory	1
GEN 320	Genetics, Agriculture and Biotechnology	3
GEOL 100	The Earth **	3
GEOL 100L	The Earth: Laboratory	1
GEOL 101	Environmental Geology: Earth in Crisis	3
GEOL 102	History of the Earth	3
GEOL 105	Gems and Gemstones	1
GEOL 108	Introduction to Oceanography	3
GEOL 111	Geological Disasters	1
GEOL 201	Geology for Engineers and Environmental Scientists	3
GEOL 451	Applied and Environmental Geophysics	3
MAT E 215 & 215L	Introduction to Materials Science and Engineering I and Introduction to Materials Science and Engineering I - Lab	4
MTEOR 206	Introduction to Weather and Climate	3
MTEOR 301	General Meteorology	4
PSYCH 310	Brain and Behavior	3
PHYS 221 or HIGHER		

Footnotes

* CHEM 163 - 231

** GEOL 100 - 111

The following courses meet the communication proficiency requirement:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
One of the following		
ENGL 302	Business Communication	3
ENGL 305	Creative Writing: Nonfiction	3
ENGL 309	Proposal and Report Writing	3
ENGL 314	Technical Communication	3

The LAS College requires a C or better in ENGL 250. The Department requires a C or higher in the upper-level ENGL course (302, 305, 309, 314).

Students must take at least 15 credits of Computer Science courses at the 300 level or higher at Iowa State University while resident here. Computer Science transfer courses need to be a minimum grade of C or higher to be considered for course substitution.

Students must earn a C- or better in each Computer Science course which is a prerequisite to a course listed in the student's degree program.

Undergraduate Minor in Computer Science

The Department of Computer Science offers an undergraduate minor in Computer Science. The minor requires at least 16 credits in computer science courses. Com S 414 cannot be used to fulfill minor requirements.

A minimum grade of C- is required in Com S 227 and Com S 228. A minimum grade of C is required in both Com S 311 and the three credits of 300-level Computer Science courses and above. At least 6 credits of the minor must be in courses numbered 300 and above and taken at ISU with a grade of C or higher. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

COM S 227	Introduction to Object-oriented Programming	4
COM S 228	Introduction to Data Structures	3
COM S 230	Discrete Computational Structures	3
COM S 311	Design and Analysis of Algorithms	3
3 credits in ComS courses at the 300 level or above		3

Undergraduate Curriculum in Software Engineering

The Department of Computer Science, together with the Department of Electrical and Computer Engineering, also offer a curriculum leading to an undergraduate degree in Software Engineering. The Software Engineering curriculum offers emphasis areas in Software Engineering principles, process, and practice. Students may also take elective courses in Computer Engineering and Computer Science.

See Index, Software Engineering. For curriculum information, see also College of Engineering and College of Liberal Arts and Sciences.

Computer Science, B.S.

Freshman

Fall	Credits	Spring	Credits
COM S 101	0	COM S 228	3
COM S 227	4	MATH 166	4
MATH 165	4	Social Science	3
ENGL 150	3	Arts and Humanities	3
LIB 160	1	Foreign Language 102/ Elective	3-4
Foreign Language 101/ Elective	3-4		
	15-16		16-17

Sophomore

Fall	Credits	Spring	Credits
COM S 203	0	COM S 311	3
COM S 230	3	CPR E 281	4
COM S 327	3	Math elective	3-4
ENGL 250	3	Arts and Humanities	3
Natural Science	3	Social science	3
Elective	3		
	15		16-17

Junior

Fall	Credits	Spring	Credits
COM S 331	3	COM S 309	3
COM S 362	3	COM S 321	3
STAT 300-level Elective	3	COM S 342	3
SP CM 212	3	ENGL 300-level Elective	3
Natural Science	5	Natural Science	5
	17		17

Senior

Fall	Credits	Spring	Credits
COM S 352	3	COM S 400-level Elective	3
COM S 400-level Elective	3	Arts and Humanities	3
PHIL 343	3	300-level Elective	3
Social Science	3	Elective	3
	12		12

Graduate Study

The department offers graduate programs leading to degrees of Master of Science (MS) and Doctor of Philosophy (PhD) with a major in Computer Science. The Doctor of Philosophy degree may also be earned with computer science as a co-major with some other discipline. Additionally, the department offers a minor for the students majoring in other disciplines.

Established research areas include algorithms, artificial intelligence, computational complexity, computer architecture, bioinformatics, computational biology, computer networks, database systems, formal methods, information assurance, machine learning and neural networks, multimedia, operating systems, parallel and distributed computing, programming languages, robotics, and software engineering. There are also numerous opportunities for interdisciplinary research.

Typically, students beginning graduate work in Computer Science have completed a bachelor's degree or equivalent in Computer Science. However, some students with undergraduate majors in other areas, such

as Mathematical, physical, or biological science or engineering become successful graduate students in Computer Science.

For the degree Master of Science, a minimum of 31 semester credits is required. A thesis or a creative component demonstrating research and the ability to organize and express significant ideas in computer science is required.

The purpose of the doctoral program is to train students to do original research in Computer Science. Each student is also required to attain knowledge and proficiency commensurate with a leadership role in the field. The PhD requirements are governed by the student's program of study committee within established guidelines of the department and the graduate college. They include coursework (demonstrating breadth and depth of knowledge), a research skills requirement, a preliminary examination, and a doctoral dissertation and final oral examination. The department recommends that all graduate students majoring in Computer Science teach as part of their training for an advanced degree.

Courses primarily for undergraduates:

COM S 101: Orientation
Cr. R. F.S.
Introduction to the procedures and policies of Iowa State University and the Department of Computer Science, test-outs, honorary societies, etc. Issues relevant to student adjustment to college life will also be discussed. Offered on a satisfactory-fail basis only.

COM S 103: Computer Applications
Cr. 4. F.S.SS.
Introduction to computer literacy and applications. Applications: Windows, Internet browser/HTML, word processing, spreadsheets, database management and presentation software. Literacy: history of computing, structure of computers, telecommunications, computer ethics, computer crime, and history of programming languages. No prior computer experience necessary. Offered online only. Attendance at an orientation session the first week of class is required. Only one of COM S 103 and COM S 113 may count toward graduation.

COM S 104: Introduction to Programming
(1.5-1) Cr. 2. F.S.
Offered first 8 weeks and last 8 weeks. Use of personal computer and workstation operating systems and beginning programming. Project-oriented approach to computer operation and programming, including use of tools to aid in programming. Topics from computer history, using basic Windows and Unix tools, program structure, expression, variables, decision and logic, and iteration. No prior computer experience necessary.

COM S 105: Short Course in Computer Programming
Cr. 2. F.S.
Prereq: Com S 104
8-week course in programming, including instruction in syntax and semantics, of the following current programming languages.

COM S 105A: Short Course in Computer Programming: Perl
(1-2) Cr. 2. F.S.
Prereq: Com S 104
8-week course in programming using Perl.

COM S 105B: Short Course in Computer Programming: MATLAB
(2-0) Cr. 2. F.S.
Prereq: Com S 104
8-week course in programming using MATLAB.

COM S 106: Introduction to Web Programming
(3-0) Cr. 3. S.
Introduction to Web programming basics. Fundamentals of developing Web pages using a comprehensive Web development life cycle. In-depth experience with current Web design techniques such as HTML5 and cascading style sheets. Programming strategies for accessibility, usability and search engine optimization.

COM S 107: Applied Computer Programming
(3-0) Cr. 3. F.S.
Introduction to computer programming for non-majors using a language such as the Visual Basic language. Basics of good programming and algorithm development. Graphical user interfaces.

COM S 108: Applied Computer Programming II
(3-0) Cr. 3. F.S.
Prereq: Com S 107 or equivalent
Advanced programming applications in Visual Basic for non-majors. Emphasis on programming projects including sorting, file processing, database processing, web programming, and graphics and animation. Students will learn problem solving techniques and advanced programming skills to build real-world applications.

COM S 113: Introduction to Spreadsheets and Databases
(2-2) Cr. 3. F.S.SS.
Using Microsoft Excel spreadsheets and Microsoft Access databases to input, store, process, manipulate, query, and analyze data for business and industrial applications. Credit in Com S 113 may not be applied toward graduation in the COM S, S E, and CPR E majors. Only one of COM S 103 and COM S 113 may count toward graduation.

COM S 127: Introduction to Programming for Problem Solving
(3-2) Cr. 4. F.S.
Prereq: MATH 140
Introduction to computer programming with an emphasis on problem solving. Topics include: program structures, expressions, variables, decision and logic, iteration, collections, input and output. Program construction and testing. Programming assignments including games and applications. No prior programming experience necessary. This course is intended for Computer Science majors.

COM S 203: Careers in Computer Science
Cr. R. F.S.
Computer science as a profession. Introduction to career fields open to computer science majors. Relationship of coursework to careers. Presentations by computer science professionals. Offered on a satisfactory-fail basis only.

COM S 207: Fundamentals of Computer Programming
(Cross-listed with MIS). (3-1) Cr. 3. F.S.
Prereq: MATH 150 or placement into MATH 140/MATH 141/MATH 142 or higher
An introduction to computer programming using an object-oriented programming language. Emphasis on the basics of good programming techniques and style. Extensive practice in designing, implementing, and debugging small programs. Use of abstract data types. Interactive and file I/O. Exceptions/error-handling. This course is not designed for computer science, software engineering, and computer engineering majors. Credit may not be applied toward graduation for both Com S 207/ MIS 207 and Com S 227.

COM S 208: Intermediate Computer Programming
(3-1) Cr. 3. S.
Prereq: MIS/COM S 207, credit or enrollment in MATH 151, MATH 160, or MATH 165
Intermediate-level programming techniques. Emphasis on designing, writing, testing, debugging, and documenting medium-sized programs. Data structures and their uses. Dynamic memory usage. Inheritance and polymorphism. Algorithm design and efficiency: recursion, searching, and sorting. Event-driven and GUI programming. The software development process. This course is not designed for computer science, software engineering and computer engineering majors. Credit may not be applied toward the major in computer science, software engineering, or computer engineering.

COM S 227: Introduction to Object-oriented Programming
(3-2) Cr. 4. F.S.
Prereq: Placement into MATH 143, 165, or higher; recommended: a previous high school or college course in programming or equivalent experience.
Introduction to object-oriented design and programming techniques. Symbolic and numerical computation, recursion and iteration, modularity procedural and data abstraction, and specifications and subtyping. Object-oriented techniques including encapsulation, inheritance and polymorphism. Imperative programming. Emphasis on principles of programming and object-oriented design through extensive practice in design, writing, running, debugging, and reasoning. Course intended for Com S majors. Credit may not be applied toward graduation for both Com S 207 and 227.

COM S 228: Introduction to Data Structures
(3-1) Cr. 3. F.S.
Prereq: Minimum of C- in 227, credit or enrollment in MATH 165
An object-oriented approach to data structures and algorithms. Object-oriented analysis, design, and programming, with emphasis on data abstraction, inheritance and subtype polymorphism. Abstract data type specification and correctness. Collections and associated algorithms, such as stacks, queues, lists, trees. Searching and sorting algorithms. Graphs. Data on secondary storage. Analysis of algoritms. Emphasis on object-oriented design, writing and documenting medium-sized programs. This course is designed for majors.

COM S 230: Discrete Computational Structures
(3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 227 and MATH 165; ENGL 150
Concepts in discrete mathematics as applied to computer science. Logic, proof techniques, set theory, relations, graphs, combinatorics, discrete probability and number theory.

COM S 252: Linux Operating System Essentials
(3-0) Cr. 3. F.
Prereq: COM S 107 or COM S 127 or COM S 207 or COM S 227
Introduction to installation, utilization, and administration of Linux systems. Topics include open-source software, package installation and management, shell programming and command-line utilities, process and service management, account management, network configuration, file sharing, interoperation with other computers and operating systems, automation, and system security.

COM S 290: Independent Study
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor
Offered on a satisfactory-fail basis only.

COM S 290H: Independent Study: Honors
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor
Offered on a satisfactory-fail basis only.

COM S 309: Software Development Practices
(3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165
A practical introduction to methods for managing software development. Process models, requirements analysis, structured and object-oriented design, coding, testing, maintenance, cost and schedule estimation, metrics. Programming projects.

COM S 311: Design and Analysis of Algorithms
(3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228; MATH 166, ENGL 150, and COM S 230 or CPR E 310
Basic techniques for design and analysis of efficient algorithms. Sorting, searching, graph algorithms, computational geometry, string processing and NP-completeness. Design techniques such as dynamic programming and the greedy method. Asymptotic, worst-case, average-case and amortized analyses. Data structures including heaps, hash tables, binary search trees and red-black trees. Programming projects.

COM S 319: Software Construction and User Interfaces
(Cross-listed with S E). (3-0) Cr. 3. F.
Prereq: COM S 228
Basic theory of grammars, parsing. Language paradigms. State transition and table-based software design. Review of principles of object orientation, object oriented analysis using UML. Frameworks and APIs. User interface architecture, evaluation of user interface. Design of windows, menus, and commands. Introduction to formal specification and model-based software design. Introduction to domain-specific software engineering.

COM S 321: Introduction to Computer Architecture and Machine-Level Programming
(3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165; CPR E 281 and ENGL 250
Introduction to computer architecture and organization. Emphasis on evaluation of performance, instruction set architecture, datapath and control, memory-hierarchy design, and pipelining. Assembly language on a simulator.

COM S 327: Advanced Programming Techniques
(3-0) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165
Object-oriented programming experience using a language suitable for exploring advanced topics in programming. Topics include memory management, parameter passing, inheritance, compiling, debugging, and maintaining programs. Significant programming projects.

COM S 331: Theory of Computing
(Cross-listed with LING). (3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228, MATH 166, and in COM S 230 or CPR E 310; ENGL 250
Models of computation: finite state automata, pushdown automata and Turing machines. Study of grammars and their relation to automata. Limits of digital computation, unsolvability and Church-Turing thesis. Chomsky hierarchy and relations between classes of languages.

COM S 336: Introduction to Computer Graphics
(3-0) Cr. 3. F.
Prereq: COM S 327, CoReq MATH 207 or MATH 317
Basic algorithms, design, and programming of interactive computer graphics systems and hardware. Topics include 2D and 3D transformations, 3D viewing, visible surface algorithms, collision detection, illumination models, shading, ray tracing, shadows, transparency and texture mapping.

COM S 342: Principles of Programming Languages
(Cross-listed with S E). (3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165; COM S 230 or CPR E 310
Study of concepts in programming languages and major programming paradigms, especially functional programming. Special emphasis on design tradeoffs that enable students to make sound choices of programming languages for a given software development task. Programming projects.

COM S 350: Number Theory
(Cross-listed with MATH). (3-0) Cr. 3. S.
Prereq: MATH 201 or COM S 230
Divisibility, integer representations, primes and divisors, linear diophantine equations, congruences, and multiplicative functions. Applications to cryptography.

COM S 352: Introduction to Operating Systems
(3-1) Cr. 3. F.S.
Prereq: COM S 321, and COM S 327; ENGL 250
Survey of operating system issues. Introduction to hardware and software components including: processors, peripherals, interrupts, management of processes, threads and memory, deadlocks, file systems, protection, virtual machines and system organization, and introduction to distributed operating systems. Programming projects.

COM S 362: Object-Oriented Analysis and Design
(3-0) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165; ENGL 250
Object-oriented requirements analysis and systems design. Design notations such as the Unifed Modeling Language. Design Patterns. Group design and programming with large programming projects.

COM S 363: Introduction to Database Management Systems
(3-0) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165; ENGL 250
Relational, object-oriented, and semistructured data models and query languages. SQL, ODMG, and XML standards. Database design using entity-relationship model, data dependencies and object definition language. Application development in SQL-like languages and general purpose host languages with application program interfaces. Information integration using data warehouses, mediators and wrappers. Programming Projects.

COM S 398: Cooperative Education
Cr. R. Repeatable.
Prereq: Permission of department chair
Required of all cooperative students. Students must register for this course prior to commencing each work period.

COM S 402: Computer Science Senior Project
Cr. 2-3. Repeatable, maximum of 6 credits. F.S.
Students work as individuals and teams to complete the planning, design, and implementation of a significant project in the topic area. Oral and written reports. No more than 6 credits of 402A, 402B, and 402C may be used toward graduation.

COM S 402A: Computer Science Senior Project: Multimedia and Computer Gaming I
Cr. 2-3. Repeatable, maximum of 6 credits. F.S.
Prereq: COM S 437
Students conceive, plan, architect and design a computer game. Student registered in this course will work with students in ARTIS 409. Oral and written reports. No more than 6 credits of 402A, 402B, and 402C may be used toward graduation.

COM S 402B: Computer Science Senior Project: Multimedia and Computer Gaming II
Cr. 2-3. Repeatable, maximum of 6 credits. F.S.
Prereq: COM S 402A
Students implement, test, and present a completed production computer game. Students in this class will work with students in ARTIS 409. Oral and written reports. No more than 6 credits of 402A, 402B, and 402C may be used toward graduation.

COM S 402C: Computer Science Senior Project: Project in Computer Science
(0-6) Cr. 2-3. Repeatable, maximum of 6 credits. F.
Prereq: Permission of instructor
Students work as individuals and teams to complete the planning, design, and implementation of a significant project in the topic area. Oral and written reports. No more than 6 credits of 402A, 402B, and 402C may be used toward graduation.

COM S 409: Software Requirements Engineering
(Dual-listed with COM S 509). (3-0) Cr. 3. F.
Prereq: COM S 309; for graduate credit: graduate standing or permission of instructor
The requirements engineering process including identification of stakeholders requirements elicitation techniques such as interviews and prototyping, analysis fundamentals, requirements specification, and validation. Use of Models: State-oriented, Function-oriented, and Object-oriented. Documentation for Software Requirements. Informal, semi-formal, and formal representations. Structural, informational, and behavioral requirements. Non-functional requirements. Use of requirements repositories to manage and track requirements through the life cycle. Case studies, software projects, written reports, and oral presentations will be required.

COM S 410: Distributed Development of Software
(Dual-listed with COM S 510). (3-0) Cr. 3. F.
Prereq: COMS 228, COMS 309, COMS 327; for graduate credit: graduate standing or permission of instructor
Team with students at foreign universities to develop a software application. Importance of distributed development. Design for distributed development, effective processes for distributed development, and cultural issues in distributed development, organizing for distributed development, communication techniques and skills for distributed development,including oral presentations. Graduate credit requires in--depth study of concepts.

COM S 412: Formal Methods in Software Engineering
(Dual-listed with COM S 512). (Cross-listed with CPR E, S E). (3-0) Cr. 3. S.
Prereq: COM S 230 or CPR E 310; COM S 311, STAT 330; for graduate credit: graduate standing or permission of instructor
A study of formal techniques for model-based specification and verification of software systems. Topics include logics, formalisms, graph theory, numerical computations, algorithms and tools for automatic analysis of systems. Graduate credit requires in-depth study of concepts.

COM S 414: Gerontechnology in Smart Home Environments
(Dual-listed with COM S 514). (3-0) Cr. 3. F.
Prereq: COM S 227 or (COM S 207 or GERON 377 or ARTGR 271) or equivalent; for graduate credit: graduate standing or permission of instructor
An interdisciplinary course designed for students who are interested in assistive technology, pervasive computing, mobile computing and principles of universal and inclusive design for end users, in particular, the elderly population. Students will work in semester-long projects as interdisciplinary teams to apply knowledge obtained from lectures and mutual presentations. For graduate credit students are required to submit a research report and give an oral presentation.

COM S 415: Software System Safety
(Dual-listed with COM S 515). (3-0) Cr. 3. S.
Prereq: For graduate credit: graduate standing or permission of instructor
An introduction to the analysis, design, and testing of software for safety-critical and high-integrity systems. Analysis techniques, formal verification, fault identification and recovery, model checking, and certification issues. Emphasizes a case-based and systematic approach to software's role in safe systems.

COM S 417: Software Testing
(Cross-listed with S E). (3-0) Cr. 3. S.
Prereq: COM S 309; COM S 230 or CPR E 310; ENGL 250, SP CM 212
Comprehensive study of software testing, principles, methodologies, management strategies and techniques. Test models, test design techniques (black box and white box testing techniques), test adequacy criteria,integration, regression, system testing methods, and software testing tools.

COM S 418: Introduction to Computational Geometry
(Dual-listed with COM S 518). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: COM S 311 or permission of instructor; for graduate credit: graduate standing or permission of instructor
Introduction to data structures, algorithms, and analysis techniques for computational problems that involve geometry. Line segment intersection, polygon triangulation, 2D linear programming, range queries, point location, arrangements and duality, Voronoi diagrams and Delaunay triangulation, convex hulls, robot motion planning, visibility graphs. Other selected topics. Programming assignments.

COM S 421: Logic for Mathematics and Computer Science
(Cross-listed with MATH). (3-0) Cr. 3. S.
Prereq: MATH 301 or MATH 207 or MATH 317 or COM S 230
Propositional and predicate logic. Topics selected from Horn logic, equational logic, resolution and unification, foundations of logic programming, reasoning about programs, program specification and verification, model checking and binary decision diagrams, temporal logic and modal logic.

COM S 424: Introduction to High Performance Computing
(Cross-listed with CPR E, MATH). (2-2) Cr. 3. F.
Prereq: MATH 265; MATH 207 or MATH 317
UNIX, serial programming for high performance, OpenMP for high performance, shared memory parallelization. Semester project required.

COM S 425: High Performance Computing for Scientific and Engineering Applications
(Cross-listed with CPR E). (3-1) Cr. 3. S.
Prereq: COM S 311, COM S 230, ENGL 250, SP CM 212
Introduction to high performance computing platforms including parallel computers and workstation clusters. Discussion of parallel architectures, performance, programming models, and software development issues. Sample applications from science and engineering. Practical issues in high performance computing will be emphasized via a number of programming projects using a variety of programming models and case studies. Oral and written reports.

COM S 426: Introduction to Parallel Algorithms and Programming
(Dual-listed with COM S 526). (Cross-listed with CPR E). (3-2) Cr. 4. F.
Prereq: CPR E 308 or COM S 321, CPR E 315 or COM S 311
Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms.

COM S 430: Advanced Programming Tools
(3-1) Cr. 3. S.
Prereq: COM S 311, COM S 362 or COM S 363, ENGL 250, SP CM 212
Topics in advanced programming techniques and tools widely used by industry (e.g., event-driven programming and graphical user interfaces, standard libraries, client/server architectures and techniques for distributed applications). Emphasis on programming projects in a modern integrated development environment. Oral and written reports.

COM S 433: Computational Models of Nanoscale Self-Assembly
(Dual-listed with COM S 533). (3-0) Cr. 3. S.
Prereq: Minimum of C- in COM S 331 or consent of the instructor; for graduate credit: graduate standing or permission of instructor
Modeling and analysis of natural and engineered systems that spontaneously assemble themselves from small components. Topics include biomolecular self-assembly, tile assembly models, computation via self-assembly, distributed folding, origami models, and self-repair. Emphasis on mathematical methods of describing, simulating, programming, and verifying the behaviors of self-assembling systems. Graduate credit requires a written or oral report on current research.

COM S 435: Algorithms for Large Data Sets: Theory and Practice
(Dual-listed with COM S 535). (3-0) Cr. 3. S.
Prereq: COM S 228, COM S 230 or CPR E 310, COM S 311 or equivalent
Challenges involved in solving computational problems on massive data sets. Discussion of computational problems that arise in the context of web search, social network analysis, recommendation systems, and online advertising etc. Theoretical aspects include modeling the computational problems using graphs, study of similarity measures and hash functions, and design of efficient algorithms for graphs. Practical aspects include implementation and performance evaluation of the algorithms on real world data sets. Graduate credit requires a written report on current research.

COM S 437: Computer Game and Media Programming
(3-0) Cr. 3. S.
Prereq: COM S 336 or permission of instructor
Students will learn video game programming using current game engine interfaces with real hardware. Particular attention is paid to the console architecture, development environment, tool chains, 2D graphics, 3D graphics, controllers, memory management, and audio systems. Students will complete the course by writing a simple game that runs on console hardware.

COM S 440: Principles and Practice of Compiling
(Dual-listed with COM S 540). (3-1) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: COM S 331, COM S 342, ENGL 250, SP CM 212; for graduate credit: graduate standing or permission of instructor
Theory of compiling and implementation issues of programming languages. Programming projects leading to the construction of a compiler. Projects with different difficulty levels will be given for 440 and 540. Topics: lexical, syntax and semantic analyses, syntax-directed translation, runtime environment and library support. Written reports.

COM S 441: Programming Languages
(Dual-listed with COM S 541). (3-1) Cr. 3. F.
Prereq: COM S 342 or COM S 440; for graduate credit: graduate standing or permission of instructor
Survey of the goals and problems of language design. Formal and informal studies of a wide variety of programming language features including type systems. Creative use of functional and declarative programming paradigms.

COM S 444: Bioinformatic Analysis
(Cross-listed with BCB, BCBIO, BIOL, CPR E, GEN). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

COM S 454: Distributed Systems
(Dual-listed with COM S 554). (Cross-listed with CPR E). (3-1) Cr. 3. S.
Prereq: COM S 311, COM S 352; for graduate credit: graduate standing or permission of instructor
(3-1) Cr. 3. Theoretical and practical issues of design and implementation of distributed systems. The client server paradigm, inter-process communications, synchronization and concurrency control, naming, consistency and replication, fault tolerance, and distributed file systems. Graduate credit requires additional in-depth study of concepts. Programming projects and written reports.

COM S 455: Simulation: Algorithms and Implementation
(Dual-listed with COM S 555). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: COM S 311 and COM S 230, STAT 330, ENGL 150, SP CM 212; for graduate credit: graduate standing or permission of instructor
Introduction to discrete-event simulation with a focus on computer science applications, including performance evaluation of networks and distributed systems. Overview of algorithms and data structures necessary to implement simulation software. Discrete and continuous stochastic models, random number generation, elementary statistics, simulation of queuing and inventory systems, Monte Carlo simulation, point and interval parameter estimation. Graduate credit requires additional in-depth study of concepts. Oral and written reports.

COM S 461: Principles and Internals of Database Systems
(Dual-listed with COM S 561). (3-1) Cr. 3. F.
Prereq: COM S 311, ENGL 250, SP CM 212; for graduate credit: graduate standing or permission of instructor
Models for structured and semistructured data. Algebraic, first order, and user-oriented query languages. Database schema design. Physical storage, access methods, and query processing. Transaction management, concurrency control, and crash recovery. Database security. Information integration using data warehouses, mediators, wrappers, and data mining. Parallel and distributed databases, and special purpose databases. Students enrolling in Com S 561 will require additional study of advanced concepts in database systems.

COM S 472: Principles of Artificial Intelligence
(Dual-listed with COM S 572). (3-1) Cr. 3. F.
Prereq: COM S 311, COM S 230 or CPR E 310, STAT 330, ENGL 250, SP CM 212, COM S 342 or comparable programming experience; for graduate credit: graduate standing or permission of instructor
Specification, design, implementation, and selected applications of intelligent software agents and multi-agent systems. Computational models of intelligent behavior, including problem solving, knowledge representation, reasoning, planning, decision making, learning, perception, action, communication and interaction. Reactive, deliberative, rational, adaptive, learning and communicative agents and multiagent systems. Artificial intelligence programming. A research project and a written report is required for students enrolled in Com S 572.

COM S 474: Introduction to Machine Learning
(3-1) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: COM S 311, COM S 230 or CPR E 310, STAT 330, MATH 165, ENGL 250, SP CM 212, COM S 342 or comparable programming experience
Basic principles, techniques, and applications of Machine Learning. Design, analysis, implementation, and applications of learning algorithms. Topics include: statistical learning, pattern classification, function approximation, Bayesian learning, linear models, artificial neural networks, support vector machines, decision trees, instance based learning, probabilistic graphical models, unsupervised learning, selected applications in automated knowledge acquisition, pattern recognition, and data mining.

COM S 477: Problem Solving Techniques for Applied Computer Science
(Dual-listed with COM S 577). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: COM S 228; COM S 230 or CPR E 310, MATH 166, MATH 207 or MATH 317, or consent of the instructor; for graduate credit: graduate standing or permission of instructor
Selected topics in applied mathematics and modern heuristics that have found applications in areas such as geometric modeling, graphics, robotics, vision, human machine interface, speech recognition, computer animation, etc. Homogeneous coordinates and transformations, perspective projection, quaternions and rotations, polynomial interpolation, roots of polynomials, resultants, solution of linear and nonlinear equations, approximation, data fitting, Fourier series and fast Fourier transform, linear programming, nonlinear optimization, Lagrange multipliers, parametric and algebraic curves, curvature, Frenet formulas, Bezier curves. Programming components. A scholarly report is required for graduate credit.

COM S 481: Numerical Methods for Differential Equations
(Cross-listed with MATH). (3-0) Cr. 3. S.
Prereq: MATH 265 and either MATH 266 or MATH 267; knowledge of a programming language
First order Euler method, high order Runge-Kutta method, and multistep method for solving ordinary differential equations. Finite difference and finite element methods for solving partial differential equations. Local truncation error, stability, and convergence for finite difference method. Numerical solution space, polynomial approximation, and error estimate for finite element method.

COM S 486: Fundamental Concepts in Computer Networking
(3-0) Cr. 3. S.
Prereq: COM S 352
An introduction to fundamental concepts in the design and implementation of computer communication in both the wired and wireless networks, their protocols, and applications. Layered network architecture in the Internet, applications, transport, Socket APIs, network, and data link layers and their protocols, multimedia networking, and network security.

COM S 487: Network Programming, Applications, and Research Issues
(Dual-listed with COM S 587). (3-0) Cr. 3. S.
Prereq: Com S 352 or CPR E 489 or equivalent; for graduate credit: graduate standing or permission of instructor
Programming paradigms for building distributed and networking applications, including multithreaded client-server programming, socket programming, distributed object frameworks and programming suites, and web computing and security. Introduction to some on-going research issues in distributed and networking applications, including peer-to-peer computing, multimedia communications, and mobile computing and networking. A written report and an oral presentation is required for students enrolling in Com S 587.

COM S 490: Independent Study
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in computer science, permission of instructor
Offered on a satisfactory-fail basis only. No more than 9 credits of Com S 490 may be counted toward graduation.

COM S 490H: Independent Study: Honors
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in computer science, permission of instructor
Offered on a satisfactory-fail basis only. No more than 9 credits of Com S 490 may be counted toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

COM S 509: Software Requirements Engineering
(Dual-listed with COM S 409). (3-0) Cr. 3. F.
Prereq: COM S 309; for graduate credit: graduate standing or permission of instructor
The requirements engineering process including identification of stakeholders requirements elicitation techniques such as interviews and prototyping, analysis fundamentals, requirements specification, and validation. Use of Models: State-oriented, Function-oriented, and Object-oriented. Documentation for Software Requirements. Informal, semi-formal, and formal representations. Structural, informational, and behavioral requirements. Non-functional requirements. Use of requirements repositories to manage and track requirements through the life cycle. Case studies, software projects, written reports, and oral presentations will be required.

COM S 510: Distributed Development of Software
(Dual-listed with COM S 410). (3-0) Cr. 3. F.
Prereq: COMS 228, COMS 309, COMS 327; for graduate credit: graduate standing or permission of instructor
Team with students at foreign universities to develop a software application. Importance of distributed development. Design for distributed development, effective processes for distributed development, and cultural issues in distributed development, organizing for distributed development, communication techniques and skills for distributed development,including oral presentations. Graduate credit requires in--depth study of concepts.

COM S 511: Design and Analysis of Algorithms
(Cross-listed with CPR E). (3-0) Cr. 3. F.
Prereq: COM S 311
A study of basic algorithm design and analysis techniques. Advanced data structures, amortized analysis and randomized algorithms. Applications to sorting, graphs, and geometry. NP-completeness and approximation algorithms.

COM S 512: Formal Methods in Software Engineering
(Dual-listed with COM S 412). (3-0) Cr. 3. S.
Prereq: COM S 230 or CPR E 310; COM S 311, STAT 330; for graduate credit: graduate standing or permission of instructor
A study of formal techniques for model-based specification and verification of software systems. Topics include logics, formalisms, graph theory, numerical computations, algorithms and tools for automatic analysis of systems. Graduate credit requires in-depth study of concepts.

COM S 514: Gerontechnology in Smart Home Environments
(Dual-listed with COM S 414). (3-0) Cr. 3. F.
Prereq: COM S 227 or (COM S 207 or GERON 377 or ARTGR 271) or equivalent; for graduate credit: graduate standing or permission of instructor
An interdisciplinary course designed for students who are interested in assistive technology, pervasive computing, mobile computing and principles of universal and inclusive design for end users, in particular, the elderly population. Students will work in semester-long projects as interdisciplinary teams to apply knowledge obtained from lectures and mutual presentations. For graduate credit students are required to submit a research report and give an oral presentation.

COM S 515: Software System Safety
(Dual-listed with COM S 415). (3-0) Cr. 3. S.
Prereq: For graduate credit: graduate standing or permission of instructor
An introduction to the analysis, design, and testing of software for safety-critical and high-integrity systems. Analysis techniques, formal verification, fault identification and recovery, model checking, and certification issues. Emphasizes a case-based and systematic approach to software's role in safe systems.

COM S 518: Introduction to Computational Geometry
(Dual-listed with COM S 418). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: COM S 311 or permission of instructor; for graduate credit: graduate standing or permission of instructor
Introduction to data structures, algorithms, and analysis techniques for computational problems that involve geometry. Line segment intersection, polygon triangulation, 2D linear programming, range queries, point location, arrangements and duality, Voronoi diagrams and Delaunay triangulation, convex hulls, robot motion planning, visibility graphs. Other selected topics. Programming assignments.

COM S 525: Numerical Analysis of High Performance Computing
(Cross-listed with CPR E, MATH). (3-0) Cr. 3. S.
Prereq: CPR E 308 or MATH 481; experience in scientific programming; knowledge of FORTRAN or C
Introduction to parallelization techniques and numerical methods for distributed memory high performance computers. A semester project in an area related to each student's research interests is required.

COM S 526: Introduction to Parallel Algorithms and Programming
(Dual-listed with COM S 426). (Cross-listed with CPR E). (3-2) Cr. 4. F.
Prereq: CPR E 308 or COM S 321, CPR E 315 or COM S 311
Models of parallel computation, performance measures, basic parallel constructs and communication primitives, parallel programming using MPI, parallel algorithms for selected problems including sorting, matrix, tree and graph problems, fast Fourier transforms.

COM S 531: Theory of Computation
(3-0) Cr. 3. S.
Prereq: COM S 331
A systematic study of the fundamental models and analytical methods of theoretical computer science. Computability, the Church-Turing thesis, decidable and undecidable problems, and the elements of recursive function theory. Time complexity, logic, Boolean circuits, and NP-completeness. Role of randomness in computation.

COM S 533: Computational Models of Nanoscale Self-Assembly
(Dual-listed with COM S 433). (3-0) Cr. 3. S.
Prereq: Minimum of C- in COM S 331 or consent of the instructor; for graduate credit: graduate standing or permission of instructor
Modeling and analysis of natural and engineered systems that spontaneously assemble themselves from small components. Topics include biomolecular self-assembly, tile assembly models, computation via self-assembly, distributed folding, origami models, and self-repair. Emphasis on mathematical methods of describing, simulating, programming, and verifying the behaviors of self-assembling systems. Graduate credit requires a written or oral report on current research.

COM S 535: Algorithms for Large Data Sets: Theory and Practice
(Dual-listed with COM S 435). (3-0) Cr. 3. S.
Prereq: COM S 228, COM S 230 or CPR E 310, COM S 311 or equivalent
Challenges involved in solving computational problems on massive data sets. Discussion of computational problems that arise in the context of web search, social network analysis, recommendation systems, and online advertising etc. Theoretical aspects include modeling the computational problems using graphs, study of similarity measures and hash functions, and design of efficient algorithms for graphs. Practical aspects include implementation and performance evaluation of the algorithms on real world data sets. Graduate credit requires a written report on current research.

COM S 540: Principles and Practice of Compiling
(Dual-listed with COM S 440). (3-1) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: COM S 331, COM S 342, ENGL 250, SP CM 212; for graduate credit: graduate standing or permission of instructor
Theory of compiling and implementation issues of programming languages. Programming projects leading to the construction of a compiler. Projects with different difficulty levels will be given for 440 and 540. Topics: lexical, syntax and semantic analyses, syntax-directed translation, runtime environment and library support. Written reports.

COM S 541: Programming Languages
(Dual-listed with COM S 441). (3-1) Cr. 3. F.
Prereq: COM S 342 or COM S 440; for graduate credit: graduate standing or permission of instructor
Survey of the goals and problems of language design. Formal and informal studies of a wide variety of programming language features including type systems. Creative use of functional and declarative programming paradigms.

COM S 544: Fundamentals of Bioinformatics
(Cross-listed with BCB, CPR E, GDCB). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent
A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies.

COM S 549: Advanced Algorithms in Computational Biology
(Cross-listed with CPR E). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: COM S 311 and either COM S 228 or COM S 208
Design and analysis of algorithms for applications in computational biology, pairwise and multiple sequence alignments, approximation algorithms, string algorithms including in-depth coverage of suffix trees, semi-numerical string algorithms, algorithms for selected problems in fragment assembly, phylogenetic trees and protein folding. No background in biology is assumed. Also useful as an advanced algorithms course in string processing.

COM S 550: Evolutionary Problems for Computational Biologists
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: COM S 311 and some knowledge of programming
Discussion and analysis of basic evolutionary principles and the necessary knowledge in computational biology to solve real world problems. Topics include character and distance based methods, phylogenetic tree distances, and consensus methods, and approaches to extract the necessary information from sequence-databases to build phylogenetic trees.

COM S 551: Computational Techniques for Genome Assembly and Analysis
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: COM S 311 and some knowledge of programming
Introduction to practical sequence assembly and comparison techniques. Topics include global alignment, local alignment, overlapping alignment, banded alignment, linear-space alignment, word hashing, DNA-protein alignment, DNA-cDNA alignment, comparison of two sets of sequences, construction of contigs, and generation of consensus sequences. Focus on development of sequence assembly and comparison programs.

COM S 552: Principles of Operating Systems
(3-0) Cr. 3. F.
Prereq: For graduate credit: graduate standing or permission of instructor
A comparative study of high-level language facilities for process synchronization and communication. Formal analysis of deadlock, concurrency control and recovery. Protection issues including capability-based systems, access and flow control, encryption, and authentication. Additional topics chosen from distributed operating systems, soft real-time operating systems, and advanced security issues.

COM S 554: Distributed Systems
(Dual-listed with COM S 454). (Cross-listed with CPR E). (3-1) Cr. 3. S.
Prereq: COM S 311, COM S 352; for graduate credit: graduate standing or permission of instructor
(3-1) Cr. 3. Theoretical and practical issues of design and implementation of distributed systems. The client server paradigm, inter-process communications, synchronization and concurrency control, naming, consistency and replication, fault tolerance, and distributed file systems. Graduate credit requires additional in-depth study of concepts. Programming projects and written reports.

COM S 555: Simulation: Algorithms and Implementation
(Dual-listed with COM S 455). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: COM S 311 and COM S 230, STAT 330, ENGL 150, SP CM 212; for graduate credit: graduate standing or permission of instructor
Introduction to discrete-event simulation with a focus on computer science applications, including performance evaluation of networks and distributed systems. Overview of algorithms and data structures necessary to implement simulation software. Discrete and continuous stochastic models, random number generation, elementary statistics, simulation of queuing and inventory systems, Monte Carlo simulation, point and interval parameter estimation. Graduate credit requires additional in-depth study of concepts. Oral and written reports.

COM S 556: Analysis Algorithms for Stochastic Models
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: For graduate credit: graduate standing or permission of instructor
Introduction to the use of stochastic models to study complex systems, including network communication and distributed systems. Data structures and algorithms for analyzing discrete-state models expressed in high-level formalisms. State space and reachability graph construction, model checking, Markov chain construction and numerical solution, computation of performance measures, product-form models, approximations, and advanced techniques.

COM S 557: Computer Graphics and Geometric Modeling
(Cross-listed with CPR E, M E). (3-0) Cr. 3. F.
Prereq: M E 421, programming experience in C
Fundamentals of computer graphics technology. Data structures. Parametric curve and surface modeling. Solid model representations. Applications in engineering design, analysis, and manufacturing.

COM S 558: Introduction to the 3D Visualization of Scientific Data
(Cross-listed with GEOL, HCI). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Graduate-student standing in the mathematical or natural sciences or engineering; basic programming knowledge
Introduction to visualizing scientific information with 3D computer graphics and their foundation in human perception. Overview of different visualization techniques and examples of 3D visualization projects from different disciplines (natural sciences, medicine, and engineering). Class project in interactive 3D visualization using the ParaView, Mayavi, TVTK, VTK or a similar system.

COM S 561: Principles and Internals of Database Systems
(Dual-listed with COM S 461). (3-1) Cr. 3. F.
Prereq: COM S 311, ENGL 250, SP CM 212; for graduate credit: graduate standing or permission of instructor
Models for structured and semistructured data. Algebraic, first order, and user-oriented query languages. Database schema design. Physical storage, access methods, and query processing. Transaction management, concurrency control, and crash recovery. Database security. Information integration using data warehouses, mediators, wrappers, and data mining. Parallel and distributed databases, and special purpose databases. Students enrolling in Com S 561 will require additional study of advanced concepts in database systems.

COM S 567: Bioinformatics I (Bioinformatics Algorithms)
(Cross-listed with BCB, CPR E). (3-0) Cr. 3. F.
Prereq: COM S 228; COM S 330; credit or enrollment in BIOL 315, STAT 430
Biology as an information science. A review of the algorithmic principles that are driving the advances in bioinformatics and computational biology.

COM S 568: Bioinformatics II (Statistical Bioinformatics)
(Cross-listed with BCB, GDCB, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or (BIOL 315 and STAT 430), credit or enrollment in GEN 409
Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models.

COM S 569: Bioinformatics III (Structural Bioinformatics)
(Cross-listed with BBMB, BCB, CPR E, GDCB). (3-0) Cr. 3. F.
Prereq: BCB 567, BBMB 316, GEN 409, STAT 430
Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution.

COM S 570: Bioinformatics IV (Systems Biology)
(Cross-listed with BCB, CPR E, GDCB, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or COM S 311, COM S 228, GEN 409, STAT 430
Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration.

COM S 572: Principles of Artificial Intelligence
(Dual-listed with COM S 472). (3-1) Cr. 3. F.
Prereq: COM S 311, COM S 230 or CPR E 310, STAT 330, ENGL 250, SP CM 212, COM S 342 or comparable programming experience; for graduate credit: graduate standing or permission of instructor
Specification, design, implementation, and selected applications of intelligent software agents and multi-agent systems. Computational models of intelligent behavior, including problem solving, knowledge representation, reasoning, planning, decision making, learning, perception, action, communication and interaction. Reactive, deliberative, rational, adaptive, learning and communicative agents and multiagent systems. Artificial intelligence programming. A research project and a written report is required for students enrolled in Com S 572.

COM S 573: Machine Learning
(3-1) Cr. 3. S.
Prereq: For graduate credit: graduate standing or permission of instructor
Algorithmic models of learning. Design, analysis, implementation and applications of learning algorithms. Learning of concepts, classification rules, functions, relations, grammars, probability distributions, value functions, models, skills, behaviors and programs. Agents that learn from observation, examples, instruction, induction, deduction, reinforcement and interaction. Computational learning theory. Data mining and knowledge discovery using artificial neural networks, support vector machines, decision trees, Bayesian networks, association rules, dimensionality reduction, feature selection and visualization. Learning from heterogeneous, distributed, dynamic data and knowledge sources. Learning in multi-agent systems. Selected applications in automated knowledge acquisition, pattern recognition, program synthesis, bioinformatics and Internet-based information systems. Oral and written reports.

COM S 575: Computational Perception
(Cross-listed with CPR E, HCI). (3-0) Cr. 3. S.
Prereq: Graduate standing or permission of instructor
Statistical and algorithmic methods for sensing, recognizing, and interpreting the activities of people by a computer. Focuses on machine perception techniques that facilitate and augment human-computer interaction. Introduce computational perception on both theoretical and practical levels. Participation in small groups to design, implement, and evaluate a prototype of a human-computer interaction system that uses one or more of the techniques covered in the lectures.

COM S 577: Problem Solving Techniques for Applied Computer Science
(Dual-listed with COM S 477). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: COM S 228; COM S 230 or CPR E 310, MATH 166, MATH 207 or MATH 317, or consent of the instructor; for graduate credit: graduate standing or permission of instructor
Selected topics in applied mathematics and modern heuristics that have found applications in areas such as geometric modeling, graphics, robotics, vision, human machine interface, speech recognition, computer animation, etc. Homogeneous coordinates and transformations, perspective projection, quaternions and rotations, polynomial interpolation, roots of polynomials, resultants, solution of linear and nonlinear equations, approximation, data fitting, Fourier series and fast Fourier transform, linear programming, nonlinear optimization, Lagrange multipliers, parametric and algebraic curves, curvature, Frenet formulas, Bezier curves. Programming components. A scholarly report is required for graduate credit.

COM S 581: Computer Systems Architecture
(Cross-listed with CPR E). (3-0) Cr. 3. F.
Prereq: CPR E 381
Quantitative principles of computer architecture design, instruction set design, processor architecture: pipelining and superscalar design, instruction level parallelism, memory organization: cache and virtual memory systems, multiprocessor architecture, cache coherency, interconnection networks and message routing, I/O devices and peripherals.

COM S 583: Reconfigurable Computing Systems
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: Background in computer architecture, design, and organization
Introduction to reconfigurable computing, FPGA technology and architectures, spatial computing architectures such as systolic and bit serial adaptive network architectures, static and dynamic rearrangeable interconnection architectures, processor architectures incorporating reconfigurabiltiy.

COM S 586: Computer Network Architectures
(3-0) Cr. 3. F.
Prereq: COM S 511, COM S 552 or CPR E 489
Design and implementation of computer communication networks: layered network architectures, local area networks, data link protocols, distributed routing, transport services, network programming interfaces, network applications, error control, flow/congestion control, interconnection of heterogeneous networks, TCP/IP, ATM networks, multimedia communications, IP and application multicast, overlay networks, network security and web computing.

COM S 587: Network Programming, Applications, and Research Issues
(Dual-listed with COM S 487). (3-0) Cr. 3. S.
Prereq: Com S 352 or CPR E 489 or equivalent; for graduate credit: graduate standing or permission of instructor
Programming paradigms for building distributed and networking applications, including multithreaded client-server programming, socket programming, distributed object frameworks and programming suites, and web computing and security. Introduction to some on-going research issues in distributed and networking applications, including peer-to-peer computing, multimedia communications, and mobile computing and networking. A written report and an oral presentation is required for students enrolling in Com S 587.

COM S 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Offered on a satisfactory-fail basis only.

COM S 592: Research Colloquia
Cr. 1. F.S.
Prereq: Graduate classification
Attend Computer Science Research Colloquia. Written summary is required. Offered on a satisfactory-fail basis only.

COM S 598: Graduate Internship
Cr. R. Repeatable. F.S.SS.
Prereq: Graduate Classification
Supervised internship working in professional settings appropriate to the student's degree program. Academic work under faculty supervision.

COM S 599: Creative Component
Cr. 1-3.
Creative component for nonthesis option of Master of Science degree. Offered on a satisfactory-fail basis only.

Courses for graduate students:

COM S 610: Seminar
Cr. arr.
Offered on a satisfactory-fail basis only.

COM S 611: Advanced Topics in Analysis of Algorithms
(3-0) Cr. 3. Repeatable. Alt. S., offered odd-numbered years.
Prereq: COM S 511, COM S 531
Advanced algorithm analysis and design techniques. Topics include graph algorithms, algebraic algorithms, number-theoretic algorithms, randomized and parallel algorithms. Intractable problems and NP-completeness. Advanced data structures.

COM S 612: Distributed Algorithms
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: COM S 511 or COM S 531
The theory of distributed computation. Algorithms, lower bounds and impossibility results. Leader Elections, mutual exlusion, consensus and clock synchronization algorithms. Synchronous, asynchronous and partially synchronous distributed systems models. Shared memory and message passing systems. Fault-tolerance and randomization. Broadcast and multicast. Wait-free object simulations. Distributed shared memory.

COM S 626: Parallel Algorithms for Scientific Applications
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: CPR E 526
Algorithm design for high-performance computing. Parallel algorithms for multidimensional tree data structures, space-filling curves, random number generation, graph partitioning and load balancing. Applications to grid and particle-based methods and computational biology.

COM S 631: Advanced Topics in Computational Complexity
(3-0) Cr. 3. Repeatable. Alt. F., offered even-numbered years.
Prereq: COM S 531
Advanced study in the quantitative theory of computation. Time and space complexity of algorithmic problems. The structure of P, NP, PH, PSPACE, and other complexity classes, especially with respect to resource-bounded reducibilities and complete problems. Complexity relative to auxiliary information, including oracle computation and relativized classes, randomized algorithms, advice machines, Boolean circuits. Kolmogorov complexity and randomness.

COM S 633: Advanced Topics in Computational Randomness
(3-0) Cr. 3. Repeatable. Alt. F., offered odd-numbered years.
Prereq: COM S 531
Advanced study of the role of randomness in computation. Randomized algorithms, derandomization, and probabilistic complexity classes. Kolmogorov complexity, algorithmic information theory, and algorithmic randomness. Applications chosen from cryptography, interactive proof systems, computational learning, lower bound arguments, mathematical logic, and the organization of complex systems.

COM S 634: Theory of Games, Knowledge and Uncertainty
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: COM S 330
Fundamentals of Game Theory: individual decision making, strategic and extensive games, mixed strategies, backward induction, Nash and other equilibrium concepts. Discussion of Auctions and Bargaining. Repeated, Bayesian and evolutionary games. Interactive Epistemology: reasoning about knowledge in multiagent environment, properties of knowledge, agreements, and common knowledge. Reasoning about and representing uncertainty, probabilities, and beliefs. Uncertainty in multiagent environments. Aspects and applications of game theory, knowledge, and uncertainty in other areas, especially Artificial Intelligence and Economics, will be discussed.

COM S 641: Advanced Topics in Programming Language Semantics
(3-0) Cr. 3. Repeatable. Alt. S., offered even-numbered years.
Prereq: COM S 531, COM S 541
Operational and other mathematical models of programming language semantics. Type systems and their soundness. Applications of semantics on areas such as program correctness, language design or translation.

COM S 652: Advanced Topics in Distributed Operating Systems
(3-0) Cr. 3. Repeatable. Alt. F., offered odd-numbered years.
Prereq: COM S 552
Concepts and techniques for network and distributed operating systems: Communications protocols, processes and threads, name and object management, synchronization, consistency and replications for consistent distributed data, fault tolerance, protection and security, distributed file systems, design of reliable software, performance analysis.

COM S 657: Advanced Topics in Computer Graphics
(3-0) Cr. 3. Repeatable, maximum of 2 times. Alt. F., offered even-numbered years.
Prereq: COM S 228, I E 557/M E 557/CPR E 557/COM S 557
Modern lighting models: Rendering Equation, Spherical Harmonics, Lafortune, Cook-Torrance. Non-polygonal primitives: volumes, points, particles. Textures: filtering, reflections creation. Graphics hardware: pipeline, performance issues, programmability in vertex and fragment path. Per-pixel lighting. Nonphotorealistic rendering. Radiosity; Ray tracing.

COM S 661: Advanced Topics in Database Systems
(3-0) Cr. 3. Repeatable. Alt. F., offered even-numbered years.
Prereq: COM S 461 or COM S 561
Advanced topics chosen from the following: database design, data models, query systems, query optimization, incomplete information, logic and databases, multimedia databases; temporal, spatial and belief databases, semistructured data, concurrency control, parallel and distributed databases, information retrieval, data warehouses, wrappers, mediators, and data mining.

COM S 672: Advanced Topics in Computational Models of Learning
(3-0) Cr. 3. Repeatable. Alt. S., offered even-numbered years.
Prereq: COM S 572 or COM S 573 or COM S 472 or COM S 474
Selected topics in Computational Learning Theory (PAC learning, Sample complexity, VC Dimension, Occam Learning, Boosting, active learning, Kolomogorov Complexity, Learning under helpful distributions, Mistake Bound Analysis). Selected topics in Bayesian and Information Theoretic Models (ML, MAP, MDL, MML). Advanced statistical methods for machine learning. Selected topics in reinforcement learning.

COM S 673: Advanced Topics in Computational Intelligence
(3-0) Cr. 3. Repeatable. Alt. S., offered odd-numbered years.
Prereq: COM S 572 or COM S 573 or COM S 472 or COM S 474
Advanced applications of artificial intelligence in bioinformatics, distributed intelligent information networks and the Semantic Web. Selected topics in distributed learning, incremental learning, multi-task learning, multi-strategy learning; Graphical models, multi-relational learning, and causal inference; statistical natural language processing; modeling the internet and the web; automated scientific discovery; neural and cognitive modeling.

COM S 681: Advanced Topics in Computer Architecture
(Cross-listed with CPR E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: CPR E 581. Repeatable with Instructor permission
Current topics in computer architecture design and implementation. Advanced pipelining, cache and memory design techniques. Interaction of algorithms with architecture models and implementations. Tradeoffs in architecture models and implementations.

COM S 699: Research
Cr. arr. Repeatable.
Prereq: Approval of instructor
Offered on a satisfactory-fail basis only.

Criminal Justice Studies

The Criminal Justice Studies program in the College of Liberal Arts and Sciences offers a Bachelor of Arts degree and a minor in Criminal Justice Studies.

Students in this major will learn about the components of the juvenile and criminal justice systems, become acquainted with the issues affecting these systems, apply theoretical concepts to real-world phenomena, interface with criminal justice and social service providers, and plan an academic and/or applied career in criminal justice.

Graduates of this program will understand and deomonstrate:

- Understand theories of crime, victimization, and criminal justice (i.e., theories about social bonds, learning, social control, conflict, labeling, rehabilitation, alternatives to incarceration).
- Think critically about crime, victimization, and criminal justice (i.e., be able to apply, critique, compare, and integrate knowledge in the area).
- Understand how race/ethnicity, gender, wealth, and power are related to crime, victimization, and criminal justice.
- Understand and be able to use basic social science research methods, as well as those most relevant to the study of crime, victimization, and criminal justice.
- Be familiar with career paths in the criminal justice system, and make career choices that best fit their career interests.
- Make appropriate decisions, think creatively and be able to express themselves in written and oral communication to supervisors and clients.

University Requirements:

International Perspective	3
US Diversity	3
Total Credits	6

Communication Proficiency: Majors must complete both ENGL 150 Critical Thinking and Communication and ENGL 250 Written, Oral, Visual, and Electronic Composition (LAS College requires C or better in ENGL 250). In addition, majors must also take an advanced course in ENGL 302 Business Communication or ENGL 309 Proposal and Report Writing or ENGL 314 Technical Communication with a grade of C or better.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
ENGL 302, 309, or 314		3
Total Credits		10

World Languages and Cultures:

3 years of H.S.

SPAN 097	Accelerated Spanish Review	0
2 semesters at the college level		8
Total Credits		8

General Education Coursework:

Students must select from a variety of LAS approved general education courses in each area listed below. A full list of approved courses can be found at https://las.iastate.edu/students/academics/general-education/.

Arts and Humanities	12
Math	3
Natural Sciences	8
Social Sciences	9
Total Credits	32

A program of study that meets the needs and interests of the student and departmental requirements will be developed in consultation with the major adviser. Students must maintain a GPA of 2.0 or higher in their core courses. Program of study will include:

SOC 115	Orientation to Sociology	1
CJ ST 240	Introduction to the U.S. Criminal Justice System	3
CJ ST 241	Youth and Crime	3

CJ ST 340	Deviant and Criminal Behavior	3
CJ ST 341	Criminology	3
CJ ST 403	Criminal Offenders	3
CJ ST 460	Criminal and Juvenile Justice Practicum	3-9
Select one of the following courses		
CJ ST 320	American Judicial Process	3
CJ ST 332	Philosophy of Law	3
CJ ST 339	Liberty and Law in America	3
PSYCH 383	Psychology and Law	3
Select 5 of the following courses		
CJ ST 320	American Judicial Process	3
CJ ST 332	Philosophy of Law	3
CJ ST 339	Liberty and Law in America	3
CJ ST 351	Police and Society	3
CJ ST 352	Punishment, Corrections, and Society	3
CJ ST 402	White-Collar Crime	3
CJ ST 410	Capital Punishment	3
CJ ST 484	Topical Studies in Criminal and Juvenile Justice	3
PSYCH 383	Psychology and Law	3
ANTHR 424	Forensic Anthropology	3

Criminal Justice, B.A.

Freshman

Fall	Credits	Spring	Credits
SOC 115	1	ENGL 250	3
LIB 160	1	CJ ST 241	3
ENGL 150	3	Humanities choice	3
CJ ST 240	3	Social Science choice	3
Social Science choice	3	Natural Science choice	3
Humanities choice	3		
	14		15

Sophomore

Fall	Credits	Spring	Credits
CJ ST 340	3	CJ ST 341	3
World Languages and Cultures	4	World Language and Cultures	4
Humanities choice	3	Math choice	3
Natural Science	3	International Perspectives	3
Elective	3	Elective	3
	16		16

Junior

Fall	Credits	Spring	Credits
CJ ST 403	3	Criminal Justice Studies Special Topics	3
Criminal Justice Studies Special Topics	3	Criminal Justice Studies Special Topics	3
ENGL 302 or 309 or 314	3	Humanities choice	3
Social Science choice	3	Natural Science	2
Elective	3	Elective	3
	15		14

Senior

Fall	Credits	Spring	Credits
CJ ST 320 or CJ ST 332 or CJ ST 339 or PSYCH 383	3	CJ ST 460	3
Criminal Justice Studies Special Topics	3	Criminal Justice Studies Special Topics	3
U.S. Diversity	3	Elective	3
Elective	3	Elective	3
Elective	3	Elective	3
	15		15

Total Credits: 120

The Criminal Justice Studies minor offers an opportunity for students to learn about the components of the criminal and juvenile justice systems, to become acquainted with the issues and problems affecting these systems, to apply theoretical concepts to real world problems, and to plan a career in the criminal justice field.

Students who declare a minor in Criminal Justice Studies are required to complete 18 total credits. Students may do up to nine credits of CJ ST 460 but only three of those credits may be applied to the minor. Nine credits must be at the 300 or 400 level. Students must have a minimum grade point average of 2.0 in courses for the minor.

CJ ST 240	Introduction to the U.S. Criminal Justice System	3
CJ ST 460	Criminal and Juvenile Justice Practicum	3
Four additonal CJ ST classes		12
Total Credits		18

Courses primarily for undergraduates:

CJ ST 240: Introduction to the U.S. Criminal Justice System
(3-0) Cr. 3. F.
Provides systematic overview of law, police organization and behavior, prosecution and defense, sentencing, the judiciary, community corrections, penology, and capital punishment. The course demonstrates the role of discretion in all of these agencies as well as the sociological influences of age, race, gender, and social class on criminal justice system processes.

CJ ST 241: Youth and Crime
(Cross-listed with SOC). (3-0) Cr. 3. F.
An examination of delinquency that focuses on the relationship between youth as victims and as offenders, social and etiological features of delinquency, the role of the criminal justice system, delinquents' rights, and traditional and alternative ways of dealing with juvenile crime.

CJ ST 320: American Judicial Process
(Cross-listed with POL S). (3-0) Cr. 3. S.
Prereq: POL S 215
An overview of the American judicial process. Emphasis on specific topics such as application of constitutional rights to the states (particularly the Fourth, Fifth, Sixth, and Fourteenth Amendments), mechanics of judicial opinions, constitutional philosophies of Supreme Court Justices, decisions of first impression, and the value and scope of precedent.

CJ ST 332: Philosophy of Law
(Cross-listed with PHIL). (3-0) Cr. 3. F.S.
Prereq: PHIL 201 or PHIL 230
Extent of our obligation to obey the law; what constitutes just punishment; how much of the immoral should be made illegal? Relation of these questions to major theories of law and the state. Discussion of such concepts as coercion, equality, and responsibility.

CJ ST 339: Liberty and Law in America
(Cross-listed with PHIL, POL S). Cr. 3.
Prereq: Sophomore status
An exploration of competing conceptions of liberty in American political thought and debates about how liberty should be protected by the law. Contemporary debates about topics such as health care, drugs, property, speech, religion, and sex.

CJ ST 340: Deviant and Criminal Behavior
(Cross-listed with SOC). (3-0) Cr. 3. S.SS.
Prereq: SOC 134 or CJ ST 240
Theory and research on the etiology of types of social deviance; issues relating to crime, antisocial behavior and social policies designed to control deviant behavior.

CJ ST 341: Criminology
(3-0) Cr. 3. F.
Prereq: CJ ST 240
The nature of crime and criminology; the concept of crime; statistics and theories of criminality; major forms of crime; official responses to crime and control of crime.

CJ ST 351: Police and Society
(3-0) Cr. 3. F.S.
Prereq: CJ ST 241, SOC 241 or CJ ST 240
Introduction and overview of law enforcement in the United States. Theory and research on police history, function, and organization; constitutional issues of policing; and critical topics, such as community policing, officer discretion and decision-making, corruption, use of force, and racial profiling. The course illustrates the interconnections between communities, police organizations, citizens, and criminal offenders.

CJ ST 352: Punishment, Corrections, and Society
(3-0) Cr. 3. F.S.
Prereq: CJ ST 241, SOC 241 or CJ ST 240
Introduction and overview of corrections in the United States. Theory and research on probation, parole, intermediate sanctions, prison, inmate society, inmate behavior and misconduct, capital punishment, recidivism, correctional treatment, rehabilitation, and offender reintegration into society.

CJ ST 402: White-Collar Crime
(3-0) Cr. 3. S.
Prereq: CJ ST 241, SOC 241 or CJ ST 240
Introduction and overview of white-collar crime as a form of deviance. Theory and research on occupational, corporate, and organizational offending; prevalence, costs, and consequences of white-collar crime; predictors and correlates of white-collar crime; and political, business, and public policy responses to white-collar crime.

CJ ST 403: Criminal Offenders
(3-0) Cr. 3. F.S.
Prereq: CJ ST 240 or CJ ST 241
Introduction and overview of criminal offenders. Theory and research on epidemiology, offender typologies, etiology of violence, recidivism, societal costs, correctional supervision, treatment, and prevention of serious antisocial behavior.

CJ ST 410: Capital Punishment
(3-0) Cr. 3.
Prereq: CJ ST 240
History, philosophy, demographics, administration, and punishment rationales of capital punishment in the United States from its founding to the present. Methods of execution and trends in public opinion about the death penalty. Examination of correlates of capital offending and criminological characteristics of persons who are sentenced to death.

CJ ST 460: Criminal and Juvenile Justice Practicum
(Cross-listed with SOC). Cr. 3-12. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Junior or senior classification; permission of criminal justice studies coordinator; major or minor in criminal justice or sociology
Study of the criminal and juvenile justice systems and social control processes. Supervised placement in a police department, prosecutor's office, court, probation and parole department, penitentiary, juvenile correctional institution, community-based rehabilitation program, or related agency. Assessed service learning component. Offered on a satisfactory-fail basis only. No more than a total of 9 credits of 460 can be counted toward graduation. No credits in Soc 460 may be used to satisfy minimum sociology requirements for sociology majors.

CJ ST 484: Topical Studies in Criminal and Juvenile Justice
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in CJ ST and permission from instructor
Thematic or topical issues and studies dealing with the sociology of police, judiciary, institutional and community-based corrections, gender/ethnicity and crime/delinquency, criminal and delinquent gangs, and crime and delinquency prevention.

Earth Science

The Earth Science major is a broad program that typically emphasizes an interdisciplinary field. Programs leading to the bachelor of science may be individually designed but will include required courses in Geology and Meteorology, and required supporting work in chemistry, physics, and mathematics. Specific programs have been designed for students interested in a geology, meteorology, or an environmental earth science emphasis. Programs leading to the bachelor of arts for earth science teaching are available. The latter program must satisfy the requirements of the Teacher Education Program.

Communication Proficiency requirement: The LAS College requires a C or better in ENGL 250. The department requires a grade of C or better in ENGL 309, ENGL 314, ENGL 302 or JL MC 347.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	
One of the following:		3
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
ENGL 302	Business Communication	
JL MC 347	Science Communication	
Total Credits		9

Earth Science, B.A.

Freshman

Fall	Credits	Spring	Credits	Summer	Credits
ENGL 150	3	GEOL 102	3	World Language if needed	8
LIB 160	1	GEOL 102L	1		
GEOL 100	3	CHEM 178	3		
GEOL 100L	1	CHEM 178L	1		
CHEM 177	4	ASTRO 120	3		
CHEM 177L	1	MTEOR 206	3		
MATH 151 or 160 or 165 or 181	3-4	HIST 222 or POL S 215	3		
		C I 219	1		
	16-17		18		8

Sophomore

Fall	Credits	Spring	Credits
ENGL 250	3	GEOL 365	3
GEOL 315	3	GEOL 356	4
GEOL 315L	1	PHYS 112	5
GEOL 316	2	C I 202	3
PHYS 111	5	PSYCH 230 or HD FS 102	3
ASTRO 150	3	C I 280M	2
C I 204	3	**Apply to Teacher Education Program 1st week**	

Take PRAXIS-I by October 15			
	20	20	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
GEOL 368	4	ENGL 309 or 302 or 314 or JL MC 347	3	GEOL 302	6
C I 333	3	COMST 102 or SP CM 212 or SP CM 313 or THTHR 358	3		
Humanities Choice[1]	3	C I 419	3		
C I 347	3	C I 468K	2		
C I 418	3	Humanities Choice	3		
C I 468J	2	COM S 107 or STAT 101 or STAT 104	3		
	18		17		6

Senior

Fall	Credits	Spring	Credits
C I 406	3	C I 417J	14
Humanities Choice	3		
Geology Choice	3		
Social Science/ Humanities Choice[1]	3		
SP ED 401	3		
Biology Choice[2]	3		
Apply to Student Teach.			
	18		14

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 300/400 level in addition to the LAS world language and cultures requirement.

1 Choice depends on whether American History (humanities) or American Government (Social Science) was chosen earlier.

2 Choose from list of approved courses available from an adviser.

Earth Science, B.S.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	GEOL 102	3
GEOL 100	3	GEOL 102L	1
GEOL 100L	1	CHEM 178	3
CHEM 177	4	CHEM 178L	1
CHEM 177L	1	MATH 166 or 182	4
MATH 165 or 181	4	Arts-and-Humanities Choice	3
LIB 160	1		
	17		15

Sophomore

Fall	Credits	Spring	Credits
ENGL 250	3	GEOL 365	3
GEOL 315	3	Arts-and-Humanities Choice	3
GEOL 315L	1	PHYS 112	5
GEOL 316	2	STAT 101 or 104	3-4
PHYS 111	5	MTEOR 206	3
COM S 107	3		
	17		17-18

Junior

Fall	Credits	Spring	Credits	Summer	Credits
GEOL 479	3	GEOL 356	4	GEOL 302	6
GEOL 368	4	Foreign Language	3-4		

Agron/ Astronomy/ EnSci Choice[1]	3	Agron/ Astronomy/ EnSci Choice[1]	3	
Foreign Language	3-4	Social-Science Choice	3	
	13-14		13-14	6

Senior				
Fall	**Credits**	**Spring**	**Credits**	
Agron/ Astronomy/ EnSci Choice[1]	2	Electives	9	
Arts-and-Humanities Choice	3	Arts-and-Humanities Choice	3	
Social Science Choice	3	Social-Science Choice	3	
ENGL 309 or 302 or 314 or JL MC 347	3			
Elective	3-4			
	14-15		15	

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 300/400 level. At least 8 credits in the major from 300+ courses must earn grade C or better. The average grade of all courses in the major must be 2.0 or higher. You must also complete the LAS foreign language requirement.

[1] Choose from list of approved courses available from an adviser or departmental office.

Economics

The department offers coursework for the degrees of bachelor of science with three different majors: agricultural business, business economics, and economics. A minor in agricultural business and a minor in economics are also possible. In addition, the department participates in four interdepartmental programs: international agriculture and global resources systems offered by the College of Agriculture and Life Sciences, and international studies and women's studies offered by the College of Liberal Arts and Sciences. For further discussion of programs in agricultural business, see the statement below under College of Agriculture and Life Sciences. For programs in business economics, see the statement below under College of Business. For programs in economics, see the statement below under College of Liberal Arts and Sciences. Visit our web site at www.econ.iastate.edu (http://www.econ.iastate.edu).

Graduates of the Department of Economics learn skills that distinguish them from other graduates. Economics teaches the abilities to think and reason clearly, to address complex issues using tools and decision-making models of economics, mathematics, and statistics, as well as concepts from the biological, physical, and social sciences. The study of Economics also helps students develop understanding of the interaction of technology, human activity, and the environment, learn to apply economic and business concepts associated with making “optimal” choices among economic alternatives, and communicate them, using a variety of means, to other professionals, collective organizations, governments, and the general public.

Economics provides a foundation for for graduate work in law, economics, and business. It also provides students the tools of critical analysis and human relations skills that are essential for being an informed citizen and getting and keeping meaningful employment.

1. College of Agriculture and Life Sciences

1.1. Major - Agricultural Business

The major in agricultural business prepares students for advanced studies and for careers in agricultural finance, management in agricultural supply and marketing industries, commodity merchandising and research, business research and management, farm and ranch operations, commercial farm management and appraisal, agricultural sales and marketing, agricultural reporting and public relations, agricultural extension, international activities, and government service. A major in agricultural business with a minor in economics is not permitted; however, a double major in agricultural business and economics is permitted.

Students majoring in agricultural business often choose elective coursework leading to minors in the College of Business or in the College of Agriculture and Life Sciences, or emphasizing specific areas within agricultural business such as finance, management, commodity analysis, research, agricultural sales and marketing, environmental economics, farm and ranch operations, international economics, agricultural extension, or government service.

The major in agricultural business requires a minimum of 120 credits and a GPA of 2.00 or higher. Only 65 credits (which may include up to 16 technical credits) from a two-year institution may apply to the degree. At

least 18 credits must be earned from courses taught by the Department of Economics at ISU, with at most 9 P-NP credits of free electives. The major in agricultural business requires:

International Perspective: 3 cr. from approved course list (http://tinyurl.com/bzbmvy9).
U.S. Diversity: 3 cr. from approved course list (http://tinyurl.com/atq6kpj).
Communication/Library: 13 cr.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
One of the following		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
One of the following		3
SP CM 212	Fundamentals of Public Speaking	
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
LIB 160	Information Literacy	1
Communication Proficiency Requirement: A grade of C or better in ENGL 250, a C or better in either ENGL 150 or (ENGL 302 or ENGL 309 or ENGL 314), and a C or better in the speech fundamentals course (SP CM 212 or AGEDS 311).		
Total Credits		13

Humanities and Social Sciences: 6 cr.

ECON 102	Principles of Macroeconomics	3
Three credits from approved course list (www.agstudent.iastate.edu/humanities.htm).		3

Ethics: 3 cr. from approved course list (www.agstudent.iastate.edu/ethics.htm (http://www.agstudent.iastate.edu/ethics.htm)**)**
Life Sciences: 6 cr.

One of the following		3
BIOL 101	Introductory Biology	
BIOL 211	Principles of Biology I	
Three credits from approved course list (www.agstudent.iastate.edu/life_science.htm).		3
Total Credits		6

Mathematics: 13-14 cr.

One of the following		4
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
One of the following		3-4
ECON 207	Applied Economic Optimization	
MATH 166	Calculus II	
STAT 226	Introduction to Business Statistics I	3
STAT 326	Introduction to Business Statistics II	3

Physical Sciences: 5 cr.

CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	5
Or		
PHYS 111	General Physics	5

Agricultural, Food, or Natural Resources Sciences: 6 cr. from approved course list (http://tinyurl.com/lcs25jb).
General Economics: 9-10 cr.

ECON 101	Principles of Microeconomics	3
ECON 301	Intermediate Microeconomics	3-4
One of the following		3
ECON 302	Intermediate Macroeconomics	
ECON 353	Money, Banking, and Financial Institutions	
ECON 492	Graduating Senior Survey	R

Business and Agricultural Business: 29 cr.

ACCT 284	Financial Accounting	3
FIN 301	Principles of Finance	3
Six credits from ACCT 285 or any 300-489 ACCT, FIN, MKT, MGMT, MIS, or SCM courses.		6
ECON 110	Orientation in Agricultural Business	1
ECON 235	Introduction to Agricultural Markets	3
ECON 292	Career Seminar	1
Nine credits of ECON 230-289, 300-389, 400-489 courses.		9
Three credits of 400-489 level ECON courses.		3

Electives: 22-24 cr.

Agricultural business majors seeking a double major in economics must take a minimum of 42 credits in economics. These include all of the economics courses required for the economics major. To double major in economics, agricultural business majors must also earn an average grade of C or higher in ECON 101 Principles of Microeconomics, ECON 102 Principles of Macroeconomics, and ECON 302 Intermediate Macroeconomics with no grade lower than a C-.

2. College of Business

2.1. Major - Business Economics

The major in business economics provides a high-quality education with a balanced emphasis in both business and economics. Graduates from the business economics major possess a unique mix of analytical and applied business skills well-suited for employment in upper level management and public service positions. Graduates also have solid preparation for graduate studies in law, economics, and in Master of Business Administration (MBA) programs. A double major in business economics and agricultural business is not permitted; a double major in business economics and economics is not permitted. A major in business economics with a minor in economics is not permitted. For

the undergraduate curriculum in business economics, see College of Business Business Economic Major or visit the College of Business web site at http://www.business.iastate.edu/.

3. College of Liberal Arts and Sciences

3.1. Major - Economics

The major in economics prepares students for advanced studies, professional degrees such as law and business administration, and for careers in finance, business and economic research, management, insurance, brokerage, real estate, labor relations, international development, and government service. Candidates for the bachelor of science degree with a major in economics must fulfill requirements established by the College of Liberal Arts and Sciences. (For details of undergraduate curricula in liberal arts and sciences, see College of Liberal Arts and Sciences, Curriculum.)

Students majoring in economics are required to take the following courses within the General Education Area of Natural Sciences and Mathematical Disciplines:

Choose one of the following:		7-8
MATH 165 & MATH 166	Calculus I and Calculus II	
MATH 165 & ECON 207	Calculus I and Applied Economic Optimization *	
MATH 160 & ECON 207	Survey of Calculus and Applied Economic Optimization ( )	

*Students who plan to take postgraduate work in economics should take MATH 165 and MATH 166.

Choose one of the following		6
STAT 226 & STAT 326	Introduction to Business Statistics I and Introduction to Business Statistics II	
STAT 341 & STAT 342	Introduction to the Theory of Probability and Statistics I and Introduction to the Theory of Probability and Statistics II	

Students must complete the following courses in economics:

ECON 101	Principles of Microeconomics	3
ECON 102	Principles of Macroeconomics	3
ECON 301	Intermediate Microeconomics	3-4
ECON 302	Intermediate Macroeconomics	3
ECON 371	Introductory Econometrics	4
ECON 492	Graduating Senior Survey	R
Three credits of ECON 230-289, 300-389, 400-489 courses.		3
Nine credits of 400-489 level ECON courses.		9

A minimum of 18 credits of economics coursework must be earned at Iowa State University. Economics majors must maintain a C average in ECON 101 Principles of Microeconomics, ECON 102 Principles of Macroeconomics, ECON 301 Intermediate Microeconomics, and ECON 302 Intermediate Macroeconomics with no grade lower than a C-.

Communication Proficiency Requirement: The LAS College requires a grade of C or better in ENGL 250. In addition the major in Economics requires a grade of C or better in ENGL 302 or ENGL 314.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	
ENGL 302	Business Communication	3
or ENGL 314	Technical Communication	

Optimal progress for an economics major would be to complete the principles sequence

ECON 101	Principles of Microeconomics	3
ECON 102	Principles of Macroeconomics	3
and one of the following sequences in the freshman year:		7-8
MATH 165	Calculus I	
or MATH 16(	Calculus II	
MATH 165	Calculus I	
or ECON 207	Applied Economic Optimization	
MATH 160	Survey of Calculus	
or ECON 207	Applied Economic Optimization	
The freshman-year sequences should be followed in the sophomore year by the intermediate theory sequence:		6-7
ECON 301 & ECON 302	Intermediate Microeconomics and Intermediate Macroeconomics	

STAT 226 Introduction to Business Statistics I and STAT 326 Introduction to Business Statistics II are recommended in the sophomore year.

4. Learner Outcome Goals

The Department of Economics at Iowa State University has general goals for its B.S. graduates. These goals are for students to be able to solve problems and think critically, engage in economic reasoning, demonstrate leadership skills, communicate effectively, make ethical decisions, understand the environmental impacts of human activities, meet the challenges of living and working in a culturally diverse and global community, develop a capacity for innovativeness and creativity, and value the importance of life-long learning. Regarding each of these general goals, there are more specific additional goals, namely:

1. Problem Solving/Critical Thinking:
   a. Distinguish factual statements from opinions or value judgments.
   b. Summarize, analyze, and interpret research data and policy issues.
   c. Distinguish causal relationships from correlations.
   d. Determine the accuracy of statements.
   e. Understand the usefulness of abstractions and models.
   f. Identify assumptions and detect bias.
   g. Critically evaluate their arguments and those of others.
   h. Distinguish relevant information from irrelevant information.
   i. Establish priorities.
   j. Apply a holistic approach to solving complex, issue-laden, problems.

2. Economic Reasoning:
   a. Distinguish positive ('what is') from normative ('what should be') economics.
   b. Determine the opportunity cost of alternatives.
   c. Apply the concepts of comparative advantage, specialization, and exchange to analyze resource allocation issues.
   d. Identify the conditions under which markets allocate resources efficiently or markets fail.
   e. Apply marginal economic analysis to solve problems.
   f. Conduct comparative static analyses.
   g. Pose and test hypotheses.
   h. Use scientific methods to identify optimal choices among economic alternatives.
   i. Identify decision-makers, objectives, choice variables, incentives, and constraints.
   j. Understand how conclusions depend on assumptions.

3. Leadership:
   a. Organize, facilitate, and participate effectively in a group, team, or organization.
   b. Define a problem or opportunity, implement an action planning process, work toward a goal and justify actions taken.

4. Professional, Interpersonal and Cross-cultural Communications:
   a. Communicate economic and business concepts to professionals, organizations, governments, and the general public.
   b. Obtain information by accessing electronic or traditional media, listening, or by observation.
   c. Read, listen, observe and reflect.
   d. Speak and write clearly and persuasively.
   e. Prepare and present effective visual, oral, written, and electronic presentations.

5. Ethics:
   a. Define and assess their ethical perspectives, sense of moral responsibility, and values.
   b. Identify and critically evaluate contemporary ethical and moral issues in professional and private life.

6. Environmental Awareness:
   a. Explain the physical and biological interactions within ecosystems.
   b. Explain how human activities impact the environment and how societies are affected by environmental change.

7. International/Multi-Cultural Awareness:

   U.S. Diversity – Students should achieve two of the following outcomes:
   a. Articulate how their personal life experiences and choices fit within the context of the larger mosaic of U.S. society, indicating how they have confronted and critically analyzed their perceptions and assumptions about diversity-related issues.
   b. Analyze and evaluate the contributions of various underrepresented social groups in shaping the history and culture of the U.S.
   c. Analyze individual and institutional forms of discrimination based on factors such as race, ethnicity, gender, religion, sexual orientation, class, etc.
   d. Analyze how cultural diversity and cooperation among social groups affect U.S. society.

   International Perspectives – Students should achieve two of the following outcomes:
   a. Analyze the accuracy and relevancy of their own worldviews and anticipate how people from other nations may perceive that worldview.
   b. Describe and analyze how cultures and societies around the world are formed, are sustained, and evolve.
   c. Analyze and evaluate the influence of global issues in their own lives.
   d. Describe the values and perspectives of cultures other than their own and discuss how the influence individuals' perceptions of global issues or events.
   e. Communicate competently in a second language.

8. Entrepreneurship:
   a. Demonstrate innovativeness and creativity regardless of context.
   b. Identify and pursue opportunities that produce value.
   c. Be persistent in shepherding necessary resources and managing associated risk to facilitate change.

9. Life-long Learning:
   a. Articulate how continued learning after graduation will enrich their lives.
   b. Identify and participate in new areas for learning beyond the classroom and after graduation.

1. College of Agriculture and Life Sciences

1.1. Minor - Agricultural Business

Courses to be included in the minimum of 15 credits include the following:

ECON 101	Principles of Microeconomics	3

ECON 230	Farm Business Management	3
ECON 235	Introduction to Agricultural Markets	3
ECON 301	Intermediate Microeconomics	3-4
Three credits of ECON 300-389, 400-489 courses.		3

2. College of Liberal Arts and Sciences

2.1 Minor - Economics

Courses to be included in the minimum of 15 credits are:

ECON 101	Principles of Microeconomics	3
ECON 102	Principles of Macroeconomics	3
ECON 301	Intermediate Microeconomics	3-4
Six credits of ECON 230-289, 300-389, 400-489 courses.		6

Economics, B.S.

Freshman

Fall	Credits	Spring	Credits
ECON 101	3	ECON 102	3
ENGL 150	3	ECON 207[a]	3
LIB 160	1	Arts and Humanities	3
MATH 160[a]	4	Natural Science	3
Arts and Humanites	3	Social Science	3
Natural Science	3		
	17		15

Sophomore

Fall	Credits	Spring	Credits
ECON 301	4	ECON 302	3
ENGL 250	3	STAT 326[b]	3
STAT 226[b]	3	Elective or Foreign Language	4
LAS 201 or Elective	1	Social Science	3
Elective or Foreign Language	4	Natural Science	2
	15		15

Junior

Fall	Credits	Spring	Credits
ECON 371	4	ECON 400-489	3
ECON 230-289, 300-389, or 400-489	3	Electives	9
Arts and Humanities	3	International or Diversity	3
Elective	2		
International or Diversity	3		
	15		15

Senior

Fall	Credits	Spring	Credits
ECON 400-489	3	ECON 400-489	3
ENGL 302 or 314	3	ECON 492	0
Arts and Humanities	3	Electives	10
Electives	6		
	15		13

Students in all ISU majors must complete a three-credit course in both U.S. diversity and in International Perspectives. The two courses may simultaneously meet the following graduation requirements: Social Science, Arts/Humanities, ECON 400-489, or Econ courses from approved list. Please discuss with our advisor.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level**. Three of the required 45 credits at the 300+ level must be earned in a general education group outside the group of your major. Econ majors must meet or complete the LAS foreign language requirement. In addition, Econ majors must earn a minimum of 18 credits from courses taught by the Department of Economics at ISU.

a MATH 165 (Calculus I) and MATH 166 (Calculus II) may be substituted for MATH 160 and ECON 207.

b STAT 341 (Introduction to Theory of Probability & Stats I) and STAT 342 (Introduction to Theory of Probability & Stats II) may be substituted for STAT 226 and 326.

Also see Agricultural Business.

Graduate Study

The department offers work toward the degrees master of science and doctor of philosophy with majors in economics and agricultural economics. The department also offers minors to students with majors in other departments. Visit our web site at www.econ.iastate.edu (http://www.econ.iastate.edu).

Students do not need to have an undergraduate major in economics or agricultural economics in order to qualify for graduate work in the department. However, students must have completed undergraduate coursework in macroeconomics, microeconomics, statistics, calculus, and matrix algebra. Some background in Math courses emphasizing logic and proofs is preferred, particularly for the Ph.D.

Candidates for the degree master of science (thesis option) are required to complete satisfactorily 30 credits of acceptable graduate work, including preparation of a thesis.

Candidates for the degree master of science (non-thesis option) may fulfill requirements by satisfactorily completing 32 credits of coursework, including preparation of a creative component.

Programs of study for the doctorate are organized by each student in consultation with the major professor and the individual's committee. Subject to staffing constraints, the department offers coursework to support the following fields of concentration: applied econometrics, agricultural economics, financial economics, industrial organization, international economics, human resources, macroeconomics, and environmental and resource economics. Each student must complete advanced courses in microeconomic and macroeconomic theory, quantitative methods and econometrics, and two fields from the list above. Students must demonstrate competence in theory by passing qualifying examinations. Students must also participate in workshops.

Courses primarily for undergraduates:

ECON 101: Principles of Microeconomics
(3-0) Cr. 3. F.S.SS.
Resource allocation, opportunity cost, comparative and absolute advantage. Supply and demand. Marginal analysis. Theories of production and consumption, pricing, and the market system. Perfect and imperfect competition and strategic behavior. Factor markets. Present discounted value.

ECON 101H: Principles of Microeconomics: Honors
(3-0) Cr. 3.
Prereq: Honors program students only
Resource allocation, opportunity cost, comparative and absolute advantage. Supply and demand. Marginal analysis. Theories of production and consumption, pricing, and the market system. Perfect and imperfect competition and strategic behavior. Factor markets. Present discounted value.

ECON 101L: Laboratory in Principles of Microeconomics
(0-2) Cr. 1. F.
Prereq: Concurrent enrollment in the appropriate section of ECON 101
Discussion of material typically covered in Econ 101. Application of economic principles to real world problems. Economic principles and basic business management concepts applied to decision-making in agribusiness operations.

ECON 102: Principles of Macroeconomics
(3-0) Cr. 3. F.S.SS.
Prereq: ECON 101 recommended
Measurement of macro variables and general macro identities. Classical models of full employment. Production and growth. Savings and investment. Employment and unemployment. Money, inflation, and price levels. Operation of the U.S. banking system. Fiscal and monetary policy. Elements of international finance.

ECON 102H: Principles of Macroeconomics: Honors
(3-0) Cr. 3.
Prereq: ECON 101 recommended; admission to the Honors program.
Measurement of macro variables and general macro identities. Classical models of full employment. Production and growth. Savings and investment. Employment and unemployment. Money, inflation, and price levels. Operation of the U.S. banking system. Fiscal and monetary policy. Elements of international finance.

ECON 110: Orientation in Agricultural Business
(1-0) Cr. 1. F.
Orientation course for freshman and new transfer students in agricultural business.

ECON 207: Applied Economic Optimization
(2-2) Cr. 3. F.S.
Prereq: MATH 151, MATH 160, MATH 165 or equivalent
Application of linear algebra, calculus and unconstrained and constrained optimization techniques to economic problems. Learning outcomes include the ability to (i) identify the objective, decision variables and constraints in economic decision problems, (ii) represent elements of an economic problem in simple mathematical models, (iii) identify and apply mathematical tools that can be used to solve the problems, (iv) identify the strengths and limitations of the solution method, and (v) interpret the economic meaning and implications of the solution.

ECON 230: Farm Business Management
(2-2) Cr. 3. F.S.
Prereq: ECON 101; ACCT 284
Business and economic principles applied to decision making and problem solving in the management of a farm business. Cash flow, partial, enterprise, and whole farm budgeting. Information systems for farm accounting, analysis, and control. Obtaining and managing land, capital, and labor resources. Alternatives for farm business organization and risk management.

ECON 234: Small Business Management
(3-0) Cr. 3.
Prereq: ECON 101
An introduction to small business management, entrepreneurship, and economics utilizing a series of case studies. Exploration of issues related to starting or acquiring a new business and development of knowledge and skills for successful management of a small business, with an emphasis on agricultural business.

ECON 235: Introduction to Agricultural Markets
(3-0) Cr. 3. F.S.
Prereq: ECON 101
Basic concepts and economics principles related to markets for agricultural inputs and products. Overview of current marketing problems faced by farms and agribusinesses, farm and retail price behavior, structure of markets, food marketing channels, food quality and food safety, and the role of agriculture in the general economy. The implications of consumer preferences at the farm level. Introduction to hedging, futures, and other risk management tools.

ECON 292: Career Seminar
(1-0) Cr. 1.
Prereq: Classification in economics or agricultural business
Career opportunities in the various industries and government institutions. Required training and skills needed to perform successfully in different types of careers. Factors important in finding and obtaining employment either before or after graduation including personal resumes, interviewing, and letter writing. Only one of ECON 292, 292A, and 292B can be used toward graduation.

ECON 292A: Career Seminar: Agricultural Business
(1-0) Cr. 1.
Prereq: Classification in economics or agricultural business
Career opportunities in the various industries and government institutions. Required training and skills needed to perform successfully in different types of careers. Factors important in finding and obtaining employment either before or after graduation including personal resumes, interviewing, and letter writing. Only one of ECON 292, 292A, and 292B can be used toward graduation.

ECON 292B: Career Seminar: Economics and Business Economics
(1-0) Cr. 1.
Prereq: Classification in economics or agricultural business
Career opportunities in the various industries and government institutions. Required training and skills needed to perform successfully in different types of careers. Factors important in finding and obtaining employment either before or after graduation including personal resumes, interviewing, and letter writing. Only one of ECON 292, 292A, and 292B can be used toward graduation.

ECON 297: Internship
Cr. 2. Repeatable, maximum of 4 credits.
Prereq: Permission of instructor and classification in agricultural business or economics
Students complete a research report, based on their internship or approved work experience, that examines chosen topics in management, marketing or finance. Offered on a satisfactory-fail basis only.

ECON 298: Cooperative Education
Cr. R. Repeatable.
Prereq: Permission of the department cooperative education coordinator; sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

ECON 301: Intermediate Microeconomics
(3-0) Cr. 3-4. F.S.SS.
Prereq: ECON 101; ECON 207 or MATH 166
Theory of consumer and business behavior; optimal consumption choices and demand; theory of firm behavior; costs, production, and supply; competitive and imperfectly competitive markets; theory of demand for and supply of factors of production; general equilibrium analysis. Recitation required for 4 credits.

ECON 301H: Intermediate Microeconomics: Honors
(3-0) Cr. 3-4.
Prereq: ECON 101; ECON 207 or MATH 166
Theory of consumer and business behavior; optimal consumption choices and demand; theory of firm behavior; costs, production, and supply; competitive and imperfectly competitive markets; theory of demand for and supply of factors of production; general equilibrium analysis. Recitation required for 4 credits.

ECON 302: Intermediate Macroeconomics
(3-0) Cr. 3. F.S.
Prereq: ECON 101, ECON 102; MATH 160 or MATH 165
Theory of income, employment, interest rates, and the price level; fiscal and monetary policy; budget and trade deficits; money and capital inflows, interest rates, and inflation.

ECON 302H: Intermediate Macroeconomics: Honors
(3-0) Cr. 3.
Prereq: ECON 101, ECON 102; MATH 160 or MATH 165
Theory of income, employment, interest rates, and the price level; fiscal and monetary policy; budget and trade deficits; money and capital inflows, interest rates, and inflation.

ECON 313: Economics of Sports
(3-0) Cr. 3.
Prereq: ECON 101
Application of economics to issues in sports, including franchising; rival leagues and barriers to entry; cooperative, competitive, and collusive behavior; player productivity and compensation; contracts, unions, and discrimination; antitrust, taxation, and subsidies. Economic concepts include supply and demand, labor economics, pricing, public finance, production, game theory, and industrial organization.

ECON 320: Labor Economics
(3-0) Cr. 3.
Prereq: ECON 101
Economic analysis of contemporary domestic and international labor market issues including labor supply and demand, unemployment, and employment in the U.S. and elsewhere; investments in and returns to education, training, health, immigration and migration; income inequality; labor productivity; out-sourcing and global competitiveness; work incentives; compensation including benefits; and labor policies such as minimum wages, over-time pay, discrimination, unions, and immigration. Examples drawn from the U.S. and other developed countries with reference to developing countries where relevant.
Meets International Perspectives Requirement.

ECON 321: Economics of Discrimination
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: ECON 101
Economic theories of discrimination. Analysis of the economic problems of women and minorities in such areas as earnings, occupations, and unemployment. Public policy concerning discrimination. Poverty measurement and antipoverty programs in the U.S.
Meets U.S. Diversity Requirement

ECON 330: Advanced Farm Business Management
(3-0) Cr. 3.
Prereq: ECON 230
Effective use of strategic planning, decision methods, and computer assistance for solving farm problems. Applications of economic and management theory to analyze farm business decisions using efficiency measures to assess current resource use and direct the farm business analysis, planning, and tax process.

ECON 332: Cooperatives
(3-0) Cr. 3.
Prereq: ECON 101
Survey of cooperative business structure, including historical developments in the United States, principles of cooperation, state and federal authorization for cooperative activity, economic motivations and foundations, governance, marketing and pricing strategies, and financing, capitalization and taxation considerations. Students will learn how the cooperative model is applied in a variety of markets.

ECON 334: Entrepreneurship in Agriculture
(3-0) Cr. 3. F.S.
Prereq: ECON 101
Introduction to the process of entrepreneurship within the agricultural and food sectors. Emphasis on opportunity recognition and assessment, resource acquisition and feasibility analysis for both private and social enterprises. Students will develop a comprehensive feasibility study for a new business or non-profit organization.

ECON 335: The Economics of Global Agricultural Food and Bio-energy
(Cross-listed with GLOBE). (3-0) Cr. 3.
Prereq: ECON 101
Applied economic analysis of the determinants of world agricultural production, marketing, and use in feed, food, fiber, biofuel, and other applications, and global food processing and consumption. Analysis of market case studies and various data on global agricultural production and transformation, land and resource use, demography, economic activity, nutrition and health trends.
Meets International Perspectives Requirement.

ECON 336: Agricultural Selling
(3-0) Cr. 3.
Prereq: ECON 101
Principles of selling with application to agricultural and food related businesses. Attitudes, value systems, and behavioral patterns that relate to agricultural sales. Electronic marketing, selling strategies, preparing for sales calls, making sales presentations, handling objections, and closing sales. Analysis of the buying or purchasing process. Evaluation of agri-selling as a possible career choice.

ECON 337: Agricultural Marketing
(2-2) Cr. 3.
Prereq: ECON 101 required, ECON 235 recommended
Understanding of agricultural commodity markets for grain, livestock and dairy with emphasis on marketing decisions and risk management for farmers and processors. Lab will provide hands-on applications of marketing and management tools via market simulations.

ECON 344: Public Finance
(3-0) Cr. 3.
Prereq: ECON 101
The economic role of governments in market economies. Public goods, externalities, income distribution, and income maintenance programs. The effect of taxes on economic behavior, descriptions of the structure of the principal U.S. taxes, and current reform proposals.

ECON 353: Money, Banking, and Financial Institutions
(3-0) Cr. 3. F.S.
Prereq: ECON 101, ECON 102
Theoretical and applied analysis of money, banking, and financial markets; interest rates and portfolio choice; the banking industry in transition; the money supply process; the Federal Reserve System and the conduct of monetary policy; macro implications of monetary policy; international finance.

ECON 355: International Trade and Finance
(3-0) Cr. 3.
Prereq: ECON 101, ECON 102
Explanations of causes of international trade and the impact of trade on welfare and employment patterns. Analysis of government policies towards trade, such as tariffs, quotas, and free trade areas. Theory of balance of payments and exchange rate determination, and the role of government policies. Examination of alternative international monetary arrangements.
Meets International Perspectives Requirement.

ECON 362: Applied Ethics in Agriculture
(Cross-listed with SOC). (3-0) Cr. 3.
Prereq: ECON 101 or SOC 134, junior or senior status in the College of Agriculture
Identify major ethical issues and dilemmas in the conduct of agricultural and agribusiness management and decision making. Discuss and debate proper ethical behavior in these issues and situations and the relationship between business and personal ethical behavior.

ECON 364: Rural Property Appraisal
(3-0) Cr. 3.
Prereq: ECON 101
Use of income capitalization, sales comparison and cost appraisal concepts in appraising agricultural resources. Application of underlying economic/business/management principles, especially present value, as they relate to farmland appraisal. Determination and estimation of economic impacts of special consideration and property use factors. Evaluate feasibility and profitability of investment in rural property.

ECON 371: Introductory Econometrics
(4-0) Cr. 4. F.S.
Prereq: ECON 301, ECON 302 OR ECON 353, STAT 326
Introduction to the models and methods used to estimate relationships and test hypotheses pertaining to economic variables. Among the topics covered in the course are: Single and multiple regression analysis; functional forms; omitted variable analysis; multicollinearity; heteroskedasticity; autocorrelation; simultaneous equations; and dynamic models.

ECON 376: Rural, Urban and Regional Economics
(Cross-listed with C R P). (3-0) Cr. 3.
Prereq: ECON 101
Firm location with respect to regional resources, transport, scale economies, externalities, and policies. Measures of local comparative advantage and specialization. Spatial markets. Population location considering jobs, wages, commuting, and local amenities. Business, residential, and farm land use and value. Migration. Other topics may include market failure, regulation, the product cycle, theories of rural and urban development, developmental policy, firm recruiting, local public goods and public finance, schools, poverty, segregation, and crime.

ECON 378: Retirement Planning and Employee Benefits
(Cross-listed with GERON, HD FS). (3-0) Cr. 3. S.
Prereq: 3 credits in Principles of Economics and 3 credits in Human Development and Family Studies
Economic well-being in the context of demographic change, the present and future of Social Security, family retirement needs analysis, investment strategies and characteristics of retirement plans, helping others to work towards financial security, family economic issues for retired persons. Overview of employee and retirement benefits.
Meets U.S. Diversity Requirement

ECON 380: Energy, Environmental and Resource Economics
(Cross-listed with ENV S). (3-0) Cr. 3.
Prereq: ECON 101
Natural resource availability, use, conservation, and government policy, with emphasis on energy issues. Environmental quality and pollution control policies.

ECON 385: Economic Development
(Cross-listed with GLOBE). (3-0) Cr. 3.
Prereq: ECON 101, ECON 102
Current problems of developing countries, theories of economic development, agriculture, and economic development, measurement and prediction of economic performance of developing countries, alternative policies and reforms required for satisfying basic needs of Third World countries, interrelationships between industrialized countries and the developing countries, including foreign aid.
Meets International Perspectives Requirement.

ECON 387: Economies of China and India

(3-0) Cr. 3.

Prereq: ECON 101

The economic development of China and India within the larger historical, political, and socioeconomic contexts. The characteristics of the development paths of major industries. The drivers of and impediments for future economic development. The two economies' connections with the world economy.

Meets International Perspectives Requirement.

ECON 398: Cooperative Education

Cr. R.

Prereq: Permission of the department cooperative education coordinator; junior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

ECON 401: Topics in Microeconomics

(3-0) Cr. 3.

Prereq: ECON 301, STAT 226

Advanced treatment of selected topics from one or more of the following areas: household production models, factor markets, game theory and imperfect competition, general equilibrium, intertemporal choice, asset markets, income distribution, externalities and public goods, etc.

ECON 402: Topics in Macroeconomics

(3-0) Cr. 3.

Prereq: ECON 301, ECON 302, STAT 226

Advanced treatment of selected topics from one or more of the following areas: business cycle theory, growth theory, fiscal and monetary policy, coordination issues, open economy macroeconomics, and financial economics.

ECON 416: Industrial Organization

(3-0) Cr. 3.

Prereq: ECON 301

Study of the structure of firms and markets and of their interaction, with emphasis on imperfectly competitive markets. Behavior of firms in strategic settings and insights of basic game-theoretic models. Welfare implications of alternative market organizations, consequences of market power, and scope for government regulation and antitrust/competition policies. Topics include monopoly and price discrimination, oligopoly models, product quality, product differentiation, vertical integration, information and advertising, patents, R&D and innovation, and regulation.

ECON 418: Introduction to Game Theory

(3-0) Cr. 3.

Prereq: ECON 301

Systematic introduction to game theory and its uses in economics. Develops the basic framework, models and tools necessary to analyze games of strategy, including: Strategic and extensive-form representations of games; best response functions and Nash equilibrium, mixed strategies backward induction and subgame-perfect equilibrium, imperfect and incomplete information, Bayesian and sequential equilibria. Examples and applications taken from economics, business, political science, law and biology.

ECON 431: Managerial Economics

(3-0) Cr. 3.

Prereq: ECON 301

Theory of the firm; organizational incentives and efficiency; moral hazard; role of information and decision making under uncertainty; ownership and control; business investment.

ECON 437: Commodity Marketing and Risk Management

(3-0) Cr. 3.

Prereq: ECON 235, ECON 301, STAT 326

The purpose and performance of commodity markets. How commodity marketing institutions function. Merchandising arrangements. Distinguishing features of agricultural commodities. Hedging, arbitrage, and speculation in commodity spot, forward, futures, and options markets. Valuation theory.

ECON 455: International Trade

(3-0) Cr. 3.

Prereq: ECON 301

Rigorous treatment of theories of international trade and international factor movements. Examination of the impact of trade and labor migration on domestic and world welfare and on the distribution of income. Theoretical analysis of government policies towards trade and factor movements, including quotas, tariffs, free trade areas and immigration restrictions. Discussion of contemporary issues and controversies concerning globalization, including multinational firms and labor migration.

Meets International Perspectives Requirement.

ECON 457: International Finance
(3-0) Cr. 3.
Prereq: ECON 302
National income accounting and balance of payments; foreign exchange rates and exchange rate markets; money, interest rates, and exchange rate determination; prices, exchange rates, and output in the short run; international monetary arrangements; fixed versus flexible exchange rates; optimal currency areas; international capital flows; currency and financial crises in emerging markets.
Meets International Perspectives Requirement.

ECON 458: Economic Systems for Electric Power Planning
(Cross-listed with E E). (3-0) Cr. 3.
Prereq: E E 303 or ECON 301
Evolution of electric power industry. Power system operation and planning and related information systems. Linear and integer optimization methods. Short-term electricity markets and locational marginal prices. Risk management and financial derivatives. Basics of public good economics. Cost recovery models including tax treatment for transmission investments.

ECON 460: Agricultural, Food, and Trade Policy
(Dual-listed with ECON 560). (3-0) Cr. 3.
Prereq: ECON 301 or ECON 501
Description and analysis of economic problems of U.S. agriculture. Explanation and economic analysis of government policies and programs to develop agriculture, conserve agricultural resources, address consumer food concerns, stabilize farm prices, and raise farm incomes. The influence of macropolicy, world economy, international trade, and bioenergy on U.S. agriculture.

ECON 466: Agricultural Finance
(3-0) Cr. 3.
Prereq: ECON 301, STAT 226, FIN 301 and ECON 353 (recommended)
Financial analysis of agricultural businesses; liquidity, capital structure, and growth and risk of agricultural firms; capital budgeting methods; analysis of land investments, leasing, and costs of credit; financial intermediation and major financial institutions for agriculture; borrower-lender relationships, and asset-liability management techniques by financial intermediaries; public policies affecting agricultural credit markets.

ECON 480: Intermediate Environmental and Resource Economics
(Dual-listed with ECON 580). (3-0) Cr. 3.
Prereq: ECON 301 or ECON 501
Theories of natural resource utilization and allocation. Externalities, public goods, and environmental quality. Renewable energy, biofuels, land use change and life cycle analysis of carbon, and sustainability and resource conservation. Methodologies for analyzing natural resource and environmental problems and evaluating resource policies.

ECON 490: Independent Study
Cr. 1-5. Repeatable, maximum of 6 credits.
Prereq: Junior or senior classification, 14 credits in economics
Offered on a satisfactory-fail basis only. No more than 9 credits of Econ 490 may be used toward graduation

ECON 490E: Independent Study: Entrepreneurship
Cr. 1-5. Repeatable, maximum of 6 credits.
Prereq: Junior or senior classification, 14 credits in economics
Offered on a satisfactory-fail basis only. No more than 9 credits of Econ 490 may be used toward graduation

ECON 490H: Independent Study: Honors
Cr. 1-5. Repeatable, maximum of 6 credits.
Prereq: Junior or senior classification, 14 credits in economics
Offered on a satisfactory-fail basis only. No more than 9 credits of Econ 490 may be used toward graduation

ECON 492: Graduating Senior Survey
Cr. R.
Prereq: Graduating senior
Final preparations for graduation. The final stages of job searching, interviewing, letter writing, and resume preparation. Outcomes assessment information from graduating seniors including opinion surveys, instructor/advisor/course evaluations, exit interviews, student accomplishment surveys, job placement surveys, and comprehensive skills examinations. Departmental recognition of graduating seniors. Life as an alumnus - expectations and obligations. Convocation and commencement information. Offered on a satisfactory-fail basis only.

ECON 495: Economics Domestic Travel Course
Cr. 1-3.
Prereq: Sophomore status. Permission of instructor
Tour and study of domestic businesses, markets, and economic institutions located outside Iowa to expose students to the diversity of activities within the U.S. economy. Pre-trip sessions arranged. Locations and duration of tours will vary.

ECON 496: Economics International Travel Course
Cr. 1-3. Repeatable.
Prereq: Sophomore status; permission of instructor.
Tour and study of international agricultural and/or nonagricultural economies, markets, and institutions. Locations and duration of tours will vary. Limited enrollment.
Meets International Perspectives Requirement.

ECON 498: Cooperative Education
Cr. R.
Prereq: Permission of the department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

ECON 500: Quantitative Methods in Economic Analysis I
(4-0) Cr. 4. F.
Prereq: ECON 301, 1 year of calculus, STAT 401, and permission of Director of Graduate Education
Economic applications of selected mathematical and statistical concepts: linear models and matrix algebra; differential calculus and optimization; integral calculus and economic dynamics; probability distributions, estimation, and hypothesis testing in the analysis of economic data.

ECON 501: Microeconomics
(4-0) Cr. 4. F.
Prereq: ECON 301, credit or enrollment in ECON 500 or equivalent background in calculus and statistics
The theory of the consumer, theory of the firm, perfect and imperfect competition, welfare economics, and selected topics in general equilibrium and uncertainty.

ECON 502: Macroeconomics
(4-0) Cr. 4. F.
Prereq: ECON 302, credit or enrollment in ECON 500 or equivalent background in calculus and statistics
Models of aggregate supply and demand, theories of consumption and investment, money supply and demand, inflation, rational expectations, stabilization policy, financial markets, and international finance.

ECON 509: Applied Numerical Methods in Economics
(3-0) Cr. 3.
Prereq: ECON 500, ECON 501; or ECON 600, ECON 601
Use of numerical techniques to solve economic problems. Numerical differentiation and integration numeric solutions of systems of equations, static and dynamic optimization problems including unconstrained optimization, maximum likelihood methods, general nonlinear programming methods, dynamic programming and optimal control, numerical methods for solving functional equations.

ECON 510: Experimental Economics
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 601
Introduction to experimental economics and major subject areas addressed by laboratory and field experiments. Exploration of experimental methods by concentrating on series of experiments. Applications include individual decision-making, behavioral game theory, markets, behavioral labor, public and development economics, social network, and neuroeconomics. Research project.

ECON 520: Labor Supply and Human Capital Formation
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 601
Labor supply decisions and empirical analysis for agricultural operators and other self-employed and wage-earning households; multiple job holding; resource allocation in productive households; human capital formation by households, firms, and public institutions, which includes schooling, on-the-job training, migration, health, research, raising of children, and implications for household income and welfare; applications to problems in rural areas of developing and developed countries.

ECON 521: Labor Markets
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 601
Analysis of labor demand and market determination of wages and employment; analysis of distortions in labor markets due to non-competitive forces, legislation, and discrimination; wage inequality, compensation and work incentives; compensating differentials; microeconomic analysis of unemployment and job search.

ECON 532: Managerial Economics for the Global Organization
(3-0) Cr. 3.
Prereq: ECON 101 and enrollment in MBA or BAS program; not for economics majors
Applications of microeconomic theory and decision analysis for firms operating in U.S. and internationally. Topics include demand & supply, consumer choice theory, production and cost theory, short run and long run business decisions, input cost and human capital differences across countries, empirical estimation of demand and supply, pricing, exchange rates, government and business, market structures and strategy.

ECON 537: Commodity Markets: Analysis and Strategy
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 532 or ECON 601, ECON 571 or STAT 326
Analysis of exchange-traded and over-the-counter commodity markets, their functions and performance. Evaluation of hedging, speculation, and arbitrage strategies. Commodity transformation over space and time. Valuation of derivatives and comparison with derivatives on financial assets. Efficiency and the role of information in commodity markets. Market regulation.

ECON 545: Public Economics
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 601
Optimal taxation; excess burden; partial and general equilibrium analysis of tax incidence; social insurance; effects of taxation on labor supply and savings; economics of the health sector.

ECON 560: Agricultural, Food, and Trade Policy
(Dual-listed with ECON 460). (3-0) Cr. 3.
Prereq: ECON 301 or ECON 501
Description and analysis of economic problems of U.S. agriculture. Explanation and economic analysis of government policies and programs to develop agriculture, conserve agricultural resources, address consumer food concerns, stabilize farm prices, and raise farm incomes. The influence of macropolicy, world economy, international trade, and bioenergy on U.S. agriculture.

ECON 571: Intermediate Econometrics
(3-0) Cr. 3. S.
Prereq: ECON 500
Single and multiple equation regression models; dummy explanatory variables; serial correlation; heteroskedasticity; distributed lags; qualitative dependent variables; simultaneity. Use of econometric models for tests of economic theories and forecasting.

ECON 576: Spatial Economics
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 601
Analysis of location choice by firms, employees, and households emphasizing the role of spatial variations in agglomeration economies, economies of scale, distance, transport, endowments, amenities, and local government. Models of land use, urban form, spatial competition, central place theory, and migration. Techniques of discrete choice analysis, statistical analysis of categorical data, urban system modeling, and interregional computable general equilibrium.

ECON 580: Intermediate Environmental and Resource Economics
(Dual-listed with ECON 480). (3-0) Cr. 3.
Prereq: ECON 301 or ECON 501
Theories of natural resource utilization and allocation. Externalities, public goods, and environmental quality. Renewable energy, biofuels, land use change and life cycle analysis of carbon, and sustainability and resource conservation. Methodologies for analyzing natural resource and environmental problems and evaluating resource policies.

ECON 581: Advanced Environmental Economics
(3-0) Cr. 3.
Prereq: ECON 501 or ECON 601
Interrelationships of natural resource use and the environment. Applied welfare and benefit-cost analyses. Externalities and pollution abatement. Nonmarket valuation of resources. Property rights. Legal and social constraints. Policy approaches.

ECON 590: Special Topics
Cr. 1-5. Repeatable.
Offered on a satisfactory-fail basis only.

ECON 599: Creative Component
Cr. 1-5.
Offered on a satisfactory-fail basis only.

Courses for graduate students:

ECON 600: Quantitative Methods in Economic Analysis II
(4-1) Cr. 4. F.
Prereq: ECON 500
Unconstrained and equality- and inequality-constrained optimization; the Kuhn-Tucker formulation; abstract spaces; dynamic programming; dynamical systems.

ECON 601: Microeconomic Analysis I
(4-1) Cr. 4. F.
Prereq: ECON 301, previous or concurrent enrollment in 600 and permission of Director of Graduate Education
Economic theory and methodology; theory of consumer behavior, theory of the competitive firm, supply and factor demand; duality relations in consumer and producer theory, welfare change measures; partial equilibrium analysis, perfect competition, monopoly; choice under uncertainty, the expected utility model, risk aversion; insurance, portfolio and production decisions under risk.

ECON 602: Macroeconomic Analysis
(4-1) Cr. 4. S.
Prereq: ECON 301, ECON 302, previous or concurrent enrollment in 600 and permission of Director of Graduate Education
Neoclassical aggregate growth models; the overlapping generations model; endogenous growth models; equilibrium business cycle theories; equilibrium job search and matching; models of money; fiscal and monetary policy; income and wealth distribution.

ECON 603: Microeconomic Analysis II
(4-1) Cr. 4. S.
Prereq: ECON 601, ECON 602 and permission of Director of Graduate Education
General equilibrium analysis, efficiency, and welfare; market failures, externalities, and the theory of the second best; introduction to game theory; adverse selection, signaling, screening and moral hazard.

ECON 604: Advanced Macroeconomic Analysis
(4-1) Cr. 4. F.
Prereq: ECON 601, ECON 602 and permission of Director of Graduate Education
Topics will be selected from: new Keynesian approaches to business cycle theory; endogenously generated business cycles; models of credit and financial intermediation; mechanism design and time inconsistency issues; political economy models; heterogeneous-agent models with strategic interaction; path dependence, network effects, and lock-in; economies as evolving self-organizing systems.

ECON 606: Advanced Topics in Macroeconomics
(3-0) Cr. 3.
Prereq: ECON 603, and credit or current enrollment in ECON 604
Selected topics in macroeconomic theory of current significance to the profession.

ECON 615: Theoretical Industrial Organization
(3-0) Cr. 3.
Prereq: ECON 603
Theoretical analysis of traditional topics in industrial organization. Review of game theory. Monopoly and oligopoly theory, price discrimination, product differentiation, research and development, diffusion of innovation, network externalities, and asymmetric information.

ECON 618: Game Theory
(3-0) Cr. 3.
Prereq: ECON 603, or ECON 501 and permission of instructor
Theoretical analysis and applications of strategic games, extensive form games, and cooperative games. Nash equilibrium, correlated equilibrium, Bayesian games, subgame perfect equilibrium, the core, evolutionary equilibrium, repeated games with finite automata, and common knowledge.

ECON 641: Agricultural Economics I
(3-0) Cr. 3.
Prereq: ECON 603
Demand and supply for agricultural products, market equilibrium models, implications of government policies on the agricultural sector, evaluation of research and development policies in agriculture, and biofuel and energy policy analysis. Commodity promotion programs, food safety and consumers' valuation of product attributes.

ECON 642: Agricultural Economics II
(3-0) Cr. 3.
Prereq: ECON 603
Advanced treatment of topics and models in agricultural economics with emphasis on stochastic models. Topics will include analysis of risk in decision making by consumers, firms and farms; analysis of risk management strategies for farmers; the economics of commodity storage; analysis of the impact of biofuels on commodity prices; and models of agricultural inputs and outputs.

ECON 653: Financial Economics
(3-0) Cr. 3.
Prereq: ECON 603, ECON 672. Recommended: ECON 674, StAT 551
Review of decision-making under uncertainty. Portfolio Theory. Theoretical foundations of asset valuation models: capital asset pricing model (CAPM), arbitrage pricing theory (APT), representative agent models, pricing of derivative securities. Complete and incomplete asset markets, credit markets, financial intermediaries, the role of government in the financial sector. Market frictions, crashes, bubbles. Applications of asset valuation models, with emphasis on their testable implications.

ECON 655: International Trade
(3-0) Cr. 3.
Prereq: ECON 603
Theories of international trade; welfare and distributional aspects of trade and commercial policies. Optimal trade policies in the presence of domestic distortions; strategic trade policy; international trade and economic growth.

ECON 657: International Finance
(3-0) Cr. 3.
Prereq: ECON 602
The intertemporal approach to current account determination; non-traded goods and the real exchange rate; fiscal policy in the open economy; monetary approach to balance of payments and exchange rate determination; sticky price models of the open economy; exchange-rate based stabilizations; capital inflows; financial and balance of payments crises; international business cycles.

ECON 671: Econometrics I
(4-1) Cr. 4. F.
Prereq: ECON 501 and STAT 447 or STAT 542
Probability and distribution theory for univariate and multivariate normal random variables, introduction to the theory of estimators for linear models, hypothesis testing and inference, introduction to large sample properties of estimators; derivation of common estimators and their properties for the classical and general multiple regression models, hypothesis testing, forecasting, implications of specification errors - missing data, left-out regressors, measurement error, stochastic regressors.

ECON 672: Econometrics II
(4-1) Cr. 4. S.
Prereq: ECON 671
Identification, estimation, and evaluation of systems of simultaneous equations; qualitative choice and limited dependent variable models; introduction to time series methods and applications, including alternative variance specifications.

ECON 673: Microeconometrics
(3-0) Cr. 3.
Prereq: ECON 672, ECON 601
Econometric treatment of models arising in microeconometric applications. Methods are primarily concerned with the analysis of cross-section data. Topics may include: systems of demand equations in panel data settings, random utility models of discrete choices, production possibilities frontier estimation, and discrete/continuous models of participation and consumption.

ECON 674: Macroeconometrics
(3-0) Cr. 3.
Prereq: ECON 672, ECON 602
Time-series econometric techniques and their application to macroeconomics and financial markets. Techniques may include GARCH and ARCH-M models, unit-root tests, nonlinear adjustment models, structural VARs, and cointegration tests.

ECON 680: Advanced Resource Economics
(3-0) Cr. 3.
Prereq: ECON 603
Dynamic allocation of scarce, exhaustible, and renewable natural resources, including minerals and energy, soil, water, forests, and fish. Social versus private decisions. Market and nonmarket considerations. Technological change. Regulation. Dynamics and uncertainty.

ECON 690: Advanced Topics
Cr. 1-5. Repeatable.
Offered on a satisfactory-fail basis only.

ECON 691: Third-Year Paper
Cr. 3.
Under the direction of the major professor, Ph.D. students write a formal research paper as an introduction to the dissertation research process. Offered on a satisfactory-fail basis only.

ECON 693: Workshops
Cr. 3.
Workshop in economics. Offered on a satisfactory-fail basis only.

ECON 699: Research for Thesis or Dissertation
Cr. arr. Repeatable.
Offered on a satisfactory-fail basis only.

English

Undergraduate Study

The English department curriculum teaches an understanding of the way the English language functions and how people use it to create and communicate. We teach all students the fundamental skills needed to succeed in college, at work, and as citizens. As one of the core disciplines in the liberal arts, English fosters critical thinking, leadership ability, and democratic engagement. Students interested in majoring in English can choose a

- BA in English (with possible emphases in Literature, Creative Writing, Literary Editing, or Rhetoric)
- BA in English with an emphasis in Teacher Education (required courses for licensure are indicated below)
- BS in Technical Communication.

Students interested in a BS degree in English need to complete 12 credits in addition to the general education requirements; these credits must be taken in linguistics, natural science, mathematics, social science, or selected courses in kinesiology.

Those interested in civic discourse and oral communication can also major or minor in Speech Communication (see the catalog listing Speech Communication). Students in secondary education can also earn an ESL endorsement through classes in the English Department (courses are indicated below).

An undergraduate major in English can be a solid basis for the professional study of law, medicine, theology, and business or careers in education, arts management, and publishing. An undergraduate major in Technical Communication can prepare students for careers in nonprofit and government communication, web design and communication consulting, software documentation, and scientific and technical writing and editing.

The department also provides communication courses for students across the disciplines through the ISUComm initiative. The goal of ISUComm is to strengthen student communication and enhance students' critical thinking by creating opportunities for them to practice communication skills throughout their academic careers. These courses include ENGL 150 and 250 (ISUComm foundation courses) and Engl 302, 309, and 314 (ISUComm advanced communication courses). These courses benefit all ISU undergraduates by addressing written, oral, visual, and electronic communication, or WOVE. WOVE prepares students for 21st-century communication activities.

As part of Iowa State's commitment to interdisciplinary study and cultural inclusiveness, English also has strong ties with African American Studies, American Indian Studies, Classical Studies, Latina/o Studies, Linguistics, Speech Communication, and Women's Studies. In addition to course offerings in literature, creative writing, linguistics, speech communication, rhetoric, and technical communication, the field of English Studies features strong connections with the technical, scientific, and environmental work that distinguishes Iowa State.

International students and other nonnative speakers of English can go to the Intensive English and Orientation Program (IEOP) in the department, which offers special courses in English for both undergraduate and graduate students who are native speakers of other languages. (See catalog entries under English Courses for Native Speakers of Other Languages and English Requirement for International Students.)

English Major Requirements

English majors are required to have, in addition to ISUComm foundation courses (ENGL 150 Critical Thinking and Communication and ENGL 250 Written, Oral, Visual, and Electronic Composition), at least 36 credits in English. English majors transferring from other institutions must take at least 18 of their credits in English while in residence at Iowa State.

To graduate with a major in the English Department and meet the departmental Communication Proficiency Requirement, a student must have credit for ENGL 150 Critical Thinking and Communication and earn at least a C (not C-) in ENGL 250 Written, Oral, Visual, and Electronic Composition as well as in each of the courses taken to fulfill the program of study, including one advanced communication course.

* Indicates English courses or groups required for students seeking teacher licensure

Texts and Language: Choose 5		15
ENGL 201	Introduction to Literature	3
ENGL 207	Introduction to Creative Writing	
ENGL 220	Descriptive English Grammar	
ENGL 225	Survey of British Literature to 1800 *	
ENGL 226	Survey of British Literature since 1800 *	
ENGL 227	Survey of American Literature to 1865 *	
ENGL 228	Survey of American Literature since 1865 *	
ENGL 260	Introduction to Literary Study *	
Critical Reading and Textual Analysis: Choose 2		6
ENGL 275	Analysis of Popular Culture Texts	
ENGL 310	Rhetorical Analysis *	
ENGL 339	Literary Theory and Criticism	
ENGL 350	Rhetorical Traditions	
ENGL 396	Teaching the Reading of Young Adult Literature *	
Advanced Communication: Choose 1 *		3
ENGL 302	Business Communication	
ENGL 303	Free-Lance Writing for Popular Magazines	
ENGL 304	Creative Writing: Fiction	
ENGL 305	Creative Writing: Nonfiction	
ENGL 306	Creative Writing: Poetry	
ENGL 309	Proposal and Report Writing	
ENGL 313	Rhetorical Website Design	
ENGL 314	Technical Communication	
ENGL 315	Creative Writing: Screenplays	
ENGL 316	Creative Writing: Playwriting	
Choose 4: English Electives at the 200, 300, and 400 level (does not include ENGL 250) (Students seeking teacher licensure must take 219*, 220*, 354*, and 420*.)		12
Total Credits		39

Additional Courses: All English majors must complete the following requirements, which may overlap with the core requirements:

Three credits in Literature of Social and Environment Justice (340s, 352, 355)*		3
Fifteen credits in English classes at the 300 level*		15
Nine credits in English classes at the 400 level. English Education majors need take only six credits in English classes at the 400 level.*		9
Nine credits in English classes with a historical perspective* (choose from the following or any 340s, 350s, 360s, or 370s course)		9
ENGL 225	Survey of British Literature to 1800 *	
ENGL 226	Survey of British Literature since 1800	3
ENGL 227	Survey of American Literature to 1865	3
ENGL 228	Survey of American Literature since 1865 *	
ENGL 237	Survey of Film History	
ENGL 389	Postcolonial Literature	3
ENGL 393	The History of Children's Literature	3

ENGL 395A	Study and Travel: Literature	arr †
ENGL 420	History of the English Language *	

† Arranged with instructor.

Teacher Licensure Courses

Students seeking teacher licensure in Teacher Education should consult their adviser for a complete list of courses that meet major requirements and specialized licensure requirements (see Teacher Education section in this catalog). Among those licensure requirements are the following additional courses in English:

ENGL 353	World Literature: Western Foundations through Renaissance *
ENGL 397	Practice and Theory of Teaching Writing in the Secondary Schools *
ENGL 494	Practice and Theory of Teaching Literature in the Secondary Schools *
ENGL 417	Student Teaching *

Additional course requirements outside English for students seeking teacher licensure include the following:

C I 202	Learning Technologies in the 7-12 Classroom
C I 204	Social Foundations of Education in the United States
C I 280A	Pre-Student Teaching Experience I: Core Experience
C I 395	Content Area Reading and Literacy
C I 406	Social Justice Education and Teaching: Secondary
C I 426	Principles of Secondary Education
SP ED 401	Teaching Secondary Students with Exceptionalities in General Education
PSYCH 230	Developmental Psychology
PSYCH 333	Educational Psychology
HIST or POL S	American History or Government
SP CM 212	Fundamentals of Public Speaking
or THTRE 358	Oral Interpretation

Some of these courses taken to meet licensure requirements may also meet General Education requirements for the college.

ESL Endorsement Requirements

At Iowa State University, ESL is an add-on endorsement, which means that students need to be certified in another area and to take all basic teacher preparation courses. The growing number of English learners in our public schools make the ESL endorsement a useful addition to a teaching license.

To add English as a Second Language, students must earn credits in the following courses. In some cases, relevant special topics courses or experimental courses may be substituted. Some courses have prerequisites.

ENGL 219	Introduction to Linguistics	3
OR		
ENGL 511	Introduction to Linguistic Analysis	3
ENGL 220	Descriptive English Grammar	3
ENGL 425	Second Language Learning and Teaching	3
OR		
ENGL 512	Second Language Acquisition	3
ENGL 514	Sociolinguistics	3
OR		
C I 420	Bilingualism, Bilingual Education, and U.S. Mexican Youth	3
OR		
C I 520	Bilingualism, Bilingual Education, and U.S. Mexican Youth	3
ENGL 524	Literacy: Issues and Methods for Nonnative Speakers of English	3
AND		
ENGL 518	Teaching English as a Second Language Methods and Materials	3
OR		
ENGL 525	Research and Teaching of Second Language Pronunciation	3
Appropriate curriculum and instruction substitutes for ENGL 524 (e.g., CI 378) will be considered).		
C I 280S	Pre-Student Teaching Experience I: English as a Second Language (ESL)	1
C I 480S	Pre-Student Teaching Experience III: English as a Second Language (ESL)	2

Departmental Awards and Scholarships

Each spring the English Department offers many scholarships and awards for both undergraduate and graduate students. Some undergraduate awards are for returning English and Technical Communication majors only; others are for returning students of any major who demonstrate excellence in some aspect of English or technical communication. Application forms and a list of current awards are available on the English Department website and in 206 Ross Hall early in the Spring Semester. Award winners are announced each year in April.

English Minor Requirements

The minor in English prepares students in any discipline for which communication activities are needed to succeed in their professions. Minors in English will complete 15 credits beyond ENGL 150 Critical Thinking and Communication and ENGL 250 Written, Oral, Visual, and Electronic Composition; ENGL 250 and additional courses require a grade of C or higher (not C-), 9 of which will be at the 300 or 400 levels. Twelve of these hours must be taken at Iowa State. Up to 6 of the 15 credits taken for the minor may be used to meet other degree program requirements.

English, B.A., B.S.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	Social Science Choice	3
Humanities Choice	3	Natural Science Choice	3
Social Science Choice	6	Humanities Choice	3
Foreign Language/Elective	4	Math Choice	3
LIB 160	1	Foreign Language/Elective	4
	17		16

Sophomore

Fall	Credits	Spring	Credits
ENGL 250	3	Texts & Lang. Course 200-level (Group A)*	3
Texts & Lang. Course 200-level (Group A)*	3	Crit. Reading & Text. Analysis (Group B)*	3
Natural Science Group	3	Texts & Lang. Course 200-level (Group A)*	3
Texts & Lang. Course 200-level (Group A)*	3	Natural Science Choice	3
Humanities Choice	3	ENGL 340s/352 - US Diversity*	3
	15		15

Junior

Fall	Credits	Spring	Credits
ENGL Advanced Communication (Group C)*	3	Crit. Reading & Text. Analysis (Group B)*	3
Texts & Lang. Course 200-level (Group A)*	3	ENGL Elective 400+ (Group D)*	3
ENGL Elective 300+ (Group D)*	3	Electives/Courses in Minor	6
Elective/Course for Minor	3	ENLG Elective 300+ (Group D)*	3
Humanities Choice	3		
	15		15

Senior

Fall	Credits	Spring	Credits
ENGL 400+ (Group D)*	3	Electives	12
Electives	3	ENGL 400+ (Grp D)	3
Electives/Course for Minor	7		
	13		15

* See English Adviser for a list of courses suited to major groups A, B, C, & D and other distributed requirements that must be met.

See English Adviser for a list of courses suited to major groups A, B, C, & D and other distributed requirements that must be met.

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

English, B.A. - English Education

Freshman

Fall	Credits	Spring	Credits
ENGL 150 or waiver	3	Science Choice	3
Humanities Choice	3	Humanities Choice	3
PSYCH 230	3	MATH 104, 105 or 150+, or STAT 101, 104	3
POL S 215	3	Foreign Language 102 or waiver	4
or American History selection		C I 204	3
Foreign Language 101 or waiver	4	LIB 160	1
	16		17

Sophomore

Fall	Credits	Spring	Credits
ENGL 220	3	ENGL 225-228	3
ENGL 250	3	ENGL 396	3
ENGL 260	3	Science Choice	3
ENGL 225-228	3	C I 202	3
Humanties Choice	3	ENGL 219	3
SP CM 212 or THTRE 358	3	ENGL 310 or 339	3
Maintain 2.5+ GPA		or SP CM 300+ course	
Take Praxis Exam - score must be 156 (reading), 162 (writing), 150 (math)		C I 280L	0.5

		Apply to Teacher Education Program
	18	18.5

Junior

Fall	Credits	Spring	Credits
ENGL 420	3	C I 333/PSYCH 333	3
ENGL 302-306, 309 OR 314-316	3	ENGL 340 Series	3
ENGL 354	3	SP ED 401	3
ENGL 225-228	3	ENGL 397	3
C I 395	3	ENGL 225-228	3
Science Choice	2	C I 280A	2
	17		17

Senior

Fall	Credits	Spring	Credits
ENGL 494	3	ENGL 417E	16
C I/ENGL 353	3		
C I 406	3		
C I 280A	2		
C I 426	3		
	14		16

Graduate Study

The department offers graduate work leading to three Master of Arts majors, one Master of Fine Arts major, two Doctor of Philosophy majors, and one TESL/TEFL Certificate. Information on application requirements and procedures for all of our graduate majors is available at http://www.engl.iastate.edu/graduate-students/prospective-students/how-to-apply-2/.

The Master of Arts (MA) degree programs offer advanced study of writing, language, and literature. The degree requires a minimum of 30 hours of graduate credits, including a final thesis or creative component (3 credits). Both the MA in English and the MA in TESL/Applied Linguistics have language requirements that may be fulfilled in a number of ways (students whose native language is other than English are considered to have met the language requirement after satisfying the Graduate College English requirement).

Students admitted to the MA in English choose between two areas of specialization. The Literature specialization is designed to prepare students for a variety of career paths. These include going on for a PhD; teaching at the secondary, two- and four-year college, and university levels; and working in fields such as publishing, research and administration, or non-profit organizations. The Literature and the Teaching of Reading specialization is designed for students with a teaching license who wish to take graduate literature courses and work toward a reading endorsement by taking three reading courses in Curriculum and Instruction.

The MA in Rhetoric, Composition, and Professional Communication (RCPC) prepares students for careers in business, technical, and professional communication in the private and public sectors and for teaching writing and communication at the postsecondary level.

The MA in TESL/Applied Linguistics (TESL/AL) prepares students for careers in teaching English to nonnative speakers of English, either in the U.S. or abroad. Students with MA degrees in TESL teach adults and younger learners in a wide variety of contexts, supervise language programs, work for testing organizations, and create language teaching materials. Students admitted to the degree program can choose among optional specializations: Computer-Assisted Language Learning (CALL); Language Assessment; English for Specific Purposes (ESP); Literacy; Literature in ESL, Teaching English to L1 Spanish Learners, as well as Corpus and Computational Linguistics.

The Master of Fine Arts (MFA) program in Creative Writing and Environment (CWE) cultivates in its students an interdisciplinary approach to research and writing. The program's unique design allows writers to develop a heightened environmental imagination that finds expression in quality, publishable works of fiction, nonfiction, poetry, and drama. The program is designed to prepare students for careers as writers, teachers, editors, and environmental educators. The MFA degree requires 54 hours of graduate credit: a core of creative writing courses, a book-length thesis (6 credits), experiential environmental fieldwork (3 credits), and 12 credits in disciplines other than English (such as Landscape Architecture, Anthropology, Environmental Science, among many others) relevant to an individual student's research interests and thesis project.

The Doctor of Philosophy (PhD) in Applied Linguistics and Technology (ALT) focuses on English language description, teaching, learning, and assessment with particular emphasis on issues and practices related to technology: analysis of language using computational and corpus linguistic methods as well as the study of computer technology in English language teaching, learning, and assessment. It prepares students for a variety of academic appointments in departments of applied linguistics and English and for professional opportunities in research and development, international publishing, and government agencies in the U.S. and around the world where English is taught and used for specific educational, vocational, and professional purposes. Candidates are required to complete 72 hours of graduate credit including a dissertation, to meet a language requirement that may be fulfilled in a number of ways (students whose native language is other than English are considered to have met the language requirement after satisfying the Graduate College English requirement), and to pass a portfolio assessment, a preliminary

examination (consisting of a dissertation proposal and pilot study and a written response to questions about the proposal or pilot study), and an oral defense of the dissertation.

The PhD in Rhetoric and Professional Communication (RPC) focuses on the rhetorical theory, history, pedagogy, and practice of written, oral, visual, and electronic communication (WOVE) in professional communities, such as business, industry, science, and government. The degree prepares graduates for academic positions in rhetoric, in multimodal composition, and in business, professional, and technical communication, as well as for work in the private and public sectors as professional communication specialists, editors, designers, and communications managers. Candidates are required to complete 72 hours of graduate credit including a dissertation and to pass a portfolio assessment, a preliminary examination (consisting of a written comprehensive examination and a special field examination), and an oral defense of the dissertation.

A Graduate Certificate in Teaching English as a Second Language/ Teaching English as a Foreign Language (TESL/TEFL) prepares students to teach English to nonnative speakers of English either in the U.S. or abroad. It offers students grounding in the linguistic understanding of English and a flexible program of study with courses in teaching methodology, language assessment, and the use of technology to address students' language needs. This 12-credit program has two prerequisites, one core requirement, and three graduate course electives.

The department offers graduate students an opportunity to gain professional experience through fieldwork and internships, departmental research activities, ISUComm, the Intensive English and Orientation Program (IEOP), and the Speech Communication Program. Teaching and research assistantships are available for qualified students. Teaching assistants are responsible for teaching, with faculty supervision, ISUComm Foundation Courses, courses in public speaking, English as a Second Language (ESL), and business and technical communication. Research assistants may be assigned to faculty members engaged in research projects. One or more Pearl Hogrefe Fellowships in Creative Writing covering stipend and tuition are awarded each year to outstanding graduate students. Grannis Scholarships may be awarded to new students in the Applied Linguistics and Technology doctoral program. Freda Huncke Endowment Graduate Teaching Fellowships are awarded to select first-year students.

With prior written approval from the School of Education, students may use selected courses to meet requirements for the ESL endorsement (K-12) for teachers.

The English Department offers minors in each of our graduate programs. A graduate minor at the MA level requires 9 credits of English at the 500 or 600 level in the respective major (English, RCPC, TESL/AL). A graduate minor at the MFA level requires 12 credits of creative writing courses at the graduate level with 3 of those credits being ENGL 550 Creative Writing: Craft and Professional Practice. A graduate minor at the PhD level requires 12 credits at the 500 or 600 level in the respective major (ALT or RPC).

Courses primarily for undergraduates:

ENGL 011: Intensive English and Orientation Program Reading
(5-0) Cr. 0. F.S.SS.
Study of English for speakers of other languages. Brochure available from the IEOP Office, 102 Landscape Architecture, or at www.ieop.iastate.edu.

ENGL 011A: Intensive English and Orientation Program Reading: Beginner
(5-0) Cr. 0. F.S.SS.
Academic reading classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 011B: Intensive English and Orientation Program Reading: Low Intermediate
(5-0) Cr. 0. F.S.SS.
Academic reading classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 011C: Intensive English and Orientation Program Reading: Intermediate
(5-0) Cr. 0. F.S.SS.
Academic reading classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 011D: Intensive English and Orientation Program Reading: High Intermediate
(5-0) Cr. 0. F.S.SS.
Academic reading classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 011E: Intensive English and Orientation Program Reading: High
(5-0) Cr. 0. F.S.SS.
Academic reading classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 011F: Intensive English and Orientation Program Reading: Advanced
(5-0) Cr. 0. F.S.SS.
Academic reading classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012: Intensive English and Orientation Program Writing
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012A: Intensive English and Orientation Program Writing: Beginner
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012B: Intensive English and Orientation Program Writing: Low Intermediate
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012C: Intensive English and Orientation Program Writing: Intermediate
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012D: Intensive English and Orientation Program Writing: High Intermediate
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012E: Intensive English and Orientation Program Writing: High
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 012F: Intensive English and Orientation Program Writing: Advanced
(5-0) Cr. 0. F.S.SS.
Academic writing classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013: Intensive English and Orientation Program Listening and Speaking
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013A: Intensive English and Orientation Program Listening and Speaking: Beginner
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013B: Intensive English and Orientation Program Listening and Speaking: Low Intermediate
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013C: Intensive English and Orientation Program Listening and Speaking: Intermediate
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013D: Intensive English and Orientation Program Listening and Speaking: High Intermediate
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013E: Intensive English and Orientation Program Listening and Speaking: High
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 013F: Intensive English and Orientation Program Listening and Speaking: Advanced
(5-0) Cr. 0.
Academic listening and speaking classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014: Intensive English and Orientation Program Grammar
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014A: Intensive English and Orientation Program Grammar: Beginner
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014B: Intensive English and Orientation Program Grammar: Low Intermediate
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014C: Intensive English and Orientation Program Grammar: Intermediate
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014D: Intensive English and Orientation Program Grammar: High Intermediate
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014E: Intensive English and Orientation Program Grammar: High
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 014F: Intensive English and Orientation Program Grammar: Advanced
(5-0) Cr. 0.
Academic grammar classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 015: Intensive English and Orientation Program Exit Academic Skills
(10-0) Cr. 0.
Academic Skills classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 016: Intensive English and Orientation Program Exit Orientation
(5-0) Cr. 0.
Academic Orientation classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 017: Intensive English and Orientation Program Exit Technology
(5-0) Cr. 0.
Academic Technology classes for speakers of other languages. More information available at www.ieop.iastate.edu.

ENGL 018: Intensive English Orientation Program Business Oral English Communication: Listening and Speaking
(5-0) Cr. 0.
Academic English classes for speakers of other languages focusing on Business. More information available at www.ieop.iastate.edu.

ENGL 019: Intensive English Orientation Program Business Written English Communication: Reading and Writing
(10-0) Cr. 0.
Academic English classes for speakers of other languages focusing on Business. More information available at www.ieop.iastate.edu.

ENGL 020: Intensive English and Orientation Program Optional Seminar
(5-0) Cr. 0.
Customized academic English and cultural orientation for speakers of other languages.

ENGL 099: Strategies for Nonnative Speakers of English
Cr. 0. F.S.
Prereq: Recommendation of English Department; placement in sections L and R is determined by examination; section S is open to all interested international students. Available P/NP to graduate students at their department's option

ENGL 099L: Strategies for Nonnative Speakers of English: Strategies for Listening
Cr. 0. F.S.
Prereq: Recommendation of English Department; placement in sections L and R is determined by examination; section S is open to all interested international students. Available P/NP to graduate students at their department's option

ENGL 099R: Strategies for Nonnative Speakers of English: Strategies for Reading
Cr. 0. F.S.
Prereq: Recommendation of English Department; placement in sections L and R is determined by examination; section S is open to all interested international students. Available P/NP to graduate students at their department's option

ENGL 099S: Strategies for Nonnative Speakers of English: Academic Speaking and Pronunciation
Cr. 0. F.S.
Prereq: Recommendation of English Department; placement in sections L and R is determined by examination; section S is open to all interested international students. Available P/NP to graduate students at their department's option

ENGL 101: English for Native Speakers of Other Languages
(3-0) Cr. 3. F.S.
Prereq: Recommendation of English Department; placement in various sections is determined by examination. (See English Requirement for International Students in Index.)
For undergraduates: Completion of ENGL 101 requirement prepares students for ENGL 150. For graduates: Completion of ENGL 101 satisfies the English requirement of the Graduate College. ENGL 101 courses are limited to students who are nonnative speakers of English. Credit from ENGL 101 does not count toward graduation.

ENGL 101B: English for Native Speakers of Other Languages: Academic English
(3-0) Cr. 3. F.S.
Prereq: Recommendation of English Department; placement in various sections is determined by examination. (See English Requirement for International Students in Index.)
For undergraduates: Completion of ENGL 101 requirement prepares students for ENGL 150. For graduates: Completion of ENGL 101 satisfies the English requirement of the Graduate College. ENGL 101 courses are limited to students who are nonnative speakers of English. Credit from ENGL 101 does not count toward graduation.

ENGL 101C: English for Native Speakers of Other Languages: Academic English II--Undergraduates
(3-0) Cr. 3. F.S.
Prereq: Recommendation of English Department; placement in various sections is determined by examination. (See English Requirement for International Students in Index.)
For undergraduates: Completion of ENGL 101 requirement prepares students for ENGL 150. For graduates: Completion of ENGL 101 satisfies the English requirement of the Graduate College. ENGL 101 courses are limited to students who are nonnative speakers of English. Credit from ENGL 101 does not count toward graduation.

ENGL 101D: English for Native Speakers of Other Languages: Academic English II--Graduates
(3-0) Cr. 3. F.S.
Prereq: Recommendation of English Department; placement in various sections is determined by examination. (See English Requirement for International Students in Index.)
Available P/NP to graduate students at their department's option. For undergraduates: Completion of ENGL 101 requirement prepares students for ENGL 150. For graduates: Completion of ENGL 101 satisfies the English requirement of the Graduate College. ENGL 101 courses are limited to students who are nonnative speakers of English. Credit from ENGL 101 does not count toward graduation.

ENGL 120: Computers and Language
(Cross-listed with LING). (3-0) Cr. 3.
Introduction to the use of linguistic knowledge in computer applications today and the basic computational techniques used in such applications. The development of these techniques throughout the history of computational linguistics. How the study of language has contributed to the advancement of technology and how certain computational problems have influenced the way linguists study language.

ENGL 150: Critical Thinking and Communication
(3-0) Cr. 3. F.S.SS.
Prereq: Concurrent enrollment in LIB 160 is recommended.
Application of critical reading and thinking abilities to topics of civic and cultural importance. Introduction of basic oral, visual, and electronic communication principles to support writing development. Initiation of communication portfolio.

ENGL 180: Communication Skills for International Teaching Assistants
Cr. 1-3. Repeatable, maximum of 2 times. F.S.
Placement based upon OECT test results. Persons whose native language is English cannot take ENGL 180 for credit. No more than one section of ENGL 180 may be taken per semester; up to two sections total. Offered on a satisfactory-fail basis only. Credit for ENGL 180 does not apply toward graduation.

ENGL 180A: Communication Skills for International Teaching Assistants: Speaking Skills
Cr. 3. Repeatable, maximum of 2 times. F.S.
Emphasis on pronunciation improvement and greater fluency in spoken English. Placement based upon OECT test results. Persons whose native language is English cannot take ENGL 180 for credit. No more than one section of ENGL 180 may be taken per semester; up to two sections total. Offered on a satisfactory-fail basis only. Credit for ENGL 180 does not apply toward graduation.

ENGL 180B: Communication Skills for International Teaching Assistants: Intermediate Spoken English
Cr. 3. Repeatable, maximum of 2 times. F.S.
Placement based upon OECT test results. Persons whose native language is English cannot take ENGL 180 for credit. No more than one section of ENGL 180 may be taken per semester; up to two sections total. Offered on a satisfactory-fail basis only. Credit for ENGL 180 does not apply toward graduation.

ENGL 180C: Communication Skills for International Teaching Assistants: Advanced Spoken English
Cr. 3. Repeatable, maximum of 2 times. F.S.
For students who have completed ENGL 180A or ENGL 180b but have not reached the passing level on the OECT test. Placement based upon OECT test results. Persons whose native language is English cannot take ENGL 180 for credit. No more than one section of ENGL 180 may be taken per semester; up to two sections total. Offered on a satisfactory-fail basis only. Credit for ENGL 180 does not apply toward graduation.

ENGL 180D: Communication Skills for International Teaching Assistants: Presentation Skills

Cr. 3. Repeatable, maximum of 2 times. F.S.

Developing explanations, leading discussions and handling questions in a teaching environment. Placement based upon OECT test results. Persons whose native language is English cannot take ENGL 180 for credit. No more than one section of ENGL 180 may be taken per semester; up to two sections total. Offered on a satisfactory-fail basis only. Credit for ENGL 180 does not apply toward graduation.

ENGL 180E: Communication Skills for International Teaching Assistants: Supervised Independent Study

Cr. 1-3. Repeatable, maximum of 2 times. F.S.

Seminar with individual observation and consultation. Placement based upon OECT test results. Persons whose native language is English cannot take 180 for credit. No more than one section of ENGL 180 may be taken per semester; up to two sections total. Offered on a satisfactory-fail basis only. Credit for ENGL 180 does not apply toward graduation.

ENGL 201: Introduction to Literature

(3-0) Cr. 3.

Prereq: Credit in or exemption from 150

Study of selected examples of drama, poetry, short fiction, and the novel drawn from both British and American literature. Recommended for nonmajors.

ENGL 207: Introduction to Creative Writing

(3-0) Cr. 3. F.S.

Prereq: Credit in or exemption from 150

Course introduces students to the fundamentals of writing fiction, poetry, and creative nonfiction. Extensive readings in all three genres. Students learn creative processes through writing exercises, workshops, and conferences.

ENGL 214: Introduction to Technical Communication

Cr. 3. F.

Prereq: ENGL 150

A broad introduction to the culture of professional work as a technical communicator, with particular emphasis on principles and best practices for developing and managing technical information and digital media. Examination of user-centered design, the history of the discipline, cross-cultural communication, and the ethics of communicating complex information to lay audiences. Study and practice of team-based collaboration, project management, and technical editing.

ENGL 219: Introduction to Linguistics

(Cross-listed with LING). (3-0) Cr. 3. F.S.

Prereq: Sophomore classification

Introduction to linguistic concepts and principles of linguistic analysis with English as the primary source of data. Sound and writing systems, sentence structure, vocabulary, and meaning. Issues in the study of usage, regional and social dialects, language acquisition, and language change.

ENGL 220: Descriptive English Grammar

(Cross-listed with LING). (3-0) Cr. 3. F.S.

Prereq: ENGL 250

Overview of grammatical structures and functions. Parts of speech; phrase, clause, and sentence structure; sentence types and sentence analysis; rhetorical grammar and sentence style; terminology. Not a remedial, English composition, or ESL course.

ENGL 225: Survey of British Literature to 1800

(3-0) Cr. 3.

Prereq: ENGL 250

Representative works of British literature from the origins to 1800 in historical, cultural, and literary contexts. Will include multiple genres.

ENGL 226: Survey of British Literature since 1800

(3-0) Cr. 3.

Prereq: ENGL 250

Representative works from 1800 to the present in historical, cultural, and literary contexts. Will include multiple genres and may include texts that reflect and/or critique the impact and legacy of the British empire on its former colonies, i.e., postcolonial literature.

ENGL 227: Survey of American Literature to 1865

(3-0) Cr. 3.

Prereq: ENGL 250

Representative works of American literature from its origins (including indigenous and conquest literatures) through the end of the Civil War in historical, cultural, and literary contexts. Will include multiple genres.

ENGL 228: Survey of American Literature since 1865

(3-0) Cr. 3.

Prereq: ENGL 250

Representative works written in the United States since the Civil War in historical, cultural, and literary contexts, with attention to the cultural and ethnic diversity of Americans. Will include multiple genres.

ENGL 237: Survey of Film History

(3-0) Cr. 3. F.

Prereq: Credit in or exemption from 150

A survey of the history of film, both U.S. and international, from the beginnings in the late nineteenth century to the present.

ENGL 240: Introduction to American Indian Literature
(Cross-listed with AM IN). (3-0) Cr. 3. F.
Prereq: Credit in or exemption from ENGL 150
Appreciation of oral and written forms of American Indian literatures. Tropes and techniques in oral, visual and written texts. Focus on the role of American Indians in interdisciplinary approaches to modern social and environmental issues as expressed in literary works.
Meets U.S. Diversity Requirement

ENGL 250: Written, Oral, Visual, and Electronic Composition
(3-0) Cr. 3. F.S.SS.
Prereq: ENGL 150 or exemption from ENGL 150; sophomore classification or exemption from ENGL 150; credit for or concurrent enrollment in LIB 160
Analyzing, composing, and reflecting on written, oral, visual, and electronic (WOVE) discourse within academic, civic, and cultural contexts. Emphasis on supporting a claim and using primary and secondary sources. Continued development of communication portfolio.

ENGL 250H: Written, Oral, Visual, and Electronic Composition: Honors
(3-0) Cr. 3. F.
Prereq: Exemption from ENGL 150 and admission to Freshman Honors Program; credit for or concurrent enrollment in LIB 160
In-depth analysis, composition, and reflection on written, oral, visual, and electronic (WOVE) discourse within academic, civic, and cultural contexts. Emphasis on argumentation: developing claims, generating reasons, providing evidence. Individual sections organized by special topics. Development of communication portfolio.

ENGL 260: Introduction to Literary Study
(3-0) Cr. 3.
Prereq: Credit in or exemption from 150
Basic principles of literary study. Emphasis on writing of interpretive and critical essays. Particular attention to poetry. Designed for English majors.

ENGL 275: Analysis of Popular Culture Texts
(Cross-listed with SP CM). (3-0) Cr. 3. F.S.
Prereq: Credit in or equivalent of 250
Analysis of how information and entertainment forms persuade and manipulate audiences. Study of several forms that may include newspapers, speeches, television, film, advertising, fiction, and magazines. Special attention to verbal and visual devices.

ENGL 302: Business Communication
(3-0) Cr. 3. F.S.SS.
Prereq: ENGL 250, junior classification
Rhetorical concepts and processes to successfully communicate individually and collaboratively via written, oral, visual, and electronic modes across a range of business disciplines. Covers strategies for analyzing audiences internal and external to an organization in order to communicate positive, neutral, and negative messages clearly, completely, correctly, and ethically; save an audience's time; and create goodwill.

ENGL 302H: Business Communication: Honors
(3-0) Cr. 3. F.S.SS.
Prereq: ENGL 250, junior classification
Theory, principles and processes of effective written, oral, visual, and electronic communication typically encountered in business and the professions. Extensive practice in many areas of workplace communication, including letter, memo, and email correspondence; short proposals and reports; policies and procedures; job packet including letters of application and resumes; website analysis; brochures; and individual and team presentations.

ENGL 303: Free-Lance Writing for Popular Magazines
(3-0) Cr. 3. S.
Prereq: ENGL 250, not open to freshmen
Practical workshop in writing nonfiction articles for popular magazines. Emphasis on writing, market research, preparation of manuscripts, methods of submission. Major goal of the course is production of marketable material.

ENGL 304: Creative Writing: Fiction
(3-0) Cr. 3. F.S.
Prereq: ENGL 250, not open to freshmen
Progresses from practice in basic techniques of fiction writing to fully developed short stories. Emphasis on writing, analytical reading, workshop criticism, and individual conferences.

ENGL 305: Creative Writing: Nonfiction
(3-0) Cr. 3. F.S.
Prereq: ENGL 250, not open to freshmen
Workshop in writing imaginative essays, both critical and personal. Analytical reading, development of literary techniques. Individual and small group conferences.

ENGL 306: Creative Writing: Poetry
(3-0) Cr. 3. F.S.
Prereq: ENGL 250, not open to freshmen
Progresses from traditional to contemporary forms. Emphasis on writing, analytical reading, workshop criticism, and individual conferences.

ENGL 308: Write Like a Woman
(Cross-listed with W S). (3-0) Cr. 3. F.
Prereq: ENGL 250
Writing and reading interpretive fiction written by women. Emphasis on stories that embody a female literary life, gender-specific ways of creating characters and conflicts, analytical reading and writing, workshop criticism and shared commentaries. Includes multi-modal projects.

ENGL 309: Proposal and Report Writing
(3-0) Cr. 3. F.S.
Prereq: ENGL 250, junior classification
Rhetorical concepts and processes to individually and collaboratively develop proposals for business, governmental, nonprofit, or other organizations and to report on the work completed both orally and in writing. Emphasizes the structure and classification of proposal and report types, qualitative and quantitative research methods, audience analysis, document design, and data visualization.

ENGL 310: Rhetorical Analysis
(3-0) Cr. 3. F.S.
Prereq: ENGL 250
Fundamental principles of rhetorical criticism. Focus on selected theories for analyzing cultural texts, including essays, speeches, film, technical and scientific documents, and websites. Emphasis on identifying artifacts, formulating research questions, applying methodologies, and understanding and practicing critical analysis through discussion and in writing.

ENGL 312: Biological Communication
(3-0) Cr. 3. F.S.
Prereq: ENGL 250
Rhetorical concepts and processes to successfully communicate individually and collaboratively via written, oral, visual, and electronic modes in disciplines in and related to biological sciences. Emphasizes the strategies for analyzing and adapting to audiences in the biological sciences. Covers developing and designing documentation, presenting scientific data visually, and communicating results orally.

ENGL 313: Rhetorical Website Design
(3-0) Cr. 3.
Prereq: ENGL 250
Rhetorical principles of multimodal composing in hypertextual environments. Focus on writing according to web style guidelines, employing cascading stylesheets for layout and design, and using principles of information architecture to determine optimal site structure. Final project involves constructing interactive client site using latest web standards.

ENGL 314: Technical Communication
(3-0) Cr. 3. F.S.SS.
Prereq: ENGL 250, junior classification
Rhetorical concepts and processes to successfully communicate technical information individually and collaboratively via written, oral, visual, and electronic modes. Emphasizes the major strategies for analyzing expert and lay audiences and adapting information to those audiences. Covers developing and designing usable technical documentation, visualizing data, and presenting technical information orally.

ENGL 314H: Technical Communication: Honors
(3-0) Cr. 3. F.S.SS.
Prereq: ENGL 250, junior classification
Theories, principles, and processes of effective written, oral, visual, and electronic communication of technical information. Attention to major strategies for analyzing and adapting to audiences in various communication situations and composing technical discourse including organizing visual and verbal information. Extensive practice in many areas of technical communication, including instructions and procedures, proposals and reports, website analysis and design, and individual and team presentations.

ENGL 315: Creative Writing: Screenplays
(3-0) Cr. 3. F.
Prereq: ENGL 250, not open to freshmen
Stresses master scene technique of writing fully developed screenplays. Emphasis on movie techniques, writing, workshop criticism, analytical reading and viewing, and individual conferences.

ENGL 316: Creative Writing: Playwriting
(Cross-listed with THTRE). (3-0) Cr. 3. S.
Prereq: ENGL 250, not open to freshmen
Progresses from production of scenes to fully developed one-act plays. Emphasis on action, staging, writing, analytical reading, workshop criticism, and individual conferences.

ENGL 322: Language and Society
(Cross-listed with LING). Cr. 3. S.
Prereq: ENGL/LING 219
Introduction to variation in language use in society. Survey of factors affecting language use, including background characteristics of language users, location, and purpose of interaction in addition to institutional, state, and national language policies.

ENGL 324: Introduction to Teaching ESL Literacy
(Cross-listed with LING). Cr. 3. F.
Prereq: ENGL/LING 219
Introduction to the issues and methods involved in teaching literacy skills to English as a second language (ESL) learners. The nature of literacy and materials and methods for developing ESL literacy at the middle school, high school, and adult ages across multiple levels of competency.

ENGL 325: Teaching Methods for ESL Learners: Oral Communication Skills
(Cross-listed with LING). Cr. 3. S.
Prereq: ENGL/LING 219
Issues and methods in teaching oral communication skills (listening, speaking, pronunciation) to English as a second language (ESL) learners. The nature of oral language ability. Materials and Methods for developing oral communication skills at middle school, high school, and adult contexts.

ENGL 330: Science Fiction
(3-0) Cr. 3.
Prereq: ENGL 250
Study of science fiction from its origins in nineteenth-century to the present. May include study of specific types of science fiction, such as classic, cyberpunk, feminist, or apocalyptic narratives; and may include consideration of science fiction film and/or theory.

ENGL 332: Visual Communication of Quantitative Information
(Cross-listed with STAT). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 101, STAT 104, STAT 201 or STAT 226; ENGL 250
Communicating quantitative information using visual displays; visualizing data; interactive and dynamic data displays; evaluating current examples in the media; color, perception, and representation in graphs; interpreting data displays.

ENGL 335: Studies in Film
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250
Principles of film art and the traditional vocabulary of literature as applied to film. Influence of film on modes of thought and behavior.

ENGL 339: Literary Theory and Criticism
(3-0) Cr. 3.
Prereq: ENGL 260 and 3 additional credits in literature
Study of selected texts of literary criticism, with attention to the purposes and practices of criticism.

ENGL 340: Women's Literature
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: ENGL 250
Historical and thematic survey of literature by and about women. May include autobiographies, journals, letters, poetry, fiction, and drama.
Meets U.S. Diversity Requirement

ENGL 342: American Indian Women Writers
(Cross-listed with AM IN, W S). (3-0) Cr. 3.
Prereq: ENGL 250
Literature of American Indian women writers which examines their social, political, and cultural roles in the United States. Exploration of American Indian women's literary, philosophical, and artistic works aimed at recovering elements of identity, redescribing stereotypes, resisting colonization, and constructing femininity.
Meets U.S. Diversity Requirement

ENGL 344: U.S. Latino/a Literature
(Cross-listed with US LS). (3-0) Cr. 3. S.
Prereq: ENGL 250
An introduction to the literature of Mexican Americans, Puerto Ricans, Cuban Americans and other Latino/a sub-groups. Special emphasis on themes such as ethnic relations and comparisons with EuroAmerican literary traditions.
Meets U.S. Diversity Requirement

ENGL 345: Women and Literature: Selected Topics
(Cross-listed with W S). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250
Literature by women and/or dealing with the images of women, e.g., study of individual authors or related schools of authors; exploration of specific themes or genres in women's literature; analysis of recurrent images of women in literature.
Meets U.S. Diversity Requirement

ENGL 346: American Indian Literature
(Cross-listed with AM IN). (3-0) Cr. 3.
Prereq: ENGL 250
Survey of literature by Native Americans from pre-Columbian tales and songs to contemporary novels and poetry.
Meets U.S. Diversity Requirement

ENGL 347: Studies in African American Literature
(Cross-listed with AF AM). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250
Literature by African Americans, which may include study of individual authors, movements, themes, genres.
Meets U.S. Diversity Requirement

ENGL 349: Topics in Multicultural Literatures of the United States
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250
Literature by writers from U.S. multicultural groups. May include literature of several groups or focus upon one of the following: Asian Americans, African Americans, Latino/a Americans, American Indians.
Meets U.S. Diversity Requirement

ENGL 350: Rhetorical Traditions
(Cross-listed with CL ST, SP CM). (3-0) Cr. 3. S.
Prereq: ENGL 250
Ideas about the relationship between rhetoric and society in contemporary and historical contexts. An exploration of classical and contemporary rhetorical theories in relation to selected topics that may include politics, gender, race, ethics, education, science, or technology.

ENGL 352: Gay and Lesbian Literature
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: ENGL 250
Literary portrayals of gay and lesbian lives and relationships from many different genres. Attention to changing definitions and representations of sexual orientation and gender identity over time.
Meets U.S. Diversity Requirement

ENGL 353: World Literature: Western Foundations through Renaissance
(Cross-listed with CL ST). (3-0) Cr. 3. F.S.
Prereq: ENGL 250
Representative works from the drama, epics, poetry, and prose of the Ancient World through the late sixteenth century. May include Homer, Aeschylus, Sappho, Catullus, Dante, Marie de France, Boccaccio, Christine de Pizan, Cervantes, and others.
Meets International Perspectives Requirement.

ENGL 354: World Literature: Seventeenth Century to the Present
(3-0) Cr. 3. F.
Prereq: ENGL 250
Global literatures in their various cultural and aesthetic contexts. Representative works, oral and written literature, including poetry, fiction, nonfiction, and drama.
Meets International Perspectives Requirement.

ENGL 355: Literature and the Environment
(Cross-listed with ENV S). (3-0) Cr. 3.
Prereq: ENGL 250
Study of literary texts that address the following topics, among others: the relationship between people and natural/urban environments, ecocriticism, and the importance of place in the literary imagination.

ENGL 358: Myth and Fairytale
(3-0) Cr. 3.
Prereq: ENGL 250
Study of traditional fairytales, myths, and legends from diverse cultures.

ENGL 360: Studies in American Literature to 1800
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250; sophomore classification
Selected readings in American literature from its beginnings through the colonial period; may reflect themes, genres, or social and cultural contexts.

ENGL 362: Studies in 19th Century American Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250; sophomore classification
Selected readings in American literature of the 19th century; may reflect themes, genres, or social and cultural contexts.

ENGL 364: Studies in American Literature: 1900 to the Present
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250; sophomore classification
Selected readings in American literature since 1900; may reflect themes, genres, or social and cultural contexts.

ENGL 370: Shakespeare
(3-0) Cr. 3. F.S.
Prereq: ENGL 250
Reading and analysis of selected plays. Development of Shakespeare's dramatic art in its social and intellectual context.
Meets International Perspectives Requirement.

ENGL 373: Studies in British Literature: The Middle Ages
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250; sophomore classification
Selected readings in medieval literature from its beginnings through the fifteenth century; may reflect themes, genres, or social and cultural contexts.

ENGL 375: Studies in British Literature: The Restoration and 18th Century
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250; sophomore classification
Selected readings in British literature from 1660 to 1800; may reflect themes, genres, or social and cultural contexts.
Meets International Perspectives Requirement.

ENGL 376: Studies in British Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250; sophomore classification
Selected readings from British literature from the late eighteenth century to about 1900; may reflect themes, genres, or social and cultural contexts.
Meets International Perspectives Requirement.

ENGL 376A: Studies in British Literature: Romantic
(3-0) Cr. 3.
Prereq: ENGL 250; sophomore classification
Selected readings from British literature from the late eighteenth century to about 1900; may reflect themes, genres, or social and cultural contexts.
Meets International Perspectives Requirement.

ENGL 376B: Studies in British Literature: Victorian
(3-0) Cr. 3.
Prereq: ENGL 250; sophomore classification
Selected readings from British literature from the late eighteenth century to about 1900; may reflect themes, genres, or social and cultural contexts.
Meets International Perspectives Requirement.

ENGL 389: Postcolonial Literature
(3-0) Cr. 3.
Prereq: ENGL 250; sophomore classification
Historical, thematic and theoretical study of postcolonial literatures from one or more of the following areas: Africa, South Asia, the Caribbean, and the Middle East. Irish and immigrant British writers may also be included.
Meets International Perspectives Requirement.

ENGL 393: The History of Children's Literature
(3-0) Cr. 3. F.
Prereq: ENGL 250
Origin and development of English and American children's literature through the early twentieth century. Special emphasis on nature, structure, and enduring themes of fantasy literature.

ENGL 395: Study and Travel
Cr. arr. SS.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.
Meets International Perspectives Requirement.

ENGL 395A: Study and Travel: Literature
Cr. arr. SS.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.
Meets International Perspectives Requirement.

ENGL 395B: Study and Travel: Creative Writing
Cr. arr. SS.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.
Meets International Perspectives Requirement.

ENGL 395C: Study and Travel: Linguistics
Cr. arr. SS.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.
Meets International Perspectives Requirement.

ENGL 395D: Study and Travel: Rhetoric and Professional Communication
Cr. arr. SS.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.
Meets International Perspectives Requirement.

ENGL 395E: Study and Travel: Teacher Education
Cr. arr. SS.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.
Meets International Perspectives Requirement.

ENGL 396: Teaching the Reading of Young Adult Literature
(3-0) Cr. 3. F.S.
Prereq: ENGL 250
Critical study and evaluation of themes, genres, and cultures found in young adult literature. Strategies of effective reading; instructional strategies including discussion techniques and use of technology; matching texts to reader needs and proficiencies. Evaluation of fiction, nonfiction, and media-based materials for use in school programs. Lesson planning.

ENGL 397: Practice and Theory of Teaching Writing in the Secondary Schools
(3-0) Cr. 3. F.S.
Prereq: ENGL 219 or ENGL 220; application process initiated for admission to university teacher education program; concurrent enrollment in C I 280 (cr. 2); and background check initiated with state of Iowa Department of Criminal Investigation
Introduction to teaching secondary language arts. Current theories and practices in the teaching of writing to secondary school students. Theories of rhetoric, approaches to teaching, lesson design and planning. Evaluating writing. Professional portfolio preparation.

ENGL 404: Creative Writing Workshop: Fiction
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.
Prereq: ENGL 304
Individual projects in short fiction on a workshop and conference basis. Readings in short fiction. Discussion of elements of narrative such as plot, point of view, characterization, theme, setting.

ENGL 405: Creative Writing Workshop: Nonfiction
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.
Prereq: ENGL 305
Individual projects in memoir, immersion journalism, character studies, and/or the personal essay on a workshop and conference basis. Readings in creative nonfiction.

ENGL 406: Creative Writing Workshop--Poetry
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.
Prereq: ENGL 306
Individual projects in poetry on a workshop and conference basis. Readings in poetry. Discussion of poetic elements such as image, sound, internal structure, rhythm, tone, figurative language.

ENGL 411: Technology, Rhetoric, and Professional Communication
(3-0) Cr. 3.
Prereq: ENGL 310; ENGL 302, ENGL 309, ENGL 313, or ENGL 314; junior classification
Seminar course on the implication of technologies, especially computer technology, for the writing and reading of business, technical, and academic texts. Extensive reading, discussion, and writing on selected technology-related topics.

ENGL 415: Business and Technical Editing
(3-0) Cr. 3. S.
Prereq: ENGL 302, ENGL 309, or ENGL 314; junior classification
Editing concepts and processes for choosing the appropriate level of editing for the particular rhetorical situation. Covers using editorial tools such as copy-marking symbols, developing style sheets and guides, and managing document production. Emphasizes developing an editorial eye for verbal and visual details in order to achieve accuracy, consistency, correctness, and completeness.

ENGL 416: Visual Aspects of Business and Technical Communication
(3-0) Cr. 3. F.
Prereq: ENGL 302, ENGL 309, or ENGL 314; junior classification
Rhetorical strategies and perceptual principles for designing print and digital visual elements such as diagrams and graphs and integrating those visual elements into business and technical communications. Covers strategies for employing visual elements such as typeface, page and screen layout, and illustrations in order to make communications more usable.

ENGL 417: Student Teaching
Cr. arr. F.S.
Prereq: admission to teacher education, approval of coordinator the semester prior to student teaching
Full-time teaching in content licensure area: long term and unit planning, lesson planning, classroom teaching practice.

ENGL 417E: Student Teaching: English and Literature
(Cross-listed with C I). Cr. arr. F.S.
Prereq: ENGL 494, admission to teacher education, approval of coordinator the semester prior to student teaching
Full-time teaching in secondary English: long term and unit planning, lesson planning, classroom teaching practice in English language arts.

ENGL 418: Seminar in Argumentation
(3-0) Cr. 3. S.
Prereq: ENGL 310, junior classification
Advanced seminar in theory and analysis with extensive practice in various modes of argument.

ENGL 420: History of the English Language
(Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: ENGL 219 or LING 219, ENGL 220 or LING 220
Comparison of English to other languages by family background and by type. Analysis of representative Old, Middle, Early Modern and present-day English texts, including both literary works and non-literary documents.

ENGL 422: Women, Men, and the English Language
(Cross-listed with LING, W S). (3-0) Cr. 3. S.
Prereq: ENGL 219 or LING 219
The ways men and women differ in using language in varied settings and the ways in which language both creates and reflects gender divisions. Meets U.S. Diversity Requirement

ENGL 425: Second Language Learning and Teaching
(Cross-listed with LING). (3-0) Cr. 3. S.
Prereq: ENGL 219 or LING 219; junior classification
The process of second language learning and principles and techniques of teaching second languages. Learning and teaching in specific situations and for particular purposes. Current applications of technology in teaching and assessment.

ENGL 437: Grammatical Analysis
(Cross-listed with LING). (3-0) Cr. 3. F.
Prereq: ENGL 220 or LING 220; ENGL 219 or LING 219 or introductory course in linguistics; junior classification
Theories and methods for analysis of syntax and morphology.

ENGL 440: Seminar in British Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Completion of 9 credits of surveys; completion of or concurrent enrollment in ENGL 339; junior classification
Selected authors, movements, eras, or genres in British literature. Readings in criticism; required research paper.

ENGL 441: Seminar in American Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Completion of 9 credits of surveys; completion of or concurrent enrollment in ENGL 339; junior classification
Selected authors, movements, eras, or genres in American literature. Readings in criticism; required research paper.

ENGL 445: Seminar: Literature Crossing Boundaries
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Completion of 9 credits of surveys; completion of or concurrent enrollment in ENGL 339; junior classification
Intensive study of selected literature that bridges traditional genre, period, national, or disciplinary boundaries. Readings in criticism; required research paper.

ENGL 450: Seminar in Literary Genres
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Completion of 9 credits of surveys; completion of or concurrent enrollment in ENGL 339; junior classification
Intensive study of drama, film, fiction, poetry, or prose. Selected movements, eras, or national traditions. Readings in criticism; required research paper.

ENGL 460: Seminar in Gender and Ethnicity
(Cross-listed with W S). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Completion of 9 credits of surveys; completion of or concurrent enrollment in ENGL 339; junior classification
Selected readings of various authors, movements, eras, or genres. Readings in criticism; required research paper.

ENGL 477: Seminar in Technical Communication
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 302, ENGL 309, or ENGL 314
Intensive study of a selected topic that bridges theory and practice in technical communication. Required project that contributes to the understanding of an emerging issue in the profession.

ENGL 487: Internship in Business, Technical, and Professional Communication
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: 9 credits in ENGL 302, ENGL 309, ENGL 313, ENGL 314, ENGL 415 (preferred), ENGL 416, or ENGL 477; junior classification; and permission of coordinator
An opportunity to write, edit, and design business and technical documents in a professional setting. Projects might include reports, proposals, manuals, brochures, newsletters.

ENGL 490: Independent Study
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490A: Independent Study: Literature
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490B: Independent Study: Linguistics
(Cross-listed with LING). Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee or Linguistics Adviser
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490C: Independent Study: Rhetoric, Teaching of Composition
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490D: Independent Study: Criticism and Theory of Literature
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490E: Independent Study: Instructional Methods and Research
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490F: Independent Study: Creative Writing
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490G: Independent Study: Business/Technical Communication
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 490H: Independent Study: Honors
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered or who desire to integrate a study of literature or language with special problems in major fields. No more than 9 credits of ENGL 490 may be used toward graduation.

ENGL 492: Undergraduate Teaching Experience
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee
Teaching assistant experience.

ENGL 493: Advanced Creative Writing Workshop—Multi-Genre
Cr. 3. Repeatable, maximum of 6 credits. F.S.
Prereq: ENGL 304, ENGL 305, or ENGL 306 and junior standing
Advanced workshop of individual creative writing projects in short fiction, nonfiction, and poetry. Readings and discussion of published examples of short fiction, nonfiction, and poetry by authors of national and international note. Extensive discussion and written analysis of elements of craft across genres.

ENGL 494: Practice and Theory of Teaching Literature in the Secondary Schools
(Cross-listed with C I). (3-0) Cr. 3. F.S.
Prereq: ENGL 310, ENGL 397, 9 other credits in English beyond ENGL 250, PSYCH 333, admission to teacher education program
Portfolio review. Current theories and practices in the teaching of literature to secondary school students. Integrating literary study and writing. Preparation and selection of materials. Classroom presentation. Unit planning. (Taken concurrently with C I 280, Cr. 2, and Sp Ed 450).

ENGL 497: Capstone Assessment
Cr. 1. F.S.
Prereq: Junior status
Must be taken in conjunction with a 400-level English course.

Courses primarily for graduate students, open to qualified undergraduates:

ENGL 500: Teaching Multimodal Composition
(3-0) Cr. 3. F.
Prereq: Graduate classification; must be teaching Engl 150 or Engl 250 concurrently
Required of all new English Department teaching assistants teaching ISUComm Foundation Courses. Introduction to the teaching of ISUComm Foundation Courses. Foundational and relevant newer composition theory and pedagogical methods related to ISUComm Foundation Courses objectives and their classroom enactment, including development of assignments and supporting activities, and evaluation of student projects.

ENGL 501: Introduction to Research in Rhetoric, Composition, and Professional Communication
(3-0) Cr. 3.
Prereq: 6 graduate credits in English
Survey of the major rhetorical, qualitative, and quantitative methods used in research on communication and language in academic and nonacademic settings.

ENGL 503: Composition Theory
(3-0) Cr. 3.
Prereq: 6 graduate credits in English
In-depth consideration of the theory and practice of composition pedagogy. Opportunities for actual classroom application.

ENGL 504: Teaching Advanced Communication
(3-0) Cr. 3. F.
Prereq: Graduate classification
Teaching business and technical communication in university, community college, and industry settings. Emphasizes curriculum planning, materials development, assignment design, responding to student work, assessment of student work, and distance (online) teaching.

ENGL 505: User Experience Architecture and Testing for Advanced Communication
(3-0) Cr. 3.
Prereq: Graduate classification
Seminar course examining user experience (UX) interface design and development in technical communication. Focus is on the UX project cycle: creating userfaces, conducting user research, system testing, and implementing data-driven results.

ENGL 506: Professional Communication Theory
(3-0) Cr. 3.
Prereq: Admission to English Department graduate degree program
Introduction to professional communication as a discipline, with emphasis on theories of communication and discourse that inform professional communication research and on trends and developments in that research and the field.

ENGL 508: Writing for Academic Publication
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: 6 graduate credits
Hands-on practice in writing academic discourse for publication; rhetorical analyses of student-selected academic journals; discussion of current trends in academic writing; professional perspectives on the referee process and on journal editorial decision making. Focus on the writing of selected short pieces (opinion essays, standard reviews, conference-length papers) and of article-length manuscripts.

ENGL 510: Introduction to Computers in Applied Linguistics
(Cross-listed with LING). (3-0) Cr. 3. F.
Prereq: Graduate classification
Use of software and web applications for language teaching, linguistic analysis, and statistical analysis. Issues and problems in applied linguistics related to computer methods.

ENGL 511: Introduction to Linguistic Analysis
(Cross-listed with LING). (3-0) Cr. 3. F.
Prereq: Graduate classification
Principles and methods of linguistic analysis with emphasis on phonology, morphology, and syntax. Description of linguistic variation and current theoretical approaches to linguistics.

ENGL 512: Second Language Acquisition
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theory, methods, and results of second language acquisition research with emphasis on approaches relevant to second language teaching.

ENGL 513: Language Assessment Practicum
(Cross-listed with LING). (3-0) Cr. 3. F.S.SS.
Prereq: ENGL 519 or LING 519
Advanced practicum in language assessment.

ENGL 514: Sociolinguistics
(Cross-listed with LING). (3-0) Cr. 3. S.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theories and methods of examining language in its social setting. Analysis of individual characteristics (e.g., age, gender, ethnicity, social class, region), interactional factors (e.g., situation, topic, purpose) and national policies affecting language use.

ENGL 515: Statistical Natural Language Processing
(Cross-listed with HCI, LING). (3-0) Cr. 3.
Prereq: STAT 330 or equivalent, recommended ENGL 219 or LING 219, or ENGL 511 or LING 511
Introduction to computational techniques involving human language and speech in applications such as information retrieval and extraction, automatic text categorization, word prediction, intelligent Web searching, spelling and grammar checking, speech recognition and synthesis, statistical machine translation, n-grams, POS-tagging, word-sense disambiguation, on-line lexicons and thesauri, markup languages, corpus analysis, and Python programming language.

ENGL 516: Methods of Formal Linguistic Analysis
Cr. 3. Alt. S., offered even-numbered years.
Prereq: ENGL/LING 219 or equivalent.
Data and knowledge structures for formal representation of natural language and speech data. Designing and implementing algorithms for automating linguistic analysis tasks. Conceptual issues for natural language and speech processing programming.

ENGL 518: Teaching English as a Second Language Methods and Materials
(Cross-listed with LING). (3-0) Cr. 3. F.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Introduction to approaches, methods, techniques, materials, curricular design, and assessment for various levels of ESL instruction. Attention to issues related to the teaching of listening, speaking, reading, writing, vocabulary, pronunciation, and culture.

ENGL 519: Second Language Assessment
(Cross-listed with LING). (3-0) Cr. 3. S.
Prereq: ENGL 511 or LING 511
Principles of second language assessment including reliability, validity, authenticity and practicality. Constructing, scoring, interpreting, and evaluating second language tests for a variety of situations.

ENGL 520: Computational Analysis of English
(Cross-listed with HCI, LING). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 510 or LING 510, and ENGL 511 or LING 511
Concepts and practices for analysis of English by computer with emphasis on the applications of computational analysis to problems in applied linguistics such as corpus analysis and recognition of learner language in computer-assisted learning and language assessment.

ENGL 521: Teaching of Literature and the Literature Curriculum
(3-0) Cr. 3.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Examination of the roles of the literary work, reader, and teacher in literary study. Responses to literature. Place of literature in language arts. Study and development of curriculum materials for middle school, high school, and college levels of instruction.

ENGL 522: Literary Theory and Criticism
(3-0) Cr. 3.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Examination of the history, logic, and rhetoric of contemporary literary criticism and analysis.

ENGL 523: Introduction to Old English Language and Literature
(3-0) Cr. 3.
Prereq: Course in medieval literature or history or history of the English language recommended
Introductory study of Old English language and literature in prose and poetry, including extracts from Beowulf. Some attention to Anglo-Saxon culture.

ENGL 524: Literacy: Issues and Methods for Nonnative Speakers of English
(Cross-listed with LING). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theoretical and practical issues and techniques in the teaching of literacy in a variety of contexts, involving children and adults at basic skill levels and teens and adults in academic and vocational programs.

ENGL 525: Research and Teaching of Second Language Pronunciation
(Cross-listed with LING). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theoretical and practical issues and techniques in the teaching of second language pronunciation as it relates to other areas of language, especially listening and speaking skills. Topics will include segmental and suprasegmental features; intelligibility; pronunciation in language assessment; classroom, technology and individual instruction; and research issues. Topics will be relevant to those intending to teach or research in various contexts.

ENGL 526: Computer-Assisted Language Learning
(Cross-listed with LING). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ENGL 511 or LING 511 or equivalent
Theory, research, and practice in computer use for teaching nonnative speakers of English. Methods for planning and evaluating computer-based learning activities.

ENGL 527: Discourse Analysis
(Cross-listed with LING). (3-0) Cr. 3. S.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Methods and theoretical foundations for linguistic approaches to discourse analysis. Applications of discourse analysis to the study of texts in a variety of settings, including academic and research contexts.

ENGL 528: English for Specific Purposes
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Issues and techniques in analyzing, teaching, and assessing English for specific purposes. Topics include theories of specific purpose language use, analysis of learner needs in target language contexts, and corpus-informed syllabus and materials development for teaching and assessment.

ENGL 529: Content Management
(3-0) Cr. 3.
Prereq: ENGL 313
Strategies for developing and delivering multimodal content via digital media. Focus on the principles of database design, interface development, usability testing, and collaborative content management within professional communication settings.

ENGL 531: Topics in the Study of Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Intensive study of literary genres, periods, movements, or themes; e.g., Literature and Historicism, Narrating the Feminine, Allegory.

ENGL 532: American Literature to 1865
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Selected texts in American literature from Beginnings to the Civil War. Study may include Native American literature, the literature of European conquest, Colonial and Revolutionary periods, Early Republic, and Jacksonian Era, in critical and cultural contexts.

ENGL 533: British Literature to 1830
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Selected texts from the Medieval, Renaissance, Restoration, Eighteenth-Century, and/or Romantic periods, in critical and cultural contexts.

ENGL 534: American Literature 1865 to the Present
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Selected texts in American literature from the Civil War to the present. Study may include Realism, Naturalism, Modernism, and Postmodernism, with significant attention to race/ethnicity, gender, and identity, and to contemporary critical views. Range of authors and genres.

ENGL 535: British Literature 1830 to the Present
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Selected texts from the Victorian, Edwardian, Modernist, and/or Contemporary periods, in critical and cultural contexts.

ENGL 537: Corpus Approaches to Grammatical Analysis
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: ENGL 220 or LING 220; ENGL 219, LING 219, ENGL 511, LING 511, or introductory course in linguistics; graduate classification
Corpus-informed analysis of syntax in authentic writing and speech, with emphasis on approaches used in applied linguistics.

ENGL 538: Fiction
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Selected fiction writers in English; range of authors and genres. Emphasis on both male and female writers; attention to the relationships between fiction and cultural change.

ENGL 539: Poetry
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Selected poets writing in English, considered in representative groups.

ENGL 540: Drama
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Primary texts in dramatic genres from various literary periods, in critical and cultural contexts. Frequently concentrates on the English Renaissance and the Shakespearean stage.

ENGL 541: Autobiography, Biography, Memoir
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Study of lifewriting, e.g., autobiography, biography, memoir, cross-genre writing, autobiographical criticism. Readings may be arranged by period, nationality, or subgenre (e.g., autobiography of childhood experience, celebrity auto/biography).

ENGL 542: Document Design and Editing
(3-0) Cr. 3.
Prereq: Senior classification
Overview of the principles of desktop publishing as practiced in the field of technical communication. Focus on theories of print document design and project management, as well as digital prepress techniques employed to produce documents using external print services. Requires extensive use of current desktop publishing software.

ENGL 543: The Study of Environmental Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification
Intensive study of environmental literary genres, periods, figures, movements, or themes: e.g., Ecofeminism, Imagining Natural Disaster, Material Ecocriticism, Environmental Justice, Posthumanism.

ENGL 545: Women's Literature
(Cross-listed with W S). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Primary texts by women writers; historical, thematic, formal, or theoretical approaches; secondary readings; e.g., Nineteenth-Century Women Writers; American Women's Personal Narratives; Southern Women Writers of the U.S.

ENGL 546: Issues in the Study of Literature
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Intensive study of current and emerging topics and problems concerning literature and its relationship to theory and to language study; e.g., Theory of Metaphor; Renegotiating the Canon; Feminist Theory.

ENGL 547: The History of Rhetorical Theory I: From Plato to Bacon
(Cross-listed with SP CM). (3-0) Cr. 3.
Prereq: 6 credits in English
Rhetorical theory from the classical period of ancient Greece and Rome through the Middle Ages to the early Renaissance; attention to its relation to the nature of knowledge, communication, practice, and pedagogy.

ENGL 548: The History of Rhetorical Theory II: From Bacon to the Present
(Cross-listed with SP CM). (3-0) Cr. 3.
Prereq: 6 credits in English
Rhetorical theory from the early modern period (Bacon, Descartes, and Locke) to the present; attention to its relation to the nature of knowledge, communication practice, and pedagogy.

ENGL 549: Multimedia and Interaction Design
(3-0) Cr. 3.
Prereq: Senior classification
Rhetorical principles of interactive multimedia design, such as those in DVDs, Blu-Ray videos, and streaming web multimedia. Practical understanding of computer applications used in interactive multimedia development. Focus on theoretical and practical elements of producing multimedia training in both education and industry. Work with interactive hypertext, digital audio, and nonlinear video editing.

ENGL 550: Creative Writing: Craft and Professional Practice
(3-0) Cr. 3. F.
Prereq: Admission into MFA Program in Creative Writing and Environment
A multigenre craft course required of all incoming students in the MFA Program in Creative Writing and Environment. Students develop an understanding of craft and environmental writing across genres (poetry, fiction, nonfiction) as well as learn about editing and publication practice through the lens of a working literary journal, "Flyway: A Journal of Writing and Environment." Other course activities include presentations on the production practices of leading literary journals, individual editing projects, pragmatic tips for finding publication outlets for polished creative work, and a field trip to publishing houses.

ENGL 551: Master Workshop
(3-0) Cr. 3. F.
Prereq: Fifth-semester or equivalent standing in the Creative Writing and Environment MFA program
An advanced multigenre creative writing workshop. Students work intensively on book-length manuscripts of fiction, creative nonfiction, scriptwriting, or poetry.

ENGL 554: Workshop: Fiction
(3-0) Cr. 3. Repeatable, maximum of 12 credits.
Prereq: ENGL 550 and graduate classification. Open to graduate students outside MFA in Creative Writing and Environment with permission of instructor
Individual projects in fiction on a workshop and conference basis. Readings in short fiction. Discussion of elements of narrative such as plot, point of view, characterization, theme, setting.

ENGL 555: Workshop: Nonfiction
Cr. arr. Repeatable, maximum of 12 credits.
Prereq: ENGL 550 and graduate classification. Open to graduate students outside MFA in Creative Writing and Environment with permission of instructor
Individual projects in memoir, immersion journalism, character studies, and/or the personal essay on a workshop and conference basis. Readings in creative nonfiction.

ENGL 556: Workshop: Poetry
(3-0) Cr. 3. Repeatable, maximum of 12 credits.
Prereq: ENGL 550 and graduate classification. Open to graduate students outside MFA in Creative Writing and Environment with permission of instructor
Individual projects in poetry on a workshop and conference basis. Readings in poetry. Discussion of poetic elements such as image, sound, internal structure, rhythm, tone, figurative language.

ENGL 557: Studies in Creative Writing
(3-0) Cr. 3. Repeatable, maximum of 12 credits.
Prereq: Graduate classification. Open to graduate students outside MFA in Creative Writing and Environment with permission of instructor.
Special topics course on ideas, issues, and techniques in creative writing. Subject matter may include specific genres, aspects of the creative writing process, or themes of particular interest. Significant readings and written work required; previous workshop experience helpful.

ENGL 558: Teaching Creative Writing
(3-0) Cr. 3.
Prereq: Graduate classification
Pedagogical approaches that are effective for grade-school through adult-education creative writing teaching. Writing exercises, workshops, text evaluation, and visits from creative writers.

ENGL 559: Creative Writing Teaching Internship
Cr. 1-3. Repeatable.
Prereq: Permission of participating instructors
Students assist in an introductory creative writing class. Some supervised teaching but mainly evaluation of submissions and individual conferences. Requirements and grades determined by participating instructors.

ENGL 560: Environmental Field Experience
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 550 and graduate classification. Open to graduate students outside MFA in Creative Writing and Environment with permission of instructor
Students spend a term on a project that requires fieldwork. Projects might include working for a federal, state, or private non-profit environmental organization or farm, or living and working in a specified natural area.

ENGL 561: Methods for Scholarship in Literature and the Humanities
Cr. 3.
Prereq: Graduate classification or permission from the instructor
Intensive study of research methods and perspectives concerning the study of literature and the humanities at the master's level. Introduction to resources and techniques of research, the structure of academic articles, and strategies for argument in academic communication.

ENGL 586: Visual Rhetoric in Professional Communication
(3-0) Cr. 3.
Prereq: A course in professional communication
Rhetorical theory and research in graphics, document design, and related principles of visual communication. Methods of designing texts, data displays, illustrations, and other visual elements in business and technical communication.

ENGL 587: Internship in Business, Technical, and Professional Communication
(3-0) Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: ENGL 507 plus 3 additional graduate credits in business and technical writing or composition and rhetoric, permission of instructor. Limited to master's and doctoral degree candidates in the field of rhetoric and professional communication
An opportunity to write, edit, and design business and technical documents in a professional setting.

ENGL 588: Supervised Practice Teaching in Teaching English as a Second Language
(Cross-listed with LING). (1-5) Cr. 3. F.S.SS.
Prereq: 9 credits toward the TESL/TEFL Certificate, 15 credits toward the TESL/AL master's degree, or 18 credits completed toward the ESL Endorsement option.
Intensive observation of ESL instruction and supervised practice in teaching learners of English in a context appropriate to the student teacher's goals. ENGL 588 cannot be used for teacher licensure and cannot be taken during student teaching.

ENGL 589: Supervised Practicum in Literary Editing
(3-0) Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: ENGL 550 and permission of instructor
An opportunity to edit literary texts and gain experience in a literary publishing setting.

ENGL 590: Special Topics
(Cross-listed with LING). Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 590A: Special Topics: Literature
Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 590B: Special Topics: Teaching English as a Second Language (TESL)/Applied Linguistics
(Cross-listed with LING). Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 590C: Special Topics: Composition and Rhetoric
Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 590E: Special Topics: Rhetoric and Professional Communication
Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 590F: Special Topics: Creative Writing
Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 590G: Special Topics: Applied Linguistics and Technology
(Cross-listed with LING). Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

ENGL 591: Directed Readings
Cr. arr. Repeatable.

ENGL 591A: Directed Readings: Literature
Cr. arr. Repeatable.

ENGL 591B: Directed Readings: Teaching English as a Second Language (TESL)/Applied Linguistics
(Cross-listed with LING). Cr. arr. Repeatable.

ENGL 591C: Directed Readings: Composition and Rhetoric
Cr. arr. Repeatable.

ENGL 591E: Directed Readings: Rhetoric and Professional Communication
Cr. arr. Repeatable.

ENGL 591F: Directed Readings: Creative Writing
Cr. arr. Repeatable.

ENGL 591G: Directed Readings: Applied Linguistics and Technology
(Cross-listed with LING). Cr. arr. Repeatable.

ENGL 592: Core Studies in Rhetoric, Composition, and Professional Communication
(Cross-listed with SP CM). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

ENGL 592A: Core Studies: Rhetoric
(Cross-listed with SP CM). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

ENGL 592B: Core Studies: Composition
(Cross-listed with SP CM). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

ENGL 592C: Core Studies: Professional Communication
(Cross-listed with SP CM). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

ENGL 595: Graduate Study and Travel
Cr. arr.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.

ENGL 595A: Graduate Study and Travel: Literature
Cr. arr.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.

ENGL 595B: Graduate Study and Travel: Creative Writing
Cr. arr.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.

ENGL 595C: Graduate Study and Travel: Linguistics
Cr. arr.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.

ENGL 595D: Graduate Study and Travel: Rhetoric and Professional Communication
Cr. arr.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.

ENGL 595E: Graduate Study and Travel: Teacher Education
Cr. arr.
Prereq: Permission of instructor
Supervised study of an appropriate area of the discipline while traveling in a foreign country or in the U.S. Special fees apply.

ENGL 599: Creative Component
Cr. 3. F.S.SS.
Prereq: Graduate classification, permission of major professor

Courses for graduate students:

ENGL 602: Research Methods in Rhetoric, Composition, and Professional Communication
(3-0) Cr. 3. S.
Prereq: ENGL 501
A workshop for advanced graduate students in rhetoric and professional communication. Focus on rhetorical analysis, qualitative methods, or quantitative methods.

ENGL 602A: Research Methods in Rhetoric, Composition, and Professional Communication: Qualitative Research
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ENGL 501
A workshop for advanced graduate students in rhetoric and professional communication.

ENGL 602B: Research Methods in Rhetoric, Composition, and Professional Communication: Quantitative Research
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: ENGL 501
A workshop for advanced graduate students in rhetoric and professional communication.

ENGL 602C: Research Methods in Rhetoric, Composition, and Professional Communication: Rhetorical Analysis
(3-0) Cr. 3.
Prereq: ENGL 501
Extended practice in close textual analysis of various kinds of rhetorical artifacts. Attention to important theoretical concepts used in rhetorical analysis and to historical controversies over the scope and function of rhetorical analysis.

ENGL 603: Seminar in Composition Theory
(3-0) Cr. 3.
Prereq: ENGL 503
Exploration of relationships between theory and practice in current pedagogy. Intensive examination of contemporary theories of poststructuralism, new media, feminism, postcolonialism, or cultural studies and their impact on current pedagogical practice. Participation in pedagogical research and theory building.

ENGL 611: Seminar in Rhetorical Theory
(3-0) Cr. 3. Repeatable.
Prereq: ENGL 547 or ENGL 548
Rhetorical theory, criticism, and/or practice in relation to an historical period or a particular theoretical issue.

ENGL 623: Research Methods in Applied Linguistics
(Cross-listed with LING). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 511 or LING 511, ENGL 517 or LING 517, ENGL 519 or LING 519
Survey of research traditions in applied linguistics. Focus on theoretical and practical aspects of quantitative and qualitative approaches to applied linguistic study, including experimental and quasiexperimental methods, classroom observation and research, introspective methods, elicitation techniques, case studies, interactional analysis, ethnography, and program evaluation. Computational tools and resources for linguistic research will be highlighted.

ENGL 626: Computer-Assisted Language Testing
(Cross-listed with LING). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ENGL 510 or LING 510, ENGL 511 or LING 511, ENGL 519 or LING 519
Principles and practice for the use and study of computers and the Internet in second language assessment.

ENGL 630: Seminar in Applied Linguistics
(Cross-listed with LING). (3-0) Cr. 3. Repeatable.
Prereq: ENGL 510 or LING 510, ENGL 511 or LING 511
Topic changes each semester. Topics include advanced methods in natural language processing, technology and literacy in a global context, feedback in CALL programs, technology and pronunciation, and advances in language assessment.

ENGL 631: Administration and Organization of Multimodal Writing Programs
(3-0) Cr. 3.
Prereq: ENGL 500, ENGL 503, ENGL 504, or ENGL 603
Survey of the major components of writing instruction in academic and nonacademic settings. History, theory, organization, and evaluation of writing programs. Guided observation of writing program functions at various institutions and businesses.

ENGL 688: Practicum in Technology and Applied Linguistics
(Cross-listed with LING). (1-5) Cr. 3. F.S.SS.
Prereq: ENGL 510 or LING 510, ENGL 626 or LING 626, or equivalent; at least 2nd year PhD student in Applied Linguistics and Technology
Focus on integrating theoretical knowledge with practical expertise. Assess client needs; develop, integrate, and evaluate solutions. Practical understanding of computer applications used in multimedia development. Create web-based or CD-ROM-based multimedia materials. Work with advanced authoring applications.

ENGL 699: Research
Cr. arr. Repeatable. F.S.SS.
Prereq: Graduate classification, permission of major professor
Research.

Environmental Science

From the College of Liberal Arts and Sciences

http://www.ensci.iastate.edu

Interdepartmental Undergraduate Programs

Environmental Science provides an integrated, quantitative, and interdisciplinary approach to the study of environmental systems. The magnitude and complexity of environmental problems are creating a growing need for scientists with rigorous, interdisciplinary training in environmental science. The Environmental Science program is designed to prepare students for positions of leadership in this rapidly changing discipline. Environmental Science graduates have a solid foundation in biological and physical natural sciences and the specialized training necessary for integrated analysis of environmental systems.

Undergraduate Study

The Environmental Science undergraduate major is offered through both the College of Agriculture and Life Sciences and the College of Liberal Arts and Sciences. Environmental Science majors complete foundation courses in biology, chemistry, earth science, geology, physics and mathematics, plus a major consisting of an integrated core of Environmental Science courses and additional advanced course work in Environmental Science. Scientific rigor is stressed throughout the program, beginning with the foundation courses in the first two years of the curriculum. The upper level core courses emphasize a dynamic systems approach that provides a framework for integrating physical, chemical, and biological aspects of environmental systems.

Students seeking an Environmental Science major complete the following:

1. A foundation of approved supporting courses in science and mathematics including biology, chemistry, earth science, physics, calculus, and statistics.

2. 32 credits of course work in the major, including a required core of 20 credits.

A combined average grade of C or higher is required in courses applied in the major.

1. Environmental Science: 32 credits

ENSCI 110	Orientation to Environmental Science	1
ENSCI 201	Introduction to Environmental Issues	2
ENSCI 202	Exploration of Environmental and Sustainability Issues	1
ENSCI 203	Exploration of Environmental Science	1
ENSCI 250	Environmental Geography	3
ENSCI 251	Biological Processes in the Environment	3
ENSCI 381	Environmental Systems I: Introduction to Environmental Systems	3
ENSCI 382	Environmental Systems II: Analysis of Environmental Systems	3
ENSCI 384	Introduction to Ecosystems	3
Addional ENSCI choice courses		12
Total Credits		32

2. Mathematics & Statistics: 7-8 credits

Choose one of the following:		4
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Choose one of the following:		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
Total Credits		7-8

3. Physical & Life Sciences: 21-24 credits

BIOL 101	Introductory Biology	3
or BIOL 211	Principles of Biology I	
Choose from one of the following:		5-6
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	
CHEM 167 & 167L	General Chemistry for Engineering Students and Laboratory in General Chemistry for Engineering	
CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
CHEM 201 & 201L	Advanced General Chemistry and Laboratory in Advanced General Chemistry	
Choose from one of the following:		3-4
CHEM 231 & 231L	Elementary Organic Chemistry and Laboratory in Elementary Organic Chemistry	
CHEM 331 & 331L	Organic Chemistry I and Laboratory in Organic Chemistry I	
BBMB 221	Structure and Reactions in Biochemical Processes	
AGRON 259	Organic Compounds in Plants and Soils	
Choose from one of the following:		4-5
PHYS 111	General Physics	
PHYS 115	Physics for the Life Sciences	
PHYS 221	Introduction to Classical Physics I	
Choose 2 of the following:		6
AGRON 182	Introduction to Soil Science	
GEOL 100	The Earth	
or GEOL 201	Geology for Engineers and Environmental Scientists	

MTEOR 206	Introduction to Weather and Climate	
BIOL 212	Principles of Biology II	
CHEM 178 & 178L	General Chemistry II and Laboratory in College Chemistry II	
Total Credits		21-24

4. Communications: 7-10 credits

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
Embedded communication coursework in ENSCI 203, 381 and 382		
Total Credits		7

Additional communication Courses required of majors in the College of Agriculture and Life Sciences

SP CM 212	Fundamentals of Public Speaking	3
or AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
Total Credits		3

5. General Education: 15-21 credits

Additional general education requirements in the College of Agriculture and Life Sciences

Humanities	3
Social Science	3
Ethics	3
International Perspectives course from university approved list	3
US Diversity course from university approved list	3
Total Credits	15

additional general education requirements in the College of Liberal Arts and Sciences

Arts and Humanities courses from college approved list	12
Social Science courses from college approved list	9
(Select courses to include 3 cr. of International Perspectives and 3 cr. of US Diversity)	
Students must have completed 3 years of a single world language in high school or take 4-8 credits of World Languages at the university level	
Total Credits	21

Electives (28-35 credits)

120.0 Total Credits

Bachelor of Science B.S.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	BIOL 211	3
ENSCI 110[1]	1	BIOL 211L (or elective)	1
ENSCI 201	2	CHEM 178	3
CHEM 177	4	CHEM 178L	1
CHEM 177L	1	MATH 160, 165, or 181	4
STAT 101 or 104	3-4	Arts and Humanaities choice[2]	3
LIB 160	1		
	15-16		15

Sophomore

Fall	Credits	Spring	Credits
ENSCI 250[1]	3	ENSCI 251	3
Social science choice[2]	3	Organic chemistry choice[3]	3
PHYS 115	4	Earth science choice[3]	3
ENGL 250	3	Arts and humanities choice[2]	3
Elective	3	Social science choice[2]	3
		Summer: Consider field experience such as an intership or field station courses.	
	16		15

Junior

Fall	Credits	Spring	Credits
ENSCI 381[1]	3-4	ENSCI 382	3
Environmental science choice[1]	3	ENSCI 384	3
Arts and humanities choice[3]	3	Arts and humanities choice[2]	3
Elective	3	Elective	3
Elective	3	Elective	3
		Summer: Consider field experience such as an intership or field station courses.	
	15-16		15

Senior

Fall	Credits	Spring	Credits
Environmental science choice[1]	3	Environmental science choice[1]	3
Social science choice[2]	3	Environmental science choice[1]	3
Electives	9	Electives	9
	15		15

Students in all ISU majors must complete a 3 credits in U.S. diversity and a 3 credits in international perspectives. Check the Environmental Science website (http://www.ensci.iastate.edu) for a list of approved courses.
Minimum of 120 credits required , including a minimum of 45 credits at the 300/400 level.

[1] Students complete at least 2-7 credits in Environmental Science including ENSCI 110, 201, 250, 381, 382 and 15 additional credits of approved ENSCI coursework.

[2] Students complete at least 12 credits in arts and humanities and 9 credits in social science from approved lists. These credits can also be used to meet the U.S. Diversity and International Perspectives requirements.

[3] Students choose one course from the following Earth Science related courses: AGRON 182, BIOL 212, GEOL 100, GEOL 201, MTEOR 206. Students choose from one of the following Organic Chemistry options: CHEM 231 & 231L, BBMB 2221, or AGRON 259.

Graduate Study

Contact information for the graduate program:
Melissa Stolt
mstolt@iastate.edu
515-294-1170
https://enscigrad.iastate.edu/

The Environmental Science graduate program offers an interdepartmental curriculum leading to M.S. and Ph.D. degrees with a major in Environmental Science. Faculty from the colleges of Agriculture and Life Sciences, Engineering, and Liberal Arts and Sciences cooperate to offer courses and research opportunities covering a broad array of environmental topics. Cooperating departments include Agricultural and Biosystems Engineering; Agronomy; Animal Science; Civil, Construction and Environmental Engineering; Ecology, Evolution and Organismal Biology; and Geological and Atmospheric Sciences.

Applicants should have completed an undergraduate or master's degree in one of the biological, chemical, physical, or engineering sciences or should have equivalent preparation.

The Environmental Science Graduate Program emphasizes fundamental concepts and research, which at the same time address major environmental issues. The curriculum is designed to provide the interdisciplinary approach needed in environmental science education and research. In addition to work in their chosen area of specialization, students are afforded a broad exposure to the biological, chemical and physical aspects of environmental systems and the specialized training necessary for integrated analysis of these systems.

Information on application procedures, curriculum requirements, and faculty research areas is available on the Environmental Science Graduate Program website (https://enscigrad.iastate.edu/).

Courses primarily for undergraduates:

ENSCI 110: Orientation to Environmental Science
(1-0) Cr. 1. F.
Prereq: Freshman classification in EnSci
Overview of Environmental Science curriculum and discussion of professional opportunities. Offered on a satisfactory-fail basis only.

ENSCI 201: Introduction to Environmental Issues
(Cross-listed with BIOL, ENV S). (2-0) Cr. 2. F.
Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change.

ENSCI 202: Exploration of Environmental and Sustainability Issues
(1-0) Cr. 1. F.
Prereq: Credit or enrollment in ENSCI 201
Exploration of specific environmental and sustainability issues; designed to complement ENSCI 201. Offered on a satisfactory-fail basis only.

ENSCI 203: Exploration of Environmental Science
(1-0) Cr. 1. S.
Prereq: ENSCI 202.
Continued exploration of specific environmental science issues developed in ENSCI 202. Topics may vary in different years. Offered on a satisfactory-fail basis only.

ENSCI 250: Environmental Geography
(Cross-listed with ENV S). (3-0) Cr. 3. F.
The distribution, origins and functions of the earth's physical systems and the spatial relationship between human activity and the natural world.

ENSCI 251: Biological Processes in the Environment
(Cross-listed with BIOL). (3-0) Cr. 3. S.
Plant and microbial processes in environmental systems including their interactions with human activities.

ENSCI 301: Natural Resource Ecology and Soils
(Cross-listed with NREM). (3-3) Cr. 4. F.
Prereq: BIOL 211, BIOL 211L; FOR 201 or a second course in biology
Effects of environmental factors on ecosystem structure and function using forest, prairie and agricultural ecosystems as models. Special emphasis is given to soil-forming factors and the role of soil in nutrient and water cycling and ecosystem dynamics. Additional emphasis is given to human influences on natural ecosystems and the role of perennial plant communities in agricultural landscapes.

ENSCI 312: Ecology
(Cross-listed with A ECL, BIOL). (3-3) Cr. 4. F.SS.
Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L
Fundamental concepts and principles of ecology dealing with organisms, populations, communities, and ecosystems. Laboratory and field exercises examine ecological principles and methods as well as illustrate habitats.

ENSCI 312I: Ecology
(Cross-listed with A ECL, IA LL). Cr. 4. SS.
An introduction to the principles of ecology at the population, community and ecosystem level. Field studies of local lakes, wetlands and prairies are used to examine factors controlling distributions, interactions, and roles of plants and animals in native ecosystems.

ENSCI 324: Energy and the Environment
(Cross-listed with ENV S, GEOL, MTEOR). (3-0) Cr. 3. S.
Renewable and non-renewable energy resources. Origin, occurrence, and extraction of fossil fuels. Nuclear, wind, geothermal, biomass, hydroelectric, and solar energy. Biofuels. Energy efficiency. Environmental effects of energy production and use, including air pollution, acid precipitation, coal ash, mountaintop removal mining, oil drilling, hydraulic fracturing, groundwater contamination, nuclear waste disposal, and global climate change. Carbon sequestration and geoengineering solutions for reducing atmospheric CO2 concentrations.

ENSCI 345: Natural Resource Photogrammetry and Geographic Information Systems
(Cross-listed with NREM). (2-3) Cr. 3. S.
Prereq: Junior classification
Measurement and interpretation of aerial photos in resource management. Introduction to Geographic Information Systems (GIS) using ArcGIS including digitizing, development and query of attribute tables, georeferencing, and use of multiple GIS layers in simple spatial analyses.

ENSCI 360: Environmental Soil Science
(Cross-listed with AGRON). (2-2) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or ENSCI 250 or GEOL 201
Application of soil science to contemporary environmental problems; comparison of the impacts that different management strategies have on short- and long-term environmental quality and land development. Emphasis on participatory learning activities.

ENSCI 370: GIS for Ecology and Environmental Science
(Cross-listed with BIOL). Cr. 1-6. Repeatable. F.S.
Prereq: Six credits in biological and /or physical sciences, and permission of instructor.
Introduction to geographic information systems (GIS) with emphasis on ecological and environmental applications. No prior GIS experience required. Guided, individualized study of topics based on student background and interest. For students with prior experience, topics and activities are selected to build upon any previous experience and minimize duplication to previous GIS coursework. Potential topics include: basic concepts of GIS, data structures, database management, spatial analysis, modeling and visualization of ecological and environmental data. Case studies in ecological and environmental applications using ArcGIS. Offered on a satisfactory-fail basis only.

ENSCI 381: Environmental Systems I: Introduction to Environmental Systems
(Dual-listed with ENSCI 581). (Cross-listed with BIOL, ENV S, MICRO). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENSCI 382: Environmental Systems II: Analysis of Environmental Systems
(Dual-listed with ENSCI 582). (Cross-listed with BIOL). (2-2) Cr. 3. S.
Prereq: ENSCI 381
Continuation of EnSci 381. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENSCI 384: Introduction to Ecosystems
(3-0) Cr. 3. S.
Prereq: 12 credits of natural science including biology and chemistry
Biological and physical processes affecting material and energy flows in natural and managed ecosystems. Understanding and predicting climate and management impacts on ecosystem services and sustainability.

ENSCI 390: Internship in Environmental Science
Cr. arr. Repeatable. F.S.SS.
Prereq: Approval of the Environmental Science coordinator
Supervised off-campus work experience in the field of environmental science. Offered on a satisfactory-fail basis only.

ENSCI 391: Apprenticeship
Cr. arr. Repeatable. F.S.SS.
Prereq: Approval of the Environmental Science Coordinator
Practical experience in an approved setting such as a research laboratory, government office, or private office. Offered on a satisfactory-fail basis only.

ENSCI 402: Watershed Hydrology
(Dual-listed with ENSCI 502). (Cross-listed with GEOL, MTEOR, NREM). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

ENSCI 402I: Watershed Hydrology and Surficial Processes
(Cross-listed with AGRON, IA LL). Cr. 4. SS.
Prereq: Four courses in physical or biological sciences or engineering
Effects of geomorphology, soils, and land use on transport of water and materials (nutrients, contaminates) in watersheds. Fieldwork will emphasize investigations of the Iowa Great Lakes watershed.

ENSCI 404: Global Change
(Dual-listed with ENSCI 504). (Cross-listed with AGRON, ENV S, MTEOR). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

ENSCI 405: Environmental Biophysics
(Dual-listed with ENSCI 505). (Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)
Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

ENSCI 406: World Climates
(Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. S.
Prereq: AGRON 206/MTEOR 206
Distribution and causes of different climates around the world. Effects of climate and climate variations on human activities including society, economy and agriculture. Current issues such as climate change and international efforts to assess and mitigate the consequences of a changing climate. Semester project and in-class presentation required. Meets International Perspectives Requirement.

ENSCI 407: Watershed Management
(Dual-listed with ENSCI 507). (Cross-listed with ENV S, NREM). (3-3) Cr. 4. S.
Prereq: A course in general biology
Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers.

ENSCI 408: GIS and Natural Resources Management
(Dual-listed with ENSCI 508). (Cross-listed with A B E). (2-2) Cr. 3. F.
Prereq: Working knowledge of computers and Windows environment
Introduction to fundamental concepts and applications of GIS in natural resources management with specific focus on watersheds. Topics include: basic GIS technology, data structures, database management, spatial analysis, and modeling; visualization and display of natural resource data. Case studies in watershed and natural resource management using ArcView GIS.

ENSCI 408I: Aquatic Ecology
(Dual-listed with ENSCI 508I ENSCI 408I). (Cross-listed with IA LL). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

ENSCI 409: Field Methods in Hydrogeology
(Dual-listed with ENSCI 509). (Cross-listed with GEOL). (0-4) Cr. 3. Alt. SS., offered even-numbered years.
Prereq: GEOL/ENSCI 402 or GEOL/ENSCI 411 or C E 473
Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects.

ENSCI 411: Hydrogeology
(Dual-listed with ENSCI 511). (Cross-listed with GEOL). (3-2) Cr. 4. F.
Prereq: Four courses in biological or physical sciences
Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations.

ENSCI 414: Applied Groundwater Flow Modeling
(Dual-listed with ENSCI 514). (Cross-listed with GEOL). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: GEOL 411 or C E 473; MATH 165 or MATH 181
Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course.

ENSCI 415: Paleoclimatology
(Dual-listed with ENSCI 515). (Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in biological or physical science
Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods, utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~1 million years).

ENSCI 416: Hydrologic Modeling and Analysis
(Dual-listed with ENSCI 516). (Cross-listed with GEOL, MTEOR). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in Earth science, meteorology, or engineering; junior standing.
Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

ENSCI 418: Stream Ecology
(Dual-listed with ENSCI 518). (Cross-listed with A ECL). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A ECL 486
Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

ENSCI 419: Aqueous and Environmental Geochemistry
(Dual-listed with ENSCI 519). (Cross-listed with GEOL). (2-2) Cr. 3. S.
Prereq: CHEM 178, CHEM 178L; junior classification
Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling.

ENSCI 420: Environmental Engineering Chemistry
(Dual-listed with ENSCI 520). (Cross-listed with C E). (2-3) Cr. 3. F.
Prereq: C E 326, CHEM 178
Principles of chemical and physical phenomena applicable to the treatment of water and wastewater and natural waters; including chemical equilbria, reaction kinetics, acid-base equilibria, chemical precipitation, redox reactions, and mass transfer principles. Individual laboratory practicals and group projects required.

ENSCI 422I: Prairie Ecology
(Cross-listed with IA LL). Cr. 4. SS.
Prereq: Familiarity with basic principles in biological sciences and ecology
Basic patterns and underlying physical and biotic causes of both regional and local distributions of plants and animals of North American prairies; field and laboratory analyses and projects.

ENSCI 424: Air Pollution
(Dual-listed with ENSCI 524). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 424A: Air Polution: Air quality and effects of pollutants
(Dual-listed with ENSCI 524A). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 424B: Air Pollution: Climate change and causes
(Dual-listed with ENSCI 524B). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 424C: Air Pollution: Transportation Air Quality
(Dual-listed with ENSCI 524C). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

ENSCI 424D: Air Pollution: Off-gas treatment technology
(Dual-listed with ENSCI 524D). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

ENSCI 424E: Air Pollution: Agricultural sources of pollution
(Dual-listed with ENSCI 524E). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 426: Stable Isotopes in the Environment
(Dual-listed with ENSCI 526). (Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Four courses in biological or physical science
Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance.

ENSCI 437: Watershed Modeling and Policy
(Dual-listed with ENSCI 537). (Cross-listed with A B E). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CE 372 or equivalent
A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools.

ENSCI 446: Integrating GPS and GIS for Natural Resource Management
(Dual-listed with ENSCI 546). (Cross-listed with NREM). (2-3) Cr. 3. F.
Prereq: 12 credits in student's major at 300 level or above, NREM 345 or equivalent experience with ArcGIS
Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation.

ENSCI 451: Applied and Environmental Geophysics
(Dual-listed with ENSCI 551). (Cross-listed with GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar.

ENSCI 452: GIS for Geoscientists
(Dual-listed with ENSCI 552). (Cross-listed with AGRON, GEOL). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

ENSCI 459: Environmental Soil and Water Chemistry
(Dual-listed with ENSCI 559). (Cross-listed with AGRON). (3-3) Cr. 4. F.
Prereq: Two semesters of college-level chemistry, MATH 140, AGRON 182 (or equivalent) or AGRON 360; GEOL 100 and AGRON 354 recommended
An introduction to the chemical properties of soils, chemical reactions and transformations in soils and surface waters, and their impact on the environment. Topics include solution chemistry in soils and surface waters, solid-phase composition of soils, reactions at the solid-solution interface, and applications to contemporary environmental issues.

ENSCI 461I: Introduction to GIS
(Cross-listed with ENV S, IA LL, L A). Cr. 4. SS.
Descriptive and predictive GIS modeling techniques, spatial statistics, and map algebra. Application of GIS modeling techniques to environmental planning and resource management.

ENSCI 463: Soil Formation and Landscape Relationships
(Dual-listed with ENSCI 563). (Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. Credit for one of AGRON 463 or AGRON 463I may be applied for graduation.

ENSCI 463I: Soil Formation and Landscape Relationships
(Dual-listed with ENSCI 563I). (Cross-listed with AGRON, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

ENSCI 464: Wetland Ecology
(Dual-listed with ENSCI 564). (Cross-listed with BIOL). (3-0) Cr. 3. S.
Prereq: 15 credits in biological sciences.
Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands.

ENSCI 466: Ecosystem Service Management
(Dual-listed with ENSCI 566). (Cross-listed with ENT, NREM). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

ENSCI 477: Soil Physics
(Dual-listed with ENSCI 577). (Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 182 or equivalent and MATH 166 recommended
The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

ENSCI 479: Surficial Processes
(Dual-listed with ENSCI 579). (Cross-listed with GEOL). (2-3) Cr. 3. F.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips.

ENSCI 480: Engineering Analysis of Biological Systems
(Cross-listed with A B E). (2-2) Cr. 3. F.
Prereq: A B E 380 or permission of the instructor
Systems-level quantitative analysis of biological systems, including applications in foods, feeds, biofuels, bioenergy, and other biological systems. Introduction to economic analysis and life-cycle assessment of these systems at multiple production scales. Applying these tools to evaluate and improve cost and sustainability performance of these biological systems.

ENSCI 484: Ecosystem Ecology
(Cross-listed with BIOL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Combined 12 credits in biology, chemistry, and physics.
Introduction of the study of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations for ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues.

ENSCI 485: Soil and Environmental Microbiology
(Dual-listed with ENSCI 585). (Cross-listed with AGRON, MICRO). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

ENSCI 486: Aquatic Ecology
(Dual-listed with ENSCI 586). (Cross-listed with A ECL, BIOL). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

ENSCI 486L: Aquatic Ecology Laboratory
(Dual-listed with ENSCI 586L). (Cross-listed with A ECL, BIOL). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

ENSCI 487: Microbial Ecology
(Dual-listed with ENSCI 587). (Cross-listed with BIOL, MICRO). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

ENSCI 488: GIS for Geoscientists II
(Dual-listed with ENSCI 588). (Cross-listed with AGRON, GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

ENSCI 490: Independent Study
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of the instructor and approval of the Environmental Science coordinator

ENSCI 490H: Independent Study: Honors
Cr. arr. Repeatable. F.S.SS.
Permission of instructor and approval of Environmental Science coordinator.

ENSCI 495: Current Topics and Case Studies in Environmental Science
Cr. 1-3.
Prereq: Junior classification in Environmental Science, permission of instructor
Current topics and case studies related to the analysis and management of environmental systems. Individual and/or group projects.

ENSCI 496: Travel Course
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings. A. International Tour B. Domestic Tour.

ENSCI 496A: Travel Course: International Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

ENSCI 496B: Travel Course: Domestic Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

ENSCI 498: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of Environmental Science Coordinator
Required of all cooperative education students. Students must register prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

ENSCI 502: Watershed Hydrology
(Dual-listed with ENSCI 402). (Cross-listed with GEOL, MTEOR, NREM). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

ENSCI 504: Global Change
(Dual-listed with ENSCI 404). (Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

ENSCI 505: Environmental Biophysics
(Dual-listed with ENSCI 405). (Cross-listed with AGRON, MTEOR). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)
Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

ENSCI 507: Watershed Management
(Dual-listed with ENSCI 407). (Cross-listed with NREM). (3-3) Cr. 4. S.
Prereq: A course in general biology
Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers.

ENSCI 508: GIS and Natural Resources Management
(Dual-listed with ENSCI 408). (Cross-listed with A B E). (2-2) Cr. 3. F.
Prereq: Working knowledge of computers and Windows environment
Introduction to fundamental concepts and applications of GIS in natural resources management with specific focus on watersheds. Topics include: basic GIS technology, data structures, database management, spatial analysis, and modeling; visualization and display of natural resource data. Case studies in watershed and natural resource management using ArcView GIS.

ENSCI 508I: Aquatic Ecology
(Cross-listed with IA LL, NREM). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

ENSCI 509: Field Methods in Hydrogeology
(Dual-listed with ENSCI 409). (Cross-listed with GEOL). (0-4) Cr. 3. Alt. SS., offered even-numbered years.
Prereq: GEOL/ENSCI 402 or GEOL/ENSCI 411 or C E 473
Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects.

ENSCI 511: Hydrogeology
(Dual-listed with ENSCI 411). (Cross-listed with GEOL). (3-2) Cr. 4. F.
Prereq: Four courses in biological or physical sciences
Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations.

ENSCI 514: Applied Groundwater Flow Modeling
(Dual-listed with ENSCI 414). (Cross-listed with GEOL). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: GEOL 411 or C E 473; MATH 165 or MATH 181
Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course.

ENSCI 515: Paleoclimatology
(Dual-listed with ENSCI 415). (Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in biological or physical science
Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods; utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~ 1 million years).

ENSCI 516: Hydrologic Modeling and Analysis
(Dual-listed with ENSCI 416). (Cross-listed with GEOL, MTEOR). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in earth science, meteorology, or engineering; junior standing
Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

ENSCI 518: Stream Ecology
(Dual-listed with ENSCI 418). (Cross-listed with A ECL). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: A ECL 486
Biological, chemical, physical, and geological processes that determine the structure and function of flowing water ecosystems. Current ecological theories as well as applications to stream management for water quality and fisheries.

ENSCI 519: Aqueous and Environmental Geochemistry
(Dual-listed with ENSCI 419). (Cross-listed with GEOL). (2-2) Cr. 3. S.
Prereq: CHEM 178, CHEM 178L; junior classification
Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling.

ENSCI 520: Environmental Engineering Chemistry
(Dual-listed with ENSCI 420). (Cross-listed with C E). (2-3) Cr. 3. F.
Prereq: C E 326, CHEM 178
Principles of chemical and physical phenomena applicable to the treatment of water and wastewater and natural waters; including chemical equilbria, reaction kinetics, acid-base equilibria, chemical precipitation, redox reactions, and mass transfer principles. Individual laboratory practicals and group projects required.

ENSCI 521: Environmental Biotechnology
(Cross-listed with C E). (2-2) Cr. 3. F.
Prereq: C E 326
Fundamentals of biochemical and microbial processes applied to environmental engineering processes, role of microorganisms in wastewater treatment and bioremediation, bioenergetics and kinetics, metabolism of xenobiotic compounds, waterborne pathogens and parasites, and disinfection. Term paper and oral presentation.

ENSCI 522: Water Pollution Control Processes
(Cross-listed with C E). (2-2) Cr. 3.
Prereq: C E 521
Fundamentals of biochemical processes, aerobic growth in a single CSTR, multiple events in complex systems, and techniques for evaluating kinetic parameters; unit processes of activated sludge system, attached growth systems, stabilization and aerated lagoon systems, biosolids digestion and disposal, nutrient removal, and anaerobic treatment systems.

ENSCI 523: Physical-Chemical Treatment Process
(Cross-listed with C E). (2-2) Cr. 3.
Prereq: C E 520
Material and energy balances. Principles and design of physical-chemical unit processes; including screening, coagulation, flocculation, chemical precipitation, sedimentation, filtration, lime softening and stabilization, oxidation, adsorption, membrane processes, ion exchange and disinfection; recovery of resources from residuals and sludges; laboratory exercises and demonstrations; case studies in mineral processing and secondary industries.

ENSCI 524: Air Pollution
(Dual-listed with ENSCI 424). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 524A: Air Polution: Air quality and effects of pollutants
(Dual-listed with ENSCI 424A). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 524B: Air Pollution: Climate change and causes
(Dual-listed with ENSCI 424B). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 524C: Air Pollution: Transportation Air Quality
(Dual-listed with ENSCI 424C). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: C E 524A; PHYS 221 or CHEM 178; MATH 166 or 3 credits in statistics. Senior classification or above.

ENSCI 524D: Air Pollution: Off-gas treatment technology
(Dual-listed with ENSCI 424D). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: C E 524A, C E 524B; Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above

ENSCI 524E: Air Pollution: Agricultural sources of pollution
(Dual-listed with ENSCI 424E). (Cross-listed with A B E, C E). (1-0) Cr. 1.
Prereq: Either PHYS 221 or CHEM 178 and either MATH 166 or 3 credits in statistics. Senior classification or above
1 cr. per module. Module A prereq for all modules; module B prereq for D and E.

ENSCI 526: Stable Isotopes in the Environment
(Dual-listed with ENSCI 426). (Cross-listed with GEOL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Four courses in biological or physical science
Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance.

ENSCI 528: Solid and Hazardous Waste Management
(Cross-listed with C E). (3-0) Cr. 3.
Prereq: C E 326 or background courses in both environmental chemistry and microbiology; junior or higher standing
Evaluation, characterization, assessment, planning and design of solid and hazardous waste management systems, regulatory requirements, material characterization and collection, minimization and recycling, energy and materials recovery, composting, off-gas treatment, incineration, stabilization, and landfill design. Design of treatment and disposal systems, including physical, chemical, and biological treatment, solidification, incineration, secure landfill design, and final disposal site closure plus restoration.

ENSCI 531: Design and Evaluation of Soil and Water Conservation Systems
(Cross-listed with A B E). (2-3) Cr. 3. F.
Prereq: E M 378 or CH E 356
Hydrology and hydraulics in agricultural and urbanizing watersheds. Design and evaluation of systems for the conservation and quality preservation of soil and water resources. Use and analysis of hydrologic data in engineering design; relationship of topography, soils, crops, climate, and cultural practices in conservation and quality preservation of soil and water for agriculture. Small watershed hydrology, water movement and utilization in the soil-plant-atmosphere system, agricultural water management, best management practices, and agricultural water quality. Graduate students will prepare several research literature reviews on topics covered in the class in addition to the other assignments.

ENSCI 532: Nonpoint Source Pollution and Control
(Cross-listed with A B E). (3-0) Cr. 3.
Prereq: A B E 431 or C E 372 or instructor permission
Characteristics and courses of non-point source (NPS) pollution in agricultural and urban watersheds, computer modeling and NPS pollution for terrestrial and aquatic systems, strategies to control and manage NPS pollution of water bodies, total maximum daily loads (TMDLs) and integrated watershed management. Graduate students are required to review research papers and develop/deliver lecture models on assigned topics.

ENSCI 533: Erosion and Sediment Transport
(Cross-listed with A B E, NREM). (2-3) Cr. 3. F.
Prereq: C E 372 or GEOL/ENSCI/MTEOR 402, MATH 166 or equivalent
Soil erosion processes, soil loss equations and their application to conservation planning, sediment properties, initiation of sediment motion and over land flow, flow in alluvial channels and theory of sediment transport, channel stability, reservoir sedimentation, wind erosion, BMPs for controlling erosion.

ENSCI 534: Contaminant Hydrogeology
(Cross-listed with GEOL). (3-0) Cr. 3. S.
Prereq: GEOL 511 or equivalent
Theory and practical considerations of fate and transport of solutes through porous geologic materials. Organic and inorganic contaminants in industrial and agricultural settings. Subsurface microbiology and biodegradation of aromatic and chlorinated hydrocarbons. Investigation of coupled processes (diffusion, advection, dispersion, sorption, and biodegradation) using computer models. Soil and groundwater monitoring and remediation strategies.

ENSCI 535: Restoration Ecology
(Cross-listed with EEOB, NREM). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 366 or BIOL 474 or graduate standing
Theory and practice of restoring animal and plant diversity, structure and function of disturbed ecosystems. Restored freshwater wetlands, forests, prairies and reintroduced species populations will be used as case studies.

ENSCI 535I: Restoration Ecology
(Cross-listed with A ECL, EEOB, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: A course in ecology
Ecological principles for the restoration of native ecosystems; establishment (site preparation, selection of seed mixes, planting techniques) and management (fire, mowing, weed control) of native vegetation; evaluation of restorations. Emphasis on the restoration of prairie and wetland vegetation.

ENSCI 536: Design and Evaluation of Soil and Water Monitoring Systems
(Cross-listed with A B E). (2-3) Cr. 3. Alt. S., offered even-numbered years.
Prereq: A B E 431/A B E 531
Development of monitoring systems that support effective planning, performance evaluation, modeling, or environmental impact assessment of soil-, water-, and waste-management systems. Typical soil and water pollutants and physical, chemical, and biological characteristics that affect sample location and timing. Sample collection, documentation, chain-of-custody, and quality assurance procedures. In addition to other assignments, graduate students will prepare several research literature reviews on topics covered in the class and develop monitoring plans.

ENSCI 537: Watershed Modeling and Policy
(Dual-listed with ENSCI 437). (Cross-listed with A B E). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: CE 372 or equivalent
A project-based course on watershed-scale models for improving water quality. Legislative and judicial basis of the Total Maximum Daily Load (TMDL) program; approaches to TMDL development; principles and techniques for implementation; stakeholder engagement strategies. Hands-on experiences with GIS-interfaced models, data sources, calibration/validation, statistical assessment of model results, and simulation using multiple tools. In addition to other assignments, graduate students will present case studies of TMDLs using different modeling tools.

ENSCI 546: Integrating GPS and GIS for Natural Resource Management
(Dual-listed with ENSCI 446). (Cross-listed with NREM). (2-3) Cr. 3. F.
Prereq: 12 credits in student's major at 300 level or above, NREM 345 or equivalent experience with ArcGIS
Emphasis on the use of GPS as a data collection tool for GIS. Basic theory of GPS. Use of Global Positioning System technology for spatial data collection and navigation. Post-processing and real-time correction of GPS data. GPS data transfer to GIS for mapping applications. Use of GIS to construct waypoints for use in GPS navigation.

ENSCI 551: Applied and Environmental Geophysics
(Dual-listed with ENSCI 451). (Cross-listed with GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar.

ENSCI 552: GIS for Geoscientists
(Dual-listed with ENSCI 452). (Cross-listed with AGRON, GEOL). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

ENSCI 553: Soil-Plant Relationships
(Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 354
Composition and properties of soils in relation to the nutrition and growth of plants.

ENSCI 558: Laboratory Methods in Soil Chemistry
(Cross-listed with AGRON). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: AGRON 354 and CHEM 211
Experimental and descriptive inorganic and organic analyses. Operational theory and principles of applicable instruments, including spectrophotometry, atomic and molecular absorption and emission spectroscopy, mass spectrometry, X-ray diffraction and fluorescence, gas and ion chromatography, and ion-selective electrodes.

ENSCI 559: Environmental Soil and Water Chemistry
(Dual-listed with ENSCI 459). (Cross-listed with AGRON). (3-3) Cr. 4. F.
Prereq: Two semesters of college-level chemistry, MATH 140, AGRON 182 (or equivalent) or AGRON 360; GEOL 100 and AGRON 354 recommended
An introduction to the chemical properties of soils, chemical reactions and transformations in soils and surface waters, and their impact on the environment. Topics include solution chemistry in soils and surface waters, solid-phase composition of soils, reactions at the solid-solution interface, and applications to contemporary environmental issues.

ENSCI 563: Soil Formation and Landscape Relationships
(Dual-listed with ENSCI 463). (Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Two weekend field trips. Credit for one of AGRON 463 or AGRON 463I may be applied for graduation.

ENSCI 563I: Soil Formation and Landscape Relationships
(Dual-listed with ENSCI 463I). (Cross-listed with AGRON, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

ENSCI 564: Wetland Ecology
(Dual-listed with ENSCI 464). (Cross-listed with EEOB). (3-0) Cr. 3. S.
Prereq: 15 credits in biological sciences.
Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands.

ENSCI 564I: Wetland Ecology
(Cross-listed with EEOB, IA LL). Cr. 4. SS.
Prereq: Ia LL 312I
Ecology, classification, creation, restoration, and management of wetlands. Field studies will examine the composition, structure and functions of local natural wetlands and restored prairie pothole wetlands. Individual or group projects.

ENSCI 566: Ecosystem Service Management
(Dual-listed with ENSCI 466). (Cross-listed with ENT, NREM). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: permission of instructor
Land use and conservation techniques for improving ecosystem services including: pollination of crops, biological control of pests, prevention of erosion and water quality improvement.

ENSCI 571: Surface Water Hydrology
(Cross-listed with C E). (3-0) Cr. 3. S.
Prereq: C E 372
Analysis of hydrologic data including precipitation, infiltration, evapotranspiration, direct runoff and streamflow; theory and use of frequency analysis; theory of streamflow and reservoir routing; use of deterministic and statistical hydrologic models. Fundamentals of surface water quality modeling, point and non-point sources of contamination. Design project.

ENSCI 572: Analysis and Modeling Aquatic Environments
(Cross-listed with C E). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: C E 372
Principles of surface water flows and mixing. Introduction to hydrologic transport and water quality simulation in natural water systems. Advection, diffusion and dispersion, chemical and biologic kinetics, and water quality dynamics. Applications to temperature, dissolved oxygen, primary productivity, and other water quality problems in rivers, lakes and reservoirs. Deterministic vs. stochastic models.

ENSCI 573: Groundwater Hydrology
(3-0) Cr. 3. F.
Prereq: C E 372
Principles of groundwater flow, hydraulics of wells, superposition, slug and pumping tests, streamlines and flownets, and regional groundwater flow. Contaminant transport. Computer modeling. Design project. Extra assignments required for graduate students.

ENSCI 575: Soil Formation and Transformation
(Cross-listed with AGRON). (3-0) Cr. 3. F.
Prereq: AGRON 463 or equivalent
Advanced study of soil formation, emphasizing relationships among soils, landscapes, environment, humans, and land use.

ENSCI 577: Soil Physics
(Dual-listed with ENSCI 477). (Cross-listed with AGRON). (3-0) Cr. 3. S.
Prereq: AGRON 182 or equivalent and MATH 166 recommended
The physical soil system: the soil components and their physical interactions; transport processes involving water, air, and heat.

ENSCI 578: Laboratory Methods in Soil Physics
(Cross-listed with AGRON). (0-3) Cr. 1. S.
Prereq: concurrent enrollment in AGRON 477 or AGRON 577
Methods of measuring soil physical properties such as texture, density, and water content, and transport of heat, water, and gases.

ENSCI 579: Surficial Processes
(Dual-listed with ENSCI 479). (Cross-listed with GEOL). (2-3) Cr. 3. F.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips.

ENSCI 581: Environmental Systems I: Introduction to Environmental Systems
(Dual-listed with ENSCI 381). (Cross-listed with EEOB). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENSCI 582: Environmental Systems II: Analysis of Environmental Systems
(Dual-listed with ENSCI 382). (Cross-listed with EEOB). (2-2) Cr. 3. S.
Prereq: ENSCI 381
Continuation of EnSci 381. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENSCI 584: Advanced Ecosystem Ecology
(Cross-listed with EEOB). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Combined 12 credits in biology, chemistry, and physics.
Advanced studies of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations and modern approaches to ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues.

ENSCI 585: Soil and Environmental Microbiology
(Dual-listed with ENSCI 485). (Cross-listed with AGRON, MICRO). (2-3) Cr. 3. F.
Prereq: AGRON 182 or equivalent; MICRO 201 and MICRO 201L recommended
The living organisms in the soil and what they do. Emphasis on soil biota composition, the carbon cycle and bioremediation, soil-plant-microbial relationships, and environmental issues.

ENSCI 586: Aquatic Ecology
(Dual-listed with ENSCI 486). (Cross-listed with A ECL, EEOB). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

ENSCI 586L: Aquatic Ecology Laboratory
(Dual-listed with ENSCI 486L). (Cross-listed with A ECL, EEOB). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

ENSCI 587: Microbial Ecology
(Dual-listed with ENSCI 487). (Cross-listed with EEOB, MICRO). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

ENSCI 588: GIS for Geoscientists II
(Dual-listed with ENSCI 488). (Cross-listed with AGRON, GEOL). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

ENSCI 590: Special Topics
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of major professor in Environmental Science faculty
Literature reviews and conference in accordance with needs and interest of the student.

ENSCI 599: Creative Component
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of major professor in Environmental Science faculty
Creative component for nonthesis master of science degree.

Courses for graduate students:

ENSCI 685: Advanced Soil Biochemistry
(Cross-listed with AGRON, MICRO). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: AGRON 585
Chemistry of soil organic matter and biochemical transformations brought about by microorganisms and enzymes in soils.

ENSCI 698: Seminar in Environmental Science
Cr. 1. Repeatable. S.
Reports and discussion of recent research and literature.

ENSCI 699: Research
Cr. arr. Repeatable. F.S.SS.

Environmental Studies

Interdepartmental Undergraduate Program

Environmental Studies deals with the relationship and interactions between humans and the environment. Students in any college at ISU may elect to take a secondary major or minor in Environmental Studies. The curriculum is designed to give students an understanding of current and emerging environmental issues and an appreciation of different perspectives regarding these issues. Courses are provided for students pursuing careers related to the environment and for others who simply want to know more about environmental issues.

Secondary Major

The Environmental Studies secondary major is taken in addition to a first major and provides the breadth of preparation and integrated perspective necessary to understand environmental issues. Students seeking a major in Environmental Studies complete 24 credits of ENV S coursework including:

At least one general survey course chosen from:	
ENV S 101	Environmental Geology: Earth in Crisis
ENV S 120	Introduction to Renewable Resources
ENV S 173	Environmental Biology
ENV S 201	Introduction to Environmental Issues
At least one integrative/issues course chosen from:	
ENV S 160	Water Resources of the World
ENV S 204	Biodiversity
ENV S 324	Energy and the Environment
ENV S 342	World Food Issues: Past and Present
ENV S 404	Global Change
ENV S 424	Sustainable and Environmental Horticulture Systems
ENV S 450	Issues in Sustainable Agriculture
At least two human/societal perspectives courses chosen from:	

ENV S 293	Environmental Planning
ENV S 320	Ecofeminism
ENV S 334	Environmental Ethics
ENV S 345	Population and Society
ENV S 355	Literature and the Environment
ENV S 380	Energy, Environmental and Resource Economics
ENV S 382	Environmental Sociology
ENV S 383	Environmental Politics and Policies
ENV S 384	Religion and Ecology
ENV S 442	The Policy and Politics of Coastal Areas
ENV S 472	U. S. Environmental History
ENV S 484	Sustainable Communities
ENV S 491	Environmental Law and Planning

Beyond these three requirements, any Environmental Studies course and up to six credits of approved environmental coursework outside of Environmental Studies may be applied toward the 24 credit total for the major. Regardless of their home college, Environmental Studies majors must complete at least 9 credits of approved coursework in natural science. Unless prohibited by program or college rules, courses used to fulfill requirements of the Environmental Studies major may also be used to satisfy general education and other requirements of departments and colleges. A combined average grade of C or higher is required in courses applied to the major.

Minor

Students seeking a minor in Environmental Studies complete 15 credits of approved Environmental Studies coursework including:

At least one general survey course chosen from:	
ENV S 101	Environmental Geology: Earth in Crisis
ENV S 120	Introduction to Renewable Resources
ENV S 173	Environmental Biology
ENV S 201	Introduction to Environmental Issues
At least one integrative/issues course chosen from:	
ENV S 160	Water Resources of the World
ENV S 204	Biodiversity
ENV S 324	Energy and the Environment
ENV S 342	World Food Issues: Past and Present
ENV S 404	Global Change
ENV S 424	Sustainable and Environmental Horticulture Systems
ENV S 450	Issues in Sustainable Agriculture
At least two human/societal perspectives courses chosen from:	
ENV S 293	Environmental Planning
ENV S 320	Ecofeminism
ENV S 334	Environmental Ethics
ENV S 345	Population and Society
ENV S 355	Literature and the Environment
ENV S 380	Energy, Environmental and Resource Economics
ENV S 382	Environmental Sociology
ENV S 383	Environmental Politics and Policies
ENV S 384	Religion and Ecology
ENV S 442	The Policy and Politics of Coastal Areas
ENV S 472	U. S. Environmental History
ENV S 484	Sustainable Communities
ENV S 491	Environmental Law and Planning

A combined average grade of C or higher is required in courses applied to the minor, and the minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

Courses primarily for undergraduates:

ENV S 101: Environmental Geology: Earth in Crisis
(Cross-listed with GEOL). (3-0) Cr. 3. F.S.
An introduction to geologic processes and the consequences of human activity from local to global scales. Discussion of human population growth, resource depletion, pollution and waste disposal, global warming and ozone depletion, desertification, and geologic hazards such as earthquakes, landslides, flooding, and volcanism.

ENV S 108: Introduction to Oceanography
(Cross-listed with GEOL). (3-0) Cr. 3. F.
Introduction to study of the oceans. Ocean exploration. Waves and currents. Shape, structure, and origin of the ocean basins. Sedimentary record of oceanic life. Composition of seawater and its significance for life. Ocean circulation and its influence on climate. Life of the oceans, including coral reefs. Use and misuse of ocean resources. Anthropogenic impacts on the oceanic environment.

ENV S 111: Geological Disasters
(Cross-listed with GEOL). (1-0) Cr. 1. F.S.SS.
Introduction to the catastrophic geologic processes that disrupt ecosystems and human activity. Includes a discussion on the role of plate tectonics, the hydrologic cycle, and humans as the driving forces behind selected case studies on volcanic eruptions, earthquakes, tsunamis, landslides, and floods. Summer - online only.

ENV S 120: Introduction to Renewable Resources
(Cross-listed with AGRON, NREM). (3-0) Cr. 3. F.S.
Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management.

ENV S 130: Natural Resources and Agriculture
(Cross-listed with NREM). (3-0) Cr. 3. S.
Survey of the ecology and management of fish, forest, and wildlife resources in areas of intensive agriculture, with emphasis on Iowa. Conservation and management practices for private agricultural lands. Designed for nonmajors.

ENV S 160: Water Resources of the World
(Cross-listed with AGRON, GEOL, MTEOR). (3-0) Cr. 3. S.
Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement.

ENV S 173: Environmental Biology
(Cross-listed with BIOL). (3-0) Cr. 3. F.S.
An introduction to the structure and function of natural systems at scales from the individual to the biosphere and the complex interactions between humans and their environment. Discussions of human population growth, biodiversity, sustainability, resource use, and pollution. Does not satisfy biology major requirements.

ENV S 201: Introduction to Environmental Issues
(Cross-listed with BIOL, ENSCI). (2-0) Cr. 2. F.
Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change.

ENV S 204: Biodiversity
(Cross-listed with BIOL). (4-0) Cr. 2. S.
Prereq: One course in life sciences
Survey of the major groups of organisms and biological systems. Definition, measurements, and patterns of distribution of organisms. Sources of information about biodiversity. Does not satisfy biology major requirements. Half semester course.

ENV S 220: Globalization and Sustainability
(Cross-listed with ANTHR, GLOBE, M E, MAT E, SOC, T SC). (3-0) Cr. 3. F.S.
An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.
Meets International Perspectives Requirement.

ENV S 250: Environmental Geography
(Cross-listed with ENSCI). (3-0) Cr. 3. F.
The distribution, origins and functions of the earth's physical systems and the spatial relationship between human activity and the natural world.

ENV S 270: Foundations in Natural Resource Policy and History
(Cross-listed with L A, NREM). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
The development of natural resource conservation philosophy and policy from the Colonial Era to the present. North American wildlife, forestry, and environmental policy; national parks and other protected lands; federal and state agencies. Relationship to cultural contexts, including urban reform and American planning movement. Discussion of common pool resources, public and private lands.

ENV S 293: Environmental Planning
(Cross-listed with C R P). (3-0) Cr. 3. F.S.
Comprehensive overview of the field of environmental relationships and the efforts being made to organize, control, and coordinate environmental, aesthetic, and cultural characteristics of land, air, and water.

ENV S 320: Ecofeminism
(Cross-listed with W S). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: W S 201 or 3 credits in Women's Studies at the 300 level or above
Women's relationships with the earth, non-human nature, and other humans. The course explores the connections between society's treatment of women and nature; origins of ecofeminism and how it relates to the science of ecology, conventional and sustainable agriculture as well as how ecofeminism relates to other branches of feminist philosophy. Evaluation and critique of modern science, technology, political systems and SOLUTIONS will be included.

ENV S 324: Energy and the Environment
(Cross-listed with ENSCI, GEOL, MTEOR). (3-0) Cr. 3. S.
Renewable and non-renewable energy resources. Origin, occurrence, and extraction of fossil fuels. Nuclear, wind, geothermal, biomass, hydroelectric, and solar energy. Biofuels. Energy efficiency. Environmental effects of energy production and use, including air pollution, acid precipitation, coal ash, mountaintop removal mining, oil drilling, hydraulic fracturing, groundwater contamination, nuclear waste disposal, and global climate change. Carbon sequestration and geoengineering solutions for reducing atmospheric CO2 concentrations.

ENV S 334: Environmental Ethics
(Cross-listed with PHIL). (3-0) Cr. 3. F.
Prereq: Three credits in philosophy or junior classification
Thorough study of some of the central moral issues arising in connection with human impact on the environment, e.g., human overpopulation, species extinction, forest and wilderness management, pollution. Several world views of the proper relationship between human beings and nature will be explored.

ENV S 342: World Food Issues: Past and Present
(Cross-listed with AGRON, FS HN, T SC). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

ENV S 342H: World Food Issues: Past and Present, Honors
(Cross-listed with AGRON, T SC). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

ENV S 345: Population and Society
(Cross-listed with SOC). (3-0) Cr. 3. F.
Prereq: SOC 134
Human population growth and structure; impact on food, environment, and resources; gender issues; trends of births, deaths, and migration; projecting future population; population policies and laws; comparison of the United States with other societies throughout the world.
Meets International Perspectives Requirement.

ENV S 355: Literature and the Environment
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 250
Study of literary texts that address the following topics, among others: the relationship between people and natural/urban environments, ecocriticism, and the importance of place in the literary imagination.

ENV S 380: Energy, Environmental and Resource Economics
(Cross-listed with ECON). (3-0) Cr. 3.
Prereq: ECON 101
Natural resource availability, use, conservation, and government policy, with emphasis on energy issues. Environmental quality and pollution control policies.

ENV S 381: Environmental Systems I: Introduction to Environmental Systems
(Cross-listed with BIOL, ENSCI, MICRO). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

ENV S 382: Environmental Sociology
(Cross-listed with SOC). (3-0) Cr. 3. F.S.
Prereq: Soc 134 or 3 credits of ENV S
Environment-society relations; social construction of nature and the environment; social and environmental impacts of resource extraction, production, and consumption; environmental inequality; environmental mobilization and movements; U.S. and international examples.

ENV S 383: Environmental Politics and Policies
(Cross-listed with POL S). (3-0) Cr. 3. F.
Prereq: sophomore classification
Major ideologies relation to conservation and ecology. Processes, participants, and institutions involved in state, national, and global environmental policymaking. Case studies of environmental controversies and proposals for policy reform.

ENV S 384: Religion and Ecology
(Cross-listed with RELIG). (3-0) Cr. 3.
Introduction to concepts of religion and ecology as they appear in different religious traditions, from both a historical and contemporary perspective. Special attention to religious response to contemporary environmental issues.
Meets International Perspectives Requirement.

ENV S 390: Internship in Environmental Studies
Cr. arr. Repeatable. F.S.SS.
Prereq: Approval of the Environmental Studies Coordinator
Practical experience with nature centers, government agencies, schools, private conservation groups, and other organizations. Offered on a satisfactory-fail basis only.

ENV S 404: Global Change
(Cross-listed with AGRON, ENSCI, MTEOR). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

ENV S 407: Watershed Management
(Cross-listed with ENSCI, NREM). (3-3) Cr. 4. S.
Prereq: A course in general biology
Managing human impacts on the hydrologic cycle. Field and watershed level best management practices for modifying the impacts on water quality, quantity and timing are discussed. Field project includes developing a management plan using landscape buffers.

ENV S 417: Urban and Peri-urban Watershed Assessment
(Cross-listed with L A). (2-3) Cr. 3. F.
Prereq: Junior classification and 6 credits of natural science
Assessment and reduction of impacts in urban and peri-urban watershed areas. Course prepares students to work with various analysis methods for vegetation, topography, stormwater and stream condition as well as work with data from other disciplines. Emphasis on communicating with the public. Introductory GIS and GPS technologies are utilized. Learning is largely field-based.

ENV S 424: Sustainable and Environmental Horticulture Systems
(Cross-listed with HORT). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Inquiry into ethical issues and environmental consequences of horticultural cropping systems, production practices and managed landscapes. Emphasis on systems that are resource efficient, environmentally sound, socially acceptable, and profitable.

ENV S 442: The Policy and Politics of Coastal Areas
(Cross-listed with POL S). (3-0) Cr. 3. SS.
Exploration of political implications of coastal policy. Issues include: "Carrying capacity," zoning, regulation of human development activities, trade-offs between conservation and jobs, the quality of coastal lifestyle, ways in which citizens participate in policy for coastal areas.

ENV S 450: Issues in Sustainable Agriculture
(Cross-listed with AGRON). (3-0) Cr. 3. F.
Agricultural science as a human activity; contemporary agricultural issues from agroecological perspective. Comparative analysis of intended and actual consequences of development of industrial agricultural practices.

ENV S 460: Controversies in Natural Resource Management
(Cross-listed with NREM). (3-0) Cr. 3. F.S.
Prereq: NREM 120, and A ECL 312 or NREM 301, and Junior classification
Analysis of controversial natural resource issues using a case approach that considers uncertainty and adequacy of information and scientific understanding. Ecological, social, political, economic, and ethical implications of issues will be analyzed.

ENV S 461I: Introduction to GIS
(Cross-listed with ENSCI, IA LL, L A). Cr. 4. SS.
Descriptive and predictive GIS modeling techniques, spatial statistics, and map algebra. Application of GIS modeling techniques to environmental planning and resource management.

ENV S 471: Global Environmental History
(Cross-listed with HIST). (3-0) Cr. 3. F.
Prereq: Either one of HIST 201, 202, or 207; or 3 credits of Environmental Studies; and sophomore classification.
Survey of the interactions of human communities with their environments from the beginnings of human history to the present. Topics include the domestication of animals, the agricultural revolution, industrialization, urbanization, deforestation, hydraulic management, fossil fuel consumption, and climate change.

ENV S 472: U. S. Environmental History
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
Survey of the interactions of human communities with the North American environment. Focus on the period from presettlement to the present, with a particular concentration on natural resources, disease, settlement patterns, land use, and conservation policies.

ENV S 484: Sustainable Communities
(Cross-listed with C R P). (3-0) Cr. 3. S.
Prereq: Junior classification
The history and theory of sustainable community planning. Procedural and substantive dimensions. Case studies of communities engaged in sustainability planning. Use and development of indicators.

ENV S 490: Independent Study
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor and approval of Environmental Studies coordinator

ENV S 490H: Independent Study: Honors
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor and approval of Environmental Studies coordinator.

ENV S 491: Environmental Law and Planning
(Cross-listed with C R P, L A). (3-0) Cr. 3. S.
Prereq: 6 credits in natural sciences
Environmental law and policy as applied in planning at the local and state levels. Brownfields, environmental justice, water quality, air quality, wetland and floodplain management, and local government involvement in ecological protection through land use planning and other programs.

ENV S 496: Travel Course
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

ENV S 496A: International Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

ENV S 496B: Domestic Tour
Cr. arr. Repeatable.
Prereq: Permission of instructor
Extended field trips to study environmental topics in varied locations. Location and duration of trips will vary. Trip expenses paid by students. Check with department for current offerings.

Genetics

Alan M. Myers, Chair, Genetics Major Committee

Genetics is the scientific study of heredity. Understanding the basis of heredity is fundamental to all aspects of the life sciences, from the most basic molecular study to applied studies of agricultural species. At Iowa State University the study of the life sciences is interdepartmental, involving faculty in the basic, agricultural, and veterinary sciences. Faculty in 20 different departments are involved in genetics research. This large group of faculty presents a broad range of possibilities for students to learn from faculty who are at the forefront of research in many areas of genetics.

Undergraduate Study

Undergraduate study in genetics is jointly administered by three departments: the Roy J. Carver Department of Biochemistry, Biophysics, and Molecular Biology; the Department of Genetics, Development, and Cell Biology; and the Department of Ecology, Evolution, and Organismal Biology. Undergraduate degrees are offered through both the College of Agriculture and Life Sciences and the College of Liberal Arts and Science. Programs of study for genetics majors leading to a B.S. degree are available.

Training in genetics may lead to employment in teaching, research, or a variety of health-related professions. Although some students find employment directly after their baccalaureate training, many students continue their education in graduate or professional programs. Students with the B.S. degree may find employment in the biotechnology, health, or food industries. Recent graduates have also developed careers in conservation biology, technical writing, science journalism, technical sales, and business.

The required course work and associated electives provide students with the foundation in basic life sciences, mathematics, chemistry, and physics that is essential for professions involving modern biological/biomedical sciences. As part of these courses students develop skills in problem solving, critical thinking, writing, and research-related activities in the biological sciences.

Specific entrance requirements for medical and health-related professions are established by the professional schools. Students interested in fulfilling pre-professional requirements for such professions as dentistry, human medicine, genetic counseling, optometry, pharmacy, physical therapy, physicians assistant, and veterinary medicine can major in genetics while fulfilling the pre-professional requirements.

Curriculum in Genetics - Requirements

Total Degree Requirement: 120 cr.

A maximum of 65 cr. from a two-year institution can be applied that may include up to 16 technical cr.; up to 9 Pass-Not Pass cr. of free electives can be applied; a cumulative GPA of at least 2.0 is required for graduation. Program-approved lists can be found on the Genetics website.

1. Genetics and Life Sciences

A grade of C– or better is required in all Genetics and Life Science courses.

A. Courses required of all Genetics majors

GEN 110	Genetics Orientation	1
BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
GEN 313	Principles of Genetics	3
GEN 313L	Genetics Laboratory	1
BIOL 314	Principles of Molecular Cell Biology	3
BIOL 315	Biological Evolution	3
One of the following:		

GEN 349	The Genome Perspective in Biology	
GEN 444	Bioinformatic Analysis	
GEN 322	Introduction to Bioinformatics and Computational Biology	
GEN 409	Molecular Genetics	3
GEN 410	Analytical Genetics	3
One of the following:		
GEN 462	Evolutionary Genetics	
EEOB 561	Evolutionary and Ecological Genomics	
EEOB 563	Molecular Phylogenetics	
GEN 491	Undergraduate Seminar	1
MICRO 302	Biology of Microorganisms	3
Total Credits		29

B. Course required of majors in the College of Agriculture and Life Sciences only

A minimum of 3 cr. of coursework in the area of environmental science from program approved list	3
Total Credits	3

2. Advanced Sciences Electives: 6 cr. from program approved list

A grade of C- or better is required in each course. No more than 3 cr. of GEN 490, 490R, 490H, 492, 496, 499, or 499H may be used to meet this requirement.

3. Mathematical Sciences

Complete at least one calculus course from MATH, minimum of 4 credits.		4
MATH 160	Survey of Calculus	
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
Complete at least one course from STAT, minimum of 3 credits.		3-4
STAT 101	Principles of Statistics	
STAT 104	Introduction to Statistics	
Complete at least one additional course from MATH or STAT, minimum of 4 credits.		4
MATH 166	Calculus II	
MATH 182	Calculus and Mathematical Modeling for the Life Sciences II	
STAT 301	Intermediate Statistical Concepts and Methods	
STAT 401	Statistical Methods for Research Workers	
Total Credits		11-12

4. Supporting Sciences

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 178L	Laboratory in College Chemistry II	1
CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
CHEM 332	Organic Chemistry II	3
CHEM 332L	Laboratory in Organic Chemistry II	1
PHYS 111	General Physics	5
or PHYS 221	Introduction to Classical Physics I	
PHYS 112	General Physics	5
or PHYS 222	Introduction to Classical Physics II	
Choose one of the following options		6-7
Option 1		
BBMB 404	Biochemistry I	
And one of the following:		
BBMB 405	Biochemistry II	
BBMB 411	Techniques in Biochemical Research	
CHEM 211 & 211L	Quantitative and Environmental Analysis and Quantitative and Environmental Analysis Laboratory	
CHEM 325	Chemical Thermodynamics	
Option 2		
BBMB 420	Mammalian Biochemistry	
And one of the following:		
BBMB 411	Techniques in Biochemical Research	
CHEM 211 & 211L	Quantitative and Environmental Analysis and Quantitative and Environmental Analysis Laboratory	
CHEM 325	Chemical Thermodynamics	
Total Credits		33-34

5. International Perspectives: 3 cr. from university approved list

This course can satisfy **both** the university requirement for International Perspectives and the college requirement for a General Education elective (item 8) if the selection appears on both lists of approved courses.

6. U.S. Diversity: 3 cr. from university approved list

This course can satisfy **both** the university requirement for U.S. Diversity and the college requirement for a General Education elective (item 8) if the selection appears on both lists of approved courses.

7. Communications/Information Literacy

A. Courses required of all Genetics majors

Grades of C or better are required in ENGL 250 and advanced writing. (The College of Agriculture and Life Sciences requires a C or better in ENGL 150, as well.)

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	
LIB 160	Information Literacy	1
One advanced English writing course from program approved list		3
Total Credits		10

B. Course required of majors in the College of Agriculture and Life Sciences only.

A grade of C or better is required by the college.

SP CM 212	Fundamentals of Public Speaking	3
or AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	
Total Credits		3

8. General Education electives

Courses from college approved lists that also appear on university approved lists of U.S. Diversity or International Perspectives courses can be used to satisfy both requirements.

A. College of Agriculture and Life Sciences

Humanities course from college approved list	3
Social Science course from college approved list	3
Ethics course from college approved list	3
Total Credits	9

B. College of Liberal Arts and Sciences

Humanities courses from college approved list; one of these should be a Science/Humanities bridge course from program approved list	12
Social Science courses from college approved list	9
Students must have completed 3 years of a single world language in high school or take 4-8 credits of World Languages at the university level.	
Total Credits	21

Undergraduate Minor

The minor in Genetics may be earned by completing the following courses. At least 9 cr. must be used **only** to fulfill the requirements of the minor and not be applied to any other major, college, or university requirement.

GEN 313	Principles of Genetics	3
GEN 313L	Genetics Laboratory	1
BIOL 314	Principles of Molecular Cell Biology	3
GEN 410	Analytical Genetics	3
GEN 409	Molecular Genetics	3
Two or more additional credits in Genetics at the 300 level or above.		2
Total Credits		15

Genetics, B.S.

Freshman

Fall	Credits	Spring	Credits
GEN 110	1	BIOL 211	3
BIOL 212	3	BIOL 211L	1
BIOL 212L	1	CHEM 178	3
CHEM 177	4	MATH/ STAT or college requirement choice	3-4
CHEM 177L	1	ENGL 250 or college requirement choice	3
MATH/ STAT choice	3-4	LIB 160	1
ENGL 150 or 250	3	(or semester 1 with ENGL 250)	
LIB 160	1	Consider Research	1-2
(if taking ENGL 250)			
	17-18		15-17

Sophomore

Fall	Credits	Spring	Credits	Summer	Credits
BIOL 313	3	BIOL 314	3	Consider Intership, Study Abroad	
BIOL 313L	1	CHEM 332	3		

CHEM 331	3	CHEM 332L	1
CHEM 331L	1	MICRO 302, BIOL 315, or Bioinformatics/ Genomics Choice	3
College requirement or Elective	3	MATH/ STAT or college requirement choice	3-4
MATH/ STAT choice	3-4	College Requirement or Elective	3
	14-15		16-17

Junior

Fall	Credits	Spring	Credits
GEN 409 or 410	3	GEN 409 or 410	3
PHYS 111 or 221*	5	PHYS 112 or 222*	5
BBMB 404*	3	BBMB 405*	3
MICRO 302 or BIOL 315 or bioinformatics/ genomics choice	3	MICRO 302 or BIOL 315 or bioinformatic/ genomics choice	3
College Requirement or Elective	3	GEN 491	1
	17		15

Senior

Fall	Credits	Spring	Credits
GEN 462	3	Advanced Science Elective(s)	3-6
Advanced science elective or STAT 301	3-4	College Requirement or Elective	3
College Requirement or Elective	1-6	Elective or STAT 301	3-4
Advanced Writing (ENGL 302-316)	3	College Requirement or Elective	3
	10-16		12-16

* Summer: Students taking the MCAT need to have completed biochemistry and physics by this time. Others can complete during the senior year.

Courses primarily for undergraduates:

GEN 110: Genetics Orientation

(1-0) Cr. 1. F.

This course is intended for first year students and others new to the genetics major. Discussion of university policies and resources, requirements of the major, career opportunities, and other topics related to the first year experience.

GEN 112: Genetics Orientation for Transfer Students

(0.5-0) Cr. 0.5. S.

Eight-week course for external transfer students and internal change of major students. Discussion of university policies and resources, requirements of the major, and career opportunities. Only one of GEN 110 or 112 may count toward graduation.

GEN 298: Cooperative Education

Cr. R. F.S.SS.

Prereq: Permission of department cooperative education coordinator; sophomore classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

GEN 313: Principles of Genetics

(Cross-listed with BIOL). (3-0) Cr. 3. F.S.SS.

Prereq: BIOL 211, BIOL 211L, BIOL 212, and BIOL 212L

Introduction to the principles of transmission and molecular genetics of plants, animals, and bacteria. Recombination, structure and replication of DNA, gene expression, cloning, quantitative genetics, and population genetics. Students may receive graduation credit for no more than one of the following: Gen 260, Gen 313 and 313L, Gen 320, Biol 313 and 313L, and Agron 320.

GEN 313L: Genetics Laboratory

(Cross-listed with BIOL). (0-3) Cr. 1. F.S.

Prereq: Credit or enrollment in BIOL 313

Laboratory to accompany 313. Students may receive graduation credit for no more than one of the following: Biol 313 and 313L, Gen 260, Gen 313, Gen 320, and Agron 320.

GEN 320: Genetics, Agriculture and Biotechnology
(Cross-listed with AGRON). (3-0) Cr. 3. F.S.
Prereq: BIOL 212
Transmission genetics with an emphasis on applications in agriculture, the structure and expression of the gene, how genes behave in populations and how recombinant DNA technology can be used to improve agriculture. Credit for graduation will not be allowed for more than one of the following: Gen 260, 313, 320 and Biol 313 and 313L.

GEN 322: Introduction to Bioinformatics and Computational Biology
(Cross-listed with BCBIO, BIOL). (3-0) Cr. 3. F.
Prereq: BIOL 212
Genome sequencing, assembly, structural and functional annotation, and comparative genomics. Investigating these topics will develop skills in programming and scripting (Perl and/or Python), the use of biological databases, sequence alignment, similarity search, identification of sequence patterns, construction of phylogenetic trees, and comparative genomics.

GEN 340: Human Genetics
(3-0) Cr. 3. F.S.SS.
Prereq: BIOL 313 or GEN 313
Fundamental concepts and current issues of human genetics. Human chromosome analysis, pedigree analysis, gene mapping, the human genome project, sex determination, genetics of the immune system, genetics of cancer, gene therapy, the genetic basis of human diversity, eugenics.

GEN 349: The Genome Perspective in Biology
(Cross-listed with BIOL). (2-2) Cr. 3. S.
Prereq: GEN 313 or GEN 320
Analysis of genome, RNA, and protein data using computer technology to answer biological questions on topics ranging from microbial diversity to human health. An introduction for students in the life sciences to the fields of genomics, bioinformatics and systems.

GEN 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

GEN 402: Microbial Genetics and Genomics
(Cross-listed with MICRO). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MICRO 302, Biol 313
The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of vertical and horizontal genetic information transfer and gene regulation are covered, along with genetic and genomic-based approaches to study these and other cellular processes of microorganisms. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics and genomics.

GEN 409: Molecular Genetics
(3-0) Cr. 3. F.S.
Prereq: BIOL 313
The principles of molecular genetics. Gene structure and function; molecular mechanisms of DNA replication, recombination and repair, transcription and translation, regulation of gene expression.

GEN 410: Analytical Genetics
(3-0) Cr. 3. F.S.
The principles and practice of genetic analysis. Mendelian genetic analysis, mutational, transgenic, and genomic analysis of gene function, linkage and gene mapping, chromosomal aberrations, aneuploidy and polyploidy, extrachromosomal inheritance, analysis of genetic pathways.

GEN 444: Bioinformatic Analysis
(Cross-listed with BCB, BCBIO, BIOL, COM S, CPR E). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent.
Broad overview of bioinformatics with a significant problem-solving component, including hands-on practice using computational tools to solve a variety of biological problems. Topics include: bioinformatic data processing, Perl programming, genome assembly, database search, sequence alignment, gene prediction, next-generation sequencing, comparative and functional genomics, and systems biology.

GEN 462: Evolutionary Genetics
(Cross-listed with BIOL). (3-0) Cr. 3. F.
Prereq: BIOL 315
The genetic basis of evolutionary processes in higher organisms. The role of genetic variation in adaptation, natural selection, adaptive processes, and the influence of random processes on evolutionary change.

GEN 490: Independent Study
Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: GEN 313, junior or senior classification, permission of instructor
Independent study in any area of genetics. Students may use no more than 9 credits of university-wide 490 credits (including Gen 490) toward the total of 120 credits required for graduation.

GEN 491: Undergraduate Seminar
(1-0) Cr. 1. F.S.
Prereq: GEN 409
Communication within the discipline based on comprehension, discussion, presentation, and critical evaluation of original research literature; survey of career paths within the genetics disciplines and approaches to obtaining positions; exposure to research publication and grantsmanship processes; ethical issues in genetics research; outcomes assessment activities.

GEN 492: Laboratory Teaching Experience
Cr. 1-2. Repeatable, maximum of 9 credits. F.S.
Prereq: GEN 313, junior or senior classification, permission of instructor
For students registering to be undergraduate laboratory assistants. Offered on a satisfactory-fail basis only. No more than 2 credits of GEN 490U or GEN 492 may be applied toward the Genetics advanced course requirement.

GEN 495: Special Topics in Genetics
(1-0) Cr. 1-3. Repeatable, maximum of 3 credits. F.S.
Prereq: GEN 313; permission of instructor
Content varies from year to year. Genetics students may use no more than 9 credits of university-wide 490-499 credits toward the total of 120 credits required for graduation.

GEN 496: Attendance and Critique of Genetics Seminars
Cr. 1. Repeatable, maximum of 3 credits. F.S.
Prereq: GEN 313, junior or senior classification, permission of instructor
Attendance and critique of departmental seminars in BBMB, GDCB, or EEOB. Offered on a satisfactory-fail basis only. Genetics students may use no more than 9 credits of university-wide 490 - 499 credits toward the total of 120 credits required for graduation.

GEN 498: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

GEN 499: Genetics Research
Cr. 1-5. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: GEN 313, junior or senior classification, permission of instructor
Independent research in any area of genetics. Genetics students may use no more than 9 credits of university-wide 490-499 credits toward the total of 120 credits required for graduation.

GEN 499H: Genetics Research for Honors
Cr. 1-5. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: GEN 313, junior or senior classification, permission of instructor
Independent research in any area of genetics; for Honors students only. Genetics students may use no more than 9 credits of university-wide 490-499 credits toward the total of 120 credits required for graduation.

Geology

The department offers courses in geology and meteorology. Majors can be earned in earth science (B.A., B.S.), geology (B.S.), and meteorology (B.S.). Candidates for all degrees must satisfy the requirements established by the College of Liberal Arts and Sciences (see Liberal Arts and Sciences, Curriculum). In addition, the department has requirements for each major. A minimum of 120 credits are required.

The bachelor of science in Geology prepares the student for a professional career and/or graduate study in the geological sciences. Students selecting geology as a major will elect an option in traditional geology or environmental geology/hydrogeology. The traditional option prepares a student for employment in state and U.S. geological surveys, mineral and petroleum exploration, and graduate study in most aspects of geology. Required courses in this option include:

GEOL 100	The Earth	3
GEOL 100L	The Earth: Laboratory	1
GEOL 102	History of the Earth	3
GEOL 102L	History of the Earth: Laboratory	1
GEOL 302	Summer Field Studies	6
GEOL 315	Mineralogy and Earth Materials	3
GEOL 315L	Laboratory in Mineralogy and Earth Materials	1
GEOL 316	Optical Mineralogy	2
GEOL 356	Structural Geology	4
GEOL 365	Igneous and Metamorphic Petrology	3
GEOL 368	Sedimentary Geology	4
GEOL 479	Surficial Processes	3
And 9 credits of geology electives		9
Total Credits		43

The environmental geology/hydrogeology option prepares a student for employment in environmental consulting, state and U.S. geological surveys, regulatory agencies, and graduate study in the environmental aspects of geology. Required courses in this option include:

GEOL 100	The Earth	3
GEOL 100L	The Earth: Laboratory	1
GEOL 102	History of the Earth	3
GEOL 102L	History of the Earth: Laboratory	1

GEOL 302	Summer Field Studies	6
GEOL 315	Mineralogy and Earth Materials	3
GEOL 315L	Laboratory in Mineralogy and Earth Materials	1
GEOL 316	Optical Mineralogy	2
GEOL 356	Structural Geology	4
GEOL 368	Sedimentary Geology	4
GEOL 411	Hydrogeology	4
One of the following		3
GEOL 419	Aqueous and Environmental Geochemistry	
GEOL 426	Stable Isotopes in the Environment	
GEOL 479	Surficial Processes	3
And 6 credits of geology electives		6
Total Credits		44

Required supporting courses include:

CHEM 177	General Chemistry I	4
CHEM 177L	Laboratory in General Chemistry I	1
CHEM 178	General Chemistry II	3
CHEM 178L	Laboratory in College Chemistry II	1
PHYS 111	General Physics	5
PHYS 112	General Physics	5
One of the following		4
MATH 165	Calculus I	
MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	
One of the following		4
MATH 166	Calculus II	
MATH 182	Calculus and Mathematical Modeling for the Life Sciences II	
And 6 additional credits from an approved departmental list of courses in the science, engineering, or mathematical disciplines outside of geology		6
Total Credits		33

No more than 9 credits in 490 may be counted toward a degree in Geology.

Graduates work to understand natural processes on Earth and other planets. They are able to apply their knowledge of forces and factors that shape the Earth to reconstruct the past and anticipate the future. Graduates provide essential information for solving problems for resource management, environmental protection, and public health, safety, and welfare. They work as consultants on engineering and environmental problems, explorers for new minerals and hydrocarbon resources, researchers, teachers, writers, editors, and museum curators.

Graduates are able to integrate field and laboratory data and to prepare reports. They are able to make presentations that include maps and diagrams that illustrate the results of their studies.

Communication Proficiency requirement: The LAS College requires a C or better in ENGL 250. The department requires a grade of C or better in ENGL 309, ENGL 314, ENGL 302 or JL MC 347.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	
One of the following:		3
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
ENGL 302	Business Communication	
JL MC 347	Science Communication	
Total Credits		9

Minor - Geology

A minor in Geology may be earned by taking 15 credits of geology coursework, including:

3 credits:

GEOL 100 & 100L	The Earth and The Earth: Laboratory	3-4
or GEOL 201	Geology for Engineers and Environmental Scientists	
GEOL 102	History of the Earth	3
GEOL 102L	History of the Earth: Laboratory	1

The remainder should be at the 300 level or above.

Geology, B.S. - Env-Geol/Hydro Option

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	GEOL 102	3
GEOL 100	3	GEOL 102L	1
GEOL 100L	1	CHEM 178	3
CHEM 177	4	CHEM 178L	1
CHEM 177L	1	MATH 166 or 182	4
MATH 165 or 181	4	Social-Science Choice	3
LIB 160	1		
	17		15

Sophomore

Fall	Credits	Spring	Credits
ENGL 250	3	Arts-and-Humanities Choice	3
GEOL 315	3	Social-Science Choice	3
GEOL 315L	1	PHYS 112	5
GEOL 316	2	Foreign Language/ Elective	3-4
PHYS 111	5		
Foreign Language/ Elective	3-4		
	17-18		14-15

Junior

Fall	Credits	Spring	Credits	Summer	Credits
GEOL 411	4	GEOL 356	4	GEOL 302	6
GEOL 368	4	Arts-and-Humanities Choice	3		
Arts-and-Humanities Choice	3	Science/ Engineering/ Mathematics Choice[1]	3		
GEOL 479	3	Elective	3-4		
	14		13-14		6

Senior

Fall	Credits	Spring	Credits
Geology Choice[1]	3	Elective	3
GEOL 419 or GEOL 426 or elective[1]	3	GEOL 434 or elective[1]	3
Science/ Engineering/ Mathematics Choice[1]	3	Arts-and-Humanities choice	3
ENGL 309 or 302 or 314 or JL MC 347	3	Social-Science Choice	3
		Elective	3
	12		15

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 300/400 level. At least 8 credits in the major from 300+ courses must earn grade C or better. The average grade of all courses in the major must be 2.0 or higher. You must also complete the LAS foreign-language requirement.

1 Choose from list of approved courses available from an adviser or the departmental office.

Geology, B.S.- Traditional Option

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	GEOL 102	3
GEOL 100	3	GEOL 102L	1
GEOL 100L	1	CHEM 178	3
CHEM 177	4	CHEM 178L	1
CHEM 177L	1	MATH 166 or 182	4
MATH 165 or 181	4	Arts-and-Humanities Choice	3
LIB 160	1		
	17		15

Sophomore

Fall	Credits	Spring	Credits
ENGL 250	3	GEOL 365	3
GEOL 315	3	Arts-and-Humanities Choice	3
GEOL 315L	1	PHYS 112	5
GEOL 316	2	Science/ Engineering/ Mathematics Choice[1]	3
PHYS 111	5	Elective	3-4

Science/ Engineering/ Mathematics Choice[1]	3			
	17		17-18	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
GEOL 479	3	GEOL 356	4	GEOL 302	6
GEOL 368	4	Foreign Language/ Elective	3-4		
Geology Choice[1]	3	Geology Choice[1]	3		
Foreign Language/ Elective	3-4	Social-Science Choice	3		
	13-14		13-14		6

Senior

Fall	Credits	Spring	Credits
Geology Choice[1]	3	Elective	3
Arts-and-Humanities Choice	3	Arts-and-Humanities Choice	3
Social-Science Choice	3	Social-Science Choice	3
ENGL 309 or 302 or 314 or JL MC 347	3	Elective	3
	12		12

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 300/400 level. At least 8 credits in the major from 300+ courses must earn grade C or better. The average grade of all courses in the major must be 2.0 or higher. You must also complete the LAS foreign-language requirement.

[1] Choose from list of approved courses available from an adviser or the departmental office.

Graduate Study

The department offers programs leading to the master of science and doctor of philosophy with majors in Earth Science, Geology, and Meteorology. Program options are available for the M.S. and Ph.D. degrees in earth science leading to careers in teaching. The department also cooperates in the interdepartmental major in Water Resources (see Index). Students desiring a major in the above fields normally will have a strong undergraduate background in the physical and mathematical sciences. Individuals desiring to enter a graduate program are evaluated by considering their undergraduate background and performance and their expressed goals.

Programs of study are designed on an individual basis in accordance with requirements of the Graduate College and established requirements for each departmental major. Additional coursework is normally taken in aerospace engineering, agronomy (soil science), chemistry, civil and construction engineering, computer engineering, computer science, engineering mechanics, materials engineering, mathematics, mechanical engineering, microbiology, physics, or statistics. Departmental requirements provide a strong, broad background in the major and allow considerable flexibility in the program of each individual.

A dissertation is required of all Ph.D. candidates.

M.S. students in Geology are required to complete a thesis. The M.S. in Earth Science is available to students electing the non-thesis (Creative Component) option in Geology or Meteorology. A non-thesis option is also offered for the M.S. degree in Meteorology.

Graduates in Geology specialize in a subdiscipline, but they comprehend and can communicate the basic principles of geology and supporting sciences. They possess the capacity for critical and independent thinking. They are able to write a fundable research proposal, evaluate current relevant literature, carry out the proposed research, and communicate the results of their research to peers at national meetings and to the general public. They work as consultants on engineering and environmental problems, explorers for new minerals and hydrocarbon resources, researchers, teachers, writers, editors, and museum curators.

Course requirements for the MS degree include MTEOR 542, 543, 507 or 518, 552 or 516x, and 502 or 504 or 505 or 605. In addition to the 5 required courses from this list, students must take at least 3 more credits of graduate course work in Meteorology, Agricultural Meteorology, or a field related to their research interests (students will work closely with their POS committee to determine the exact amount of structured course work required – typically this is 18-21 credits). Students without prior synoptic meteorology course work must complete MTEOR 511 and may substitute these credits in place ofthe required MTEOR 507 or 518 courses.

Graduates in Meteorology have a good comprehension of basic principles, a capacity for critical and independent thought and an ability to communicate effectively with scientific colleagues. They have an appropriate breadth in their understanding of meteorology with a suitable specialization. Graduates are able to undertake thorough research and explain the results in a scientifically reasonable fashion.

Courses primarily for undergraduates:

GEOL 100: The Earth
(3-0) Cr. 3. F.S.SS.
How does the earth work, what is it made of, and how does it change through time? Plate tectonics, Earth materials, landforms, structures, climate, and natural resources. Emphasis on the observations and hypotheses used to interpret earth system processes. Students may also enroll in Geol 100L.

GEOL 100L: The Earth: Laboratory
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in GEOL 100
Students will gain understanding of how Earth processes affect their lives and how they affect the Earth, and of the complex nature of the Earth and its processes. They will gain a deep knowledge of the methods used to understand the time scales and rates of Earth processes also through an applied research experience on groundwater and surface water.

GEOL 101: Environmental Geology: Earth in Crisis
(Cross-listed with ENV S). (3-0) Cr. 3. F.S.
An introduction to geologic processes and the consequences of human activity from local to global scales. Discussion of human population growth, resource depletion, pollution and waste disposal, global warming and ozone depletion, desertification, and geologic hazards such as earthquakes, landslides, flooding, and volcanism.

GEOL 102: History of the Earth
(3-0) Cr. 3. S.
Prereq: GEOL 100 or GEOL 201
The Earth's physical and biological evolution; concepts of global tectonics. Methods used to decipher earth history. Students majoring in geology must also enroll in Geol 102L.

GEOL 102L: History of the Earth: Laboratory
(0-2) Cr. 1. S.
Prereq: Credit or enrollment in GEOL 102
Introduction to the use of sedimentary rocks and fossils in reconstructing the Earth's history.

GEOL 105: Gems and Gemstones
(2-0) Cr. 1. F.
Offered in second half of the semester. Introduction to gems and gemstones, physical and optical properties of gems and gemstones, explanation of where gems come from and how they are found, how to distinguish between synthetic and naturally occurring gems, how the value of gems are determined, and the history of famous gems.

GEOL 106: Earth and Space Science for Elementary Education Majors
(Cross-listed with ASTRO). (2-0) Cr. 2. F.S.
Prereq: Major in elementary or early childhood education.
Fundamental concepts of Earth and Space Science, including the solar system, weather and climate, water and soils, plate tectonics, and geologic hazards. Online course format.

GEOL 106L: Earth and Space Science for Elementary Education Majors: Laboratory
(Cross-listed with ASTRO). (0-2) Cr. 1. F.S.
Prereq: Restricted to elementary and early childhood education majors; to be taken concurrently with GEOL 106/ASTRO 106
Inquiry-based lab exploring fundamental concepts of Earth and Space Science, including the solar system, weather and climate, water and soils, plate tectonics, and geologic hazards. Must be taken concurrently with GEOL/ASTRO 106.

GEOL 108: Introduction to Oceanography
(Cross-listed with ENV S). (3-0) Cr. 3. F.
Introduction to study of the oceans. Ocean exploration. Waves and currents. Shape, structure, and origin of the ocean basins. Sedimentary record of oceanic life. Composition of seawater and its significance for life. Ocean circulation and its influence on climate. Life of the oceans, including coral reefs. Use and misuse of ocean resources. Anthropogenic impacts on the oceanic environment.

GEOL 111: Geological Disasters
(Cross-listed with ENV S). (1-0) Cr. 1. F.S.SS.
Introduction to the catastrophic geologic processes that disrupt ecosystems and human activity. Includes a discussion on the role of plate tectonics, the hydrologic cycle, and humans as the driving forces behind selected case studies on volcanic eruptions, earthquakes, tsunamis, landslides, and floods. Summer - online only.

GEOL 112: Geoscience Orientation
(Cross-listed with MTEOR). (1-0) Cr. 1. F.
Orientation course for students enrolled in the Earth, Wind and Fire Learning Community. Provides an introduction to Iowa State University and meteorology, geology, and Earth science programs for students enrolled in the department's learning community. Activities include academic and social activities, talks and presentations on academic success, resume writing, and study abroad, as well as research talks by faculty members.

GEOL 113: Spring Geoscience Orientation for Earth, Wind and Fire Learning Community
(Cross-listed with MTEOR). (0.5-0) Cr. 0.5. S.
Spring orientation course for students enrolled in the Earth, Wind and Fire Learning Community. Students are introduced to interview strategies, the importance of creating a professional image on social media, and the basics of financial literacy. Focused on professionalism and resilience, in this course students use their individual strengths to work in teams on a research project that applies their quantitative, data analysis, management, and communication skills. Activities include academic and social events, and two field trips.

GEOL 160: Water Resources of the World
(Cross-listed with AGRON, ENV S, MTEOR). (3-0) Cr. 3. S.
Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement.

GEOL 201: Geology for Engineers and Environmental Scientists
(2-2) Cr. 3. F.
Introduction to Earth materials and processes with emphasis on engineering and environmental applications.

GEOL 290: Independent Study
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Independent study for freshman and sophomore students.

GEOL 298: Cooperative Education
Cr. R. F.S.SS.
Prereq: GEOL 100 or GEOL 201, GEOL 100L, GEOL 102, GEOL 102L, and permission of the department cooperative education coordinator; sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing the work period.

GEOL 302: Summer Field Studies
Cr. 6. SS.
Prereq: GEOL 102, GEOL 356, GEOL 368
Geologic mapping; structural, stratigraphic, sedimentologic, metamorphic, geomorphic, and environmental analyses. Study areas in the Bighorn Basin and Wind River Range and excursions to Yellowstone and Grand Teton National Parks. A 6-week summer field course required of all geology majors.

GEOL 306: Geology Field Course
Cr. 1-2. Repeatable, maximum of 2 times. F.S.
Prereq: GEOL 100 or GEOL 201
Weekly seminar introduces students to a selected geological region or theme that is visited on a required ten-day field excursion. Introduction to field-safety leadership.

GEOL 315: Mineralogy and Earth Materials
(3-0) Cr. 3. F.
Prereq: GEOL 100 or GEOL 201, CHEM 177
Introduction to mineral classification, elementary crystal chemistry, crystal growth and morphology, mineral stability, and mineral associations.

GEOL 315L: Laboratory in Mineralogy and Earth Materials
(0-3) Cr. 1. F.
Prereq: GEOL 100 or GEOL 201
Mineral identification methods, especially hand-specimen identification.

GEOL 316: Optical Mineralogy
(1-2) Cr. 2. F.
Prereq: GEOL 100 or GEOL 201, CHEM 177, credit or enrollment in GEOL 315
Laboratory problems in mineral-identification methods utilizing optical microscopic techniques.

GEOL 324: Energy and the Environment
(Cross-listed with ENSCI, ENV S, MTEOR). (3-0) Cr. 3. S.
Renewable and non-renewable energy resources. Origin, occurrence, and extraction of fossil fuels. Nuclear, wind, geothermal, biomass, hydroelectric, and solar energy. Biofuels. Energy efficiency. Environmental effects of energy production and use, including air pollution, acid precipitation, coal ash, mountaintop removal mining, oil drilling, hydraulic fracturing, groundwater contamination, nuclear waste disposal, and global climate change. Carbon sequestration and geoengineering solutions for reducing atmospheric CO2 concentrations.

GEOL 356: Structural Geology

(3-3) Cr. 4. S.

Prereq: GEOL 100 or GEOL 201; PHYS 111

Principles of stress, strain, and rheology. Brittle and ductile behavior of rocks. Mechanics of formation, description, and classification of fractures, faults, folds, foliation, and lineation. From micro-structures to tectonic processes. Laboratory includes application of geometrical techniques to solve structural problems; emphasizes 3D thinking, map interpretation, and use of stereonet.

GEOL 365: Igneous and Metamorphic Petrology

(2-3) Cr. 3. S.

Prereq: GEOL 315, GEOL 315L, GEOL 316

Nature and origin of igneous and metamorphic rocks. Emphasis on important rock-forming environments and processes and their influence on rock characteristics. Laboratory includes thin section study of rock textures and mineralogy and the interpretation of these features.

GEOL 368: Sedimentary Geology

(3-3) Cr. 4. F.

Prereq: GEOL 102

Exploration of the interplay between weathering, sedimentation, sea-level change, tectonics, and life through time that creates sedimentary rocks and stratigraphic packages. Understanding of the historical development of sedimentary geology through the development of petrography, paleontology, deep earth sampling, geophysical technologies, and geochemistry. Field and laboratory problem sets illuminate lecture material.

GEOL 398: Cooperative Education

Cr. R. F.S.SS.

Prereq: GEOL 100 or GEOL 201, GEOL 100L, GEOL 102, GEOL 102L, and permission of the department cooperative education coordinator; junior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

GEOL 402: Watershed Hydrology

(Dual-listed with GEOL 502). (Cross-listed with ENSCI, MTEOR, NREM). (2-3) Cr. 3. F.

Prereq: Four courses in physical or biological sciences or engineering; junior standing

Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

GEOL 409: Field Methods in Hydrogeology

(Dual-listed with GEOL 509). (Cross-listed with ENSCI). (0-4) Cr. 3. Alt. SS., offered even-numbered years.

Prereq: GEOL/ENSCI 402 or GEOL/ENSCI 411 or C E 473

Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects.

GEOL 411: Hydrogeology

(Dual-listed with GEOL 511). (Cross-listed with ENSCI). (3-2) Cr. 4. F.

Prereq: Four courses in biological or physical sciences

Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations.

GEOL 414: Applied Groundwater Flow Modeling

(Dual-listed with GEOL 514). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. S., offered even-numbered years.

Prereq: GEOL 411 or C E 473; MATH 165 or MATH 181

Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course.

GEOL 415: Paleoclimatology

(Dual-listed with GEOL 515). (Cross-listed with ENSCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: Four courses in biological or physical science

Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods; utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~1 million years).

GEOL 416: Hydrologic Modeling and Analysis
(Dual-listed with GEOL 516). (Cross-listed with ENSCI, MTEOR). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in Earth science, meteorology, or engineering; junior standing
Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

GEOL 419: Aqueous and Environmental Geochemistry
(Dual-listed with GEOL 519). (Cross-listed with ENSCI). (2-2) Cr. 3. S.
Prereq: CHEM 178, CHEM 178L; junior classification
Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling.

GEOL 420: Mineral Resources
(Dual-listed with GEOL 520). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: GEOL 365
Geology and geochemistry of non-metallic and metallic ore deposits. Major processes that concentrate metals in the Earth. Geochemical conditions of ore formation using stable-isotope and fluid-inclusion studies. Laboratory emphasizes the study of metallic ores.

GEOL 426: Stable Isotopes in the Environment
(Dual-listed with GEOL 526). (Cross-listed with ENSCI). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Four courses in biological or physical science
Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance.

GEOL 444: Petroleum Geoscience and Engineering
(Dual-listed with GEOL 544). (2-2) Cr. 3. Alt. S., offered even-numbered years.
The geoscience and engineering aspects of exploration, development, and production of hydrocarbon resources around the world, as well as the historical and legal frameworks through which the industry has developed. Broader discussions of safety, risk, uncertainty, cost, and integrity as relevant to the petroleum industry.

GEOL 451: Applied and Environmental Geophysics
(Dual-listed with GEOL 551). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar.

GEOL 452: GIS for Geoscientists
(Dual-listed with GEOL 552). (Cross-listed with AGRON, ENSCI). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

GEOL 457: Seismic Methods in Geology, Engineering, and Petroleum Exploration
(Dual-listed with GEOL 557). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Physics of elastic-wave propagation. Seismic surveys in environmental imaging, engineering, and petroleum exploration. Reflection and refraction techniques. Data collection, processing, and geological interpretation. Field work with state-of-the-art equipment.

GEOL 474: Glacial and Quaternary Geology
(Dual-listed with GEOL 574). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of glaciers and glacial processes. Discussion of glaciology, glacial sediment transport, glacial landforms, and Quaternary history. Laboratory emphasizes topographic map interpretation and the Quaternary landscapes of Iowa.

GEOL 479: Surficial Processes
(Dual-listed with GEOL 579). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips.

GEOL 488: GIS for Geoscientists II
(Dual-listed with GEOL 588). (Cross-listed with AGRON, ENSCI). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

GEOL 489: Survey of Remote Sensing Technologies
(Dual-listed with GEOL 589). (Cross-listed with E E, MTEOR, NREM). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

GEOL 489L: Satellite Remote Sensing Laboratory
(Cross-listed with E E, MTEOR, NREM). (0-3) Cr. 1. S.
Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589
Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

GEOL 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in geology and permission of instructor
Independent study for senior students. No more than 9 credits of Geol 490 may be counted toward graduation.

GEOL 495: Undergraduate Seminar
Cr. 1. F.S.
Prereq: Junior or senior classification
Weekly seminar on topics of current research interest.

GEOL 498: Cooperative Education
Cr. R. F.S.SS.
Prereq: Geol 100 or GEOL 201, GEOL 100L, GEOL 102, GEOL 102L, and permission of the department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

GEOL 502: Watershed Hydrology
(Dual-listed with GEOL 402). (Cross-listed with ENSCI, MTEOR, NREM). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

GEOL 506: Geology Field Course
Cr. 1-2. Repeatable, maximum of 2 times. F.S.
Prereq: Graduate classification
Weekly seminar introduces students to a selected geological region or theme that is visited on a required ten-day field excursion. Graduate students are expected to assist in field teaching and safety leadership.

GEOL 507: Midwestern Geology Field Trip
Cr. 1. Repeatable, maximum of 4 times. F.
Prereq: GEOL 365
On-site inspection of various ore deposits, mining operations, and terrains dominated by igneous or metamorphic rocks. Offered on a satisfactory-fail basis only.

GEOL 509: Field Methods in Hydrogeology
(Dual-listed with GEOL 409). (Cross-listed with ENSCI). (0-4) Cr. 3. Alt. SS., offered even-numbered years.
Prereq: GEOL/ENSCI 402 or GEOL/ENSCI 411 or C E 473
Introduction to field methods used in groundwater investigations. In-field implementation of pumping tests, slug tests, monitoring well installation and drilling techniques, geochemical and water quality sampling, seepage meters, minipiezometers, stream gaging, and electronic instrumentation for data collection. Field trips to investigate water resource, water quality, and remediation projects.

GEOL 511: Hydrogeology
(Dual-listed with GEOL 411). (Cross-listed with ENSCI). (3-2) Cr. 4. F.
Prereq: Four courses in biological or physical sciences
Physical principles of groundwater flow, nature and origin of aquifers and confining units, well hydraulics, groundwater modeling, and contaminant transport. Lab emphasizes applied field and laboratory methods for hydrogeological investigations.

GEOL 514: Applied Groundwater Flow Modeling
(Dual-listed with GEOL 414). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: GEOL 411 or C E 473; MATH 165 or MATH 181
Introduction to the principles of modeling groundwater flow systems. Finite-difference and analytic-element methods, spreadsheet models, boundary conditions, calibration, sensitivity analysis, parameter estimation, particle tracking, and post-audit analysis. Application of MODFLOW to regional flow-system analysis. Computer laboratory emphasizes assigned problems that illustrate topics discussed in the course.

GEOL 515: Paleoclimatology
(Dual-listed with GEOL 415). (Cross-listed with ENSCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in biological or physical science
Introduction to mechanisms that drive climate, including the interplay between oceanic and atmospheric circulation and fluctuation in Earth's orbital parameters. Examination and analysis of past climate records ranging from historical documentation to ecological and geochemical proxies (e.g. tree ring analysis; O and C isotopes of skeletal carbonates and soils). Dating methods used to constrain and correlate climatic periods; utility of computer models to reconstruct past climates and predict future climate change. Emphasis placed on paleoclimatology and paleoecology of the late Quaternary (last ~ 1 million years).

GEOL 516: Hydrologic Modeling and Analysis
(Dual-listed with GEOL 416). (Cross-listed with ENSCI, MTEOR). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in earth science, meteorology, or engineering; junior standing
Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

GEOL 519: Aqueous and Environmental Geochemistry
(Dual-listed with GEOL 419). (Cross-listed with ENSCI). (2-2) Cr. 3. S.
Prereq: CHEM 178, CHEM 178L; junior classification
Geochemistry of natural waters and water-rock interactions. Acid-base equilibria, carbonate chemistry and buffer systems, mineral dissolution and precipitation, sorption, ion exchange, and redox reactions. Introduction to thermodynamics and kinetics. Laboratory emphasizes chemical analysis of waters and computer modeling.

GEOL 520: Mineral Resources
(Dual-listed with GEOL 420). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: GEOL 365
Geology and geochemistry of non-metallic and metallic ore deposits. Major processes that concentrate metals in the Earth. Geochemical conditions of ore formation using stable-isotope and fluid-inclusion studies. Laboratory emphasizes the study of metallic ores.

GEOL 526: Stable Isotopes in the Environment
(Dual-listed with GEOL 426). (Cross-listed with ENSCI). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Four courses in biological or physical science
Introduction to the theory, methods and applications of stable isotopes. Primary focus on the origin, natural abundance, and fractionation of carbon, hydrogen, oxygen, nitrogen isotopes. Applications of isotopic occurrence for elucidation of physical, chemical, biological, and environmental processes. Effects of plant physiology, photosynthesis, trophic structure, diffusion, evaporation, chemical precipitation, soil and atmospheric processes, and environmental factors on isotope abundance.

GEOL 544: Petroleum Geoscience and Engineering
(Dual-listed with GEOL 444). (2-2) Cr. 3. Alt. S., offered even-numbered years.
The geoscience and engineering aspects of exploration, development, and production of hydrocarbon resources around the world, as well as the historical and legal frameworks through which the industry has developed. Broader discussions of safety, risk, uncertainty, cost, and integrity as relevant to the petroleum industry.

GEOL 551: Applied and Environmental Geophysics
(Dual-listed with GEOL 451). (Cross-listed with ENSCI). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Seismic, gravity, magnetic, resistivity, electromagnetic, and ground-penetrating radar techniques for shallow subsurface investigations and imaging. Data interpretation methods. Lab emphasizes computer interpretation packages. Field work with seismic - and resistivity-imaging systems and radar.

GEOL 552: GIS for Geoscientists
(Dual-listed with GEOL 452). (Cross-listed with AGRON, ENSCI). (2-2) Cr. 3. F.S.
Prereq: GEOL 100, GEOL 201 or equivalent
Introduction to geographic information systems (GIS) with particular emphasis on geoscientific data. Uses ESRI's ArcGIS Desktop Software and extension modules. Emphasizes typical GIS operations and analyses in the geosciences to prepare students for advanced GIS courses.

GEOL 555: Environmental Soil Mineralogy
(Cross-listed with AGRON). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: AGRON 473, CHEM 178. Recommend: GEOL 311
Structure and behavior of clay minerals, humic substances and biochar in soil environments, with emphasis on reactions and environmental implications.

GEOL 557: Seismic Methods in Geology, Engineering, and Petroleum Exploration
(Dual-listed with GEOL 457). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: GEOL 100 or GEOL 201, college algebra and trigonometry
Physics of elastic-wave propagation. Seismic surveys in environmental imaging, engineering, and petroleum exploration. Reflection and refraction techniques. Data collection, processing, and geological interpretation. Field work with state-of-the-art equipment.

GEOL 558: Introduction to the 3D Visualization of Scientific Data
(Cross-listed with COM S, HCI). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Graduate-student standing in the mathematical or natural sciences or engineering; basic programming knowledge
Introduction to visualizing scientific information with 3D computer graphics and their foundation in human perception. Overview of different visualization techniques and examples of 3D visualization projects from different disciplines (natural sciences, medicine, and engineering). Class project in interactive 3D visualization using the ParaView, Mayavi, TVTK, VTK or a similar system.

GEOL 574: Glacial and Quaternary Geology
(Dual-listed with GEOL 474). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of glaciers and glacial processes. Discussion of glaciology, glacial sediment transport, glacial landforms, and Quaternary history. Laboratory emphasizes topographic map interpretation and the Quaternary landscapes of Iowa.

GEOL 579: Surficial Processes
(Dual-listed with GEOL 479). (Cross-listed with ENSCI). (2-3) Cr. 3. F.
Prereq: GEOL 100 or GEOL 201 or equivalent experience
The study of physical processes that shape Earth's surface. Topics include weathering, sediment transport, and landform genesis with emphasis on fluvial, glacial, hillslope, eolian, and coastal processes. Applications to engineering and environmental problems. Laboratory includes topographic map interpretation and local field trips.

GEOL 588: GIS for Geoscientists II
(Dual-listed with GEOL 488). (Cross-listed with AGRON, ENSCI). (2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: GIS course, such as GEOL 452, CRP 451, CRP 452, NREM 345, NREM 446, AE 408 or equivalent
GIS course with focus on the spatial analysis and modeling of raster data and triangulated irregular network (TIN) data. Uses ArcGIS and various extensions, such as Spatial Analyst, 3D Analyst, and ArcScene. Includes practical exercises during lectures, lab exercises, homework assignments, and (for GEOL 588) a class project.

GEOL 589: Survey of Remote Sensing Technologies
(Dual-listed with GEOL 489). (Cross-listed with E E, MTEOR, NREM). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

GEOL 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590A: Special Topics: Surficial Processes
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590B: Special Topics: Stratigraphy
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590C: Special Topics: Sedimentation
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590D: Special Topics: Paleontology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590E: Special Topics: Petrology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590F: Special Topics: Structural Geology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590G: Special Topics: Geochemistry
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590H: Special Topics: Hydrogeology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590I: Special Topics: Earth Science
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590J: Special Topics: Mineral Resources
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590K: Special Topics: Geophysics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590L: Special Topics: Mineralogy
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590M: Special Topics: Tectonics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590N: Special Topics: Paleoecology and Paleoclimatology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590O: Special Topics: Isotope Geochemistry
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590P: Special Topics: Computational Methods and GIS
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590R: Special Topics: Surface Hydrology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 590S: Special Topics: Oceanography
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

GEOL 595: Graduate Seminar
(Cross-listed with MTEOR). Cr. 1. Repeatable. F.S.
Prereq: Senior or graduate classification
Weekly seminar on topics of current research interest. All students seeking a graduate degree in geology must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

GEOL 595A: Graduate Seminar: Presentation Required
(Cross-listed with MTEOR). (1-0) Cr. 1. Repeatable. F.S.
Prereq: Senior or graduate classification
Weekly seminar on topics of current research interest. All students seeking a graduate degree in geology must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

GEOL 595B: Graduate Seminar: Attendance Only
(Cross-listed with MTEOR). Cr. R. Repeatable. F.S.
Prereq: Senior or graduate classification
Attendance only. Weekly seminar on topics of current research interest. All students seeking a graduate degree in geology must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

GEOL 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

GEOL 610: Advanced Seminar
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610A: Advanced Seminar: Earth Materials
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610B: Advanced Seminar: Economic Geology
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610C: Advanced Seminar: Environmental Geochemistry
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610D: Advanced Seminar: Geophysics
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610E: Advanced Seminar: Geotectonics
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610F: Advanced Seminar: Hydrogeology
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610G: Advanced Seminar: Surficial Processes
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610H: Advanced Seminar: Sedimentation and Stratigraphy
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610I: Advanced Seminar: Paleoecology and Paleoclimatology
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610J: Advanced Seminar: Isotope Geochemistry
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 610K: Advanced Seminar: Computational Methods and GIS
Cr. 1-3. Repeatable. F.S.
Prereq: Graduate standing and permission of instructor

GEOL 699: Research
Cr. arr. Repeatable.

GEOL 699A: Research: Surficial Processes
Cr. arr. Repeatable.

GEOL 699B: Research: Stratigraphy
Cr. arr. Repeatable.

GEOL 699C: Research: Sedimentation
Cr. arr. Repeatable.

GEOL 699D: Research: Paleontology
Cr. arr. Repeatable.

GEOL 699E: Research: Petrology
Cr. arr. Repeatable.

GEOL 699F: Research: Structural Geology
Cr. arr. Repeatable.

GEOL 699G: Research: Geochemistry
Cr. arr. Repeatable.

GEOL 699H: Research: Hydrogeology
Cr. arr. Repeatable.

GEOL 699I: Research: Earth Science
Cr. arr. Repeatable.

GEOL 699J: Research: Mineral Resources
Cr. arr. Repeatable.

GEOL 699K: Research: Geophysics
Cr. arr. Repeatable.

GEOL 699L: Research: Mineralogy
Cr. arr. Repeatable.

GEOL 699M: Research: Tectonics
Cr. arr. Repeatable.

GEOL 699N: Research: Paleoecology and Paleoclimatology
Cr. arr. Repeatable.

GEOL 699O: Research: Isotope Geochemistry
Cr. arr. Repeatable.

GEOL 699P: Research: Computational Methods and GIS
Cr. arr. Repeatable.

GEOL 699R: Research: Surface Hydrology
Cr. arr. Repeatable.

GEOL 699S: Research: Geoscience Education
Cr. arr. Repeatable.

History

The History department offers courses leading to the B.A. and B.S. degrees in history, an M.A. in History, and a Ph.D. in Rural, Agricultural, Technological and Environmental History.

The department offers a variety of survey courses (200 series) for first- and second-year students as either general education courses or as introductions to advanced courses in history or other subject areas. In addition to 200-level survey courses, it offers advanced undergraduate courses in the history of Europe, Asia, Africa, Latin America, the United States, technology and science, agriculture, and other selected topics.

The History Major

History majors may earn either a bachelor of arts or bachelor of science degree. The minimum required for a major in history is 37 credits, including HIST 195 and HIST 495. At least 24 credits of HIST must be in courses numbered 300 or above. Students may take a maximum of 12 credits at the 200-level, a maximum of 15 credits at the 300-level, and must take a minimum of 12 credits at the 400-level or above. A minimum of 15 credits of HIST numbered 300 or above must be taken in residence at Iowa State. The department will accept a maximum of 6 credits of cross-listed courses originating in another teaching department toward the major degree. Candidates for the B.A. must complete two years of university-level study in one foreign language or the equivalent. Many history majors also pursue a minor in another discipline, a second major, or teacher certification.

Objectives for History Majors

1. Display the appropriate level of cognitive knowledge of historical themes and events based upon the student's course of study
2. Display an understanding of past cultures and social organizations, based on the course of study
3. Develop the fundamental methodological skills of the historical craft:- The ability to contextualize and analyze primary source evidence.- Familiarity with the concepts of historical argument and interpretation, and the ability to formulate effective argumentation in written and oral forms.- Awareness of the basic historiography in selected research area.- The ability to conduct research and to write a historical essay based upon primary and secondary source research. Students receive an introduction to these concepts in HIST 195 Introduction to History.
4. Display a sophisticated understanding of the relationship between past events and the present. For purposes of outcomes assessment, all History majors must complete three credits of HIST 495 Historiography and Research Writing or, if qualified and willing, one graduate level writing/research seminar.

Communication Proficiency requirement: History majors must receive a grade of C or better in ENGL 250 (or ENGL 250H), and HIST 495 or any graduate seminar.

History, B.S.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	History Choice - 200 Level	3
HIST 195	1	Natural Science Choice	3
History Choice - 200 Level	3	Humanities Choice	3
Social Science Choice	3	Math Choice	3
Humanities Choice	3	Social Science Choice	3
Natural Science Choice	3	LIB 160	1
	16		16

Sophomore

Fall	Credits	Spring	Credits
ENGL 250	3	History Choice - 200/300 Level	3
History Choice - 200-300 Level	3	Social Science Choice	3
Foreign Language/Elective	4	Foreign Language/Elective	4
Humanities Choice	3	Natural Science Choice	2
Elective	2	Elective	3
	15		15

Junior

Fall	Credits	Spring	Credits
History Choice - 300/400 Level	3	History Choice - 300/400 Level	3
History Choice - 300/400 Level	3	History Choice - 300/400 Level	3
Elective	9	Elective	8
	15		14

Senior

Fall	Credits	Spring	Credits
History Choice - 400 Level	3	HIST 495	3
History Choice - 400 Level	3	History Choice - 400 Level	3
Elective	9	Elective	8
	15		14

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.** For a history major, 15 credits of history at the 300/400 level must be taken at ISU. You must also complete the LAS foreign language requirement.

Students seeking teacher certification should contact the History Department directly for the latest information on specific course work required for certification by the State of Iowa. Course work in addition to the degree minimums may be required.

History, B.A.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	History Choice - 200 Level	3
HIST 195	1	Math Choice	3
History Choice - 200 Level	3	Humanities Choice	3
Humanities Choice	3	Natural Science Choice	3
Natural Science Choice	3	Social Science Choice	3
Social Science Choice	3	LIB 160	1
	16		16

Sophomore

Fall	Credits	Spring	Credits
ENGL 250	3	History Choice - 200/300 Level	3

History Choice - 200/300 Level	3	Social Science Choice	3
Elementary Foreign Language - 100 Level	4	Elementary Foreign Language - 100 Level	4
Humanities Choice	3	Natural Science Choice	2
Elective	2	Elective	3
	15		15

Junior

Fall	Credits	Spring	Credits
History Choice - 300/400 Level	3	History Choice - 300/400 Level	3
History Choice - 300/400 Level	3	History Choice - 300/400 Level	3
Interemediate Foreign Language - 200 Level	4	Intermediate Foreign Language - 200 Level	4
Electives	5	Electives	4
	15		14

Senior

Fall	Credits	Spring	Credits
History Choice - 400 Level	3	HIST 495	3
History Choice - 400 Level	3	History Choice - 400 Level	3
Electives	9	Electives	8
	15		14

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.** For a history major, 15 credits of history at the 300/400 -level must be taken at ISU. You must also complete the LAS foreign language requirement.

The BA in History requires the equivalent of 2 years of college-level study in the same foreign language. Six credits of electives may be replaced by 6 additional credits of foreign language.

Students seeking teacher certification should contact the History Department directly for the latest information on specific course work required for certification by the State of Iowa. Course work in addition to the degree minimums may be required.

Minor

The department offers a minor in History, which may be earned with 15 credits in History courses, of which at least 9 must be in courses numbered 300 or above, excluding HIST 490 Independent Study. A minimum of 9 credits numbered 300 or above must be taken at Iowa State. The College of Liberal Arts and Sciences requires students to earn a C or higher in at least 6 of the required 300-level credits. A student may count a maximum of 3 hours of cross-listed courses originating in another teaching department toward the minor in History. The History minor is most frequently chosen by students majoring in Political Science, English, Journalism, Computer Science, and Business.

Graduate Study

The History Department offers two graduate degrees: a M.A. in History and a Ph.D. in Rural, Agricultural, Technological and Environmental History.

Most history graduate courses are either proseminars or seminars. Proseminars acquaint students with the historical literature of a field and prepare them for careers in teaching and research. Seminars require students to conduct original historical research and to write research papers reporting the results.

The M.A. in history includes three options. See the departmental website on the M.A. in History for a full discussion of the options and requirements. An M.A. in History serves as the basis for continued study in history, as well as preparation for careers in law, education, business, and government service. Throughout world history human beings have depended on rural and agricultural communities as well as on the technologies developed and employed by these communities to sustain lives. Iowa State's Doctoral Program in Rural, Agricultural, Technological and Environmental History offers a scholarly community and learning environment dedicated to the close examination of pervasive and enduring questions about these basic aspects of human history. Such questions can best be answered through the multi-faceted perspectives provided by rural, agricultural, technological, and environmental history. The result is a dynamic learning experience that leads to comparative and transnational analysis shaped by a broad range of methods drawn from the humanities and social/physical sciences. The Program's aim is to produce students who are excellent researchers and engaging teachers, capable of succeeding in a broad variety of professional positions, both inside and outside of academia.

The Ph.D. in Rural, Agricultural, Technological and Environmental History is designed for students who have completed an M.A. in history. Those who have not yet completed an M.A. will be expected to complete the degree while progressing toward the Ph.D. Thirty semester hours of graduate credit are required for the M.A. and 72 for the Ph.D. Students who continue beyond the M.A. are expected to pass preliminary examinations in four areas of specialization, complete a dissertation, and defend it orally in the Ph.D. final examination. See the departmental website on the program for a full description of requirements.

Courses primarily for undergraduates:

HIST 195: Introduction to History
(1-0) Cr. 1.
Prereq: classification as history major
Introduction to the discipline of history and how historians think and work. Focus on research methodologies, writing and analytical practices of historians, and specialization in the discipline.

HIST 201: Introduction to Western Civilization I
(3-0) Cr. 3. F.
Western civilization from ancient Mediterranean world to 1500. Social and cultural developments; economic and political ideas and institutions; problems of historical change and continuity.
Meets International Perspectives Requirement.

HIST 202: Introduction to Western Civilization II
(3-0) Cr. 3. S.
Western civilization from 1500 to present. Social and cultural developments; economic and political ideas and institutions; problems of historical change and continuity.
Meets International Perspectives Requirement.

HIST 207: Chinese Civilization
(3-0) Cr. 3.
Origins, development, decline and transformation of China from earliest times to 1911.
Meets International Perspectives Requirement.

HIST 221: Survey of United States History I
(3-0) Cr. 3-5. F.
Colonial foundations: revolution, confederation, and constitution; nationalism and democracy; sectional disunity, Civil War, and reunion.

HIST 222: Survey of United States History II
(3-0) Cr. 3. S.
Industrialization; emergence as a great power; boom and depression; war, internationalism and Cold War; modern industrial society.

HIST 225: Introduction to Asian American Studies
(3-0) Cr. 3.
An interdisciplinary and chronological examination of Asian American immigration experiences from the early 19th century to the 21st century. Focus on how these immigration histories are accompanied by changing racial constructions. Discussion of racial stereotyping, the model minority myth, identity development, and efforts for social justice.
Meets U.S. Diversity Requirement

HIST 240: Latina/o History
(Cross-listed with US LS). (3-0) Cr. 3.
Historical and cultural heritage of Latinas/os in the United States. The histories of Mexican, Puerto Rican, Cuban, and other Latin American peoples in the U.S. emphasizing political and cultural convergence and congruencies.
Meets U.S. Diversity Requirement

HIST 280: Introduction to History of Science I
(3-0) Cr. 3.
Ideas of nature from ancient Greece to the seventeenth-century scientific revolution.
Meets International Perspectives Requirement.

HIST 281: Introduction to History of Science II
(3-0) Cr. 3.
Science from seventeenth-century scientific revolution to Darwin and Einstein.
Meets International Perspectives Requirement.

HIST 284: Wonders of the World, Global History of Innovation
(3-0) Cr. 3. F.
Innovation across cultures from the ancient "Seven Wonders of the World" to the modern world, with developments in Egypt, Greece, Rome, the Islamic World, India, China, Europe, and the Americas. Topics include major inventions, agricultural technologies, architecture, manufacturing, warfare, engineering, printing, entertainment, transport, and communications.
Meets International Perspectives Requirement.

HIST 304: Cultural Heritage of the Ancient World
(Cross-listed with CL ST). (3-0) Cr. 3.
Prereq: Sophomore classification
Historical examination of art, literature, thought, and religious beliefs of major civilizations of the ancient Mediterranean countries until the end of the 8th century.

HIST 307: American Popular Culture
(3-0) Cr. 3.
Prereq: Sophomore classification
Social practices, beliefs and material traits of everyday life in America from the mid-19th century to the present. Includes literature, music, theater and other entertainments. Dime novels, vaudeville, rock and roll music, Hollywood and establishment of professional athletic leagues are among the cultural artifacts and phenomena considered.

HIST 311: Africa under Colonial Rule
(Cross-listed with AF AM). (3-0) Cr. 3.
Prereq: 3 credits of 200-level HIST at Iowa State, and sophomore classification.
Development of Africa from imposition of colonial rule to independence, including processes of European domination, African reaction and resistance, emergence of nationalism, and dismantling of colonialism.
Meets International Perspectives Requirement.

HIST 316: History of Medieval Europe, 300-1500
(3-0) Cr. 3.
Prereq: Sophomore classification
Survey of political, social, and cultural developments in western Europe for the entire medieval period, 300-1500.

HIST 318: History of Early Modern Europe, 1450-1789
(3-0) Cr. 3.
Prereq: Sophomore classification
Survey of major themes in the social, political, cultural, and religious history of early modern Europe, including the eras of renaissance and reformation, the age of exploration, development of the modern individual and household, and enlightenment.

HIST 320: History of Modern Europe, 1789 to Present
(3-0) Cr. 3. F.
Prereq: 3 credits of 200-level HIST at Iowa State, and sophomore classification.
Survey of major themes in the social, political, and religious history of Europe from the French Revolution to the present. Topics to be covered include the French Revolution, nationalism, the Industrial Revolution, the Russian Revolution, World Wars I and II, the Cold War, the fall of the Soviet Union, and the history of globalization.

HIST 325: Society and Politics in England, 1525-1700
(3-0) Cr. 3.
Prereq: Sophomore classification
Social, cultural, demographic, and economic experiences. Religious Reformation. Growth of the State (and Empire) and political institutions.

HIST 331: History of the Islamic World to 1800
(3-0) Cr. 3. F.
Prereq: 3 credits of 200-level HIST at Iowa State and sophomore classification.
Survey of the Islamic world from pre-Islamic Arabia to the 19th century covering the life of the Prophet Muhammad, the spread of Islam through the Arab conquests and the Caliphal dynasties of the Umayyads and the Abbasids, the Mongol conquests, Turkic migrations from Central Asia, and the rise of the Ottoman Empire.

HIST 333: Asian American Material Cultures
(Cross-listed with ANTHR). (3-0) Cr. 3.
Examination of material objects made and used by Asian Americans with both historical and contemporary focuses; transnational and interdisciplinary lenses to interpret the material world; contemporary approaches to analysis of artifacts.
Meets U.S. Diversity Requirement

HIST 336: History of Modern China I
(3-0) Cr. 3.
Prereq: Sophomore classification
China from 1644 to 1912; internal and external stimuli on traditional structure leading to reform and revolution.
Meets International Perspectives Requirement.

HIST 337: History of Modern China II
(3-0) Cr. 3.
Prereq: Sophomore classification
China from 1912 to present; search for a new order and continuing Chinese revolution.
Meets International Perspectives Requirement.

HIST 338: Modern Japanese History
(3-0) Cr. 3.
Prereq: Sophomore classification
Japan 1600 to the present; emphasis on transformation of feudal Japan into a post-industrial society.
Meets International Perspectives Requirement.

HIST 340: History of Latin America I
(3-0) Cr. 3.
Prereq: Sophomore classification
Colonial Latin America from European discovery and colonization to wars for independence.

HIST 341: History of Latin America II
(3-0) Cr. 3.
Prereq: Sophomore classification
Modern Latin America national origins from 1800 to present.
Meets International Perspectives Requirement.

HIST 353: History of African Americans I
(Cross-listed with AF AM). (3-0) Cr. 3.
Prereq: Sophomore classification
Examines African roots of black culture and the African American experience in the United States from the colonial period through the Civil War. Topics include Atlantic Slave Trade, slavery and American identity, abolition, the emergence of Black Nationalism, and black participation in the Civil War.
Meets U.S. Diversity Requirement

HIST 354: History of African Americans II
(Cross-listed with AF AM). (3-0) Cr. 3.
Prereq: Sophomore classification
Explores African American political thought and political action from Reconstruction to the present. Topics include rise of Jim Crow segregation, urban migration, Garvey movement, Harlem Renaissance, Depression and world wars, Pan-Africanism, civil rights, Black Power, and black feminism.
Meets U.S. Diversity Requirement

HIST 355: Early American Republic
(3-0) Cr. 3.
Prereq: Sophomore classification
Examination of the United States from the Constitutional Convention up to the Mexican War. Topics include the Washington, Jefferson, and Jackson administrations, the War of 1812, slavery and the South, economic and social development, Westward expansion and reform.

HIST 356: U.S. Civil War and Reconstruction Era
(3-0) Cr. 3.
Prereq: Sophomore classification
Examination of the social and economic contradictions that led to Civil War and the reconstruction of American freedom and democracy. Topics include the Mexican War, sectional conflict and the crisis of disunion, economic, political and social aspects of civil war, emancipation, and reconstruction.

HIST 360: U.S. 1900 to 1945
(3-0) Cr. 3.
Prereq: Sophomore classification
America in transition and crisis: Progressivism, World War I, the twenties, the Great Depression, and World War II.

HIST 361: U.S. 1945 to the Present
(3-0) Cr. 3.
Prereq: Sophomore classification
Modern American history with an emphasis on political, socio-cultural, ethno-racial, and military history. Topics include the Cold War, the wars in Korea and Vietnam, civil rights and Black/ethnic Power, modern feminism, and the conservative movement.

HIST 365: American Agriculture I: The Maya to McCormick's Reaper
(3-0) Cr. 3.
Prereq: Sophomore classification
North American agricultural development to 1865. American Indian agricultural systems, European background and agricultural revolution, agriculture in the colonial era, early republic and antebellum period. Topics include origins of modern crops, agriculture's role in the economy, politics, and settlement of the U.S., slavery, rural and frontier life, and mechanization.

HIST 366: American Agriculture II: Homestead Act to GMOs
(3-0) Cr. 3.
Prereq: Sophomore classification
American agricultural development since 1865. Post-Civil War adjustments; westward expansion; economic boom and bust; mechanization; Dust Bowl and environmental challenges; Great Depression and New Deal; changing rural life; scientific and technological advances; farm crisis and late twentieth century challenges.

HIST 367: America Eats
(3-0) Cr. 3.
Prereq: Sophomore classification
Thematic approach to the development of the American agricultural system through the topics of food and eating. Changes in American food systems from Native American, pre-contact diets through modern innovations such as fast food, organics, and eating locally.

HIST 370: History of Iowa
(3-0) Cr. 3.
Prereq: Sophomore classification
Survey of major social, cultural and economic developments in Iowa from the late 1700s. Emphasis on minority groups, pioneer life, early economic development, industrial development, educational and religious development, and outstanding personalities.

HIST 371: Mexican American History
(Cross-listed with US LS). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 3 credits of 200-level HIST at Iowa State and sophomore classification.
History of the Mexican American community in the U.S. from the 1820s to the present. Topics include community development, employment, social marginalization, racism/discrimination, depression and world wars, civil rights, ethnic power and politics.
Meets U.S. Diversity Requirement

HIST 374: Sex, Gender, and Culture in the Ancient Mediterranean World
(Cross-listed with CL ST, W S). (3-0) Cr. 3. S.
Prereq: Any one course in Cl St, W S, Latin, or Greek
Chronological and topical survey of the status of women and men, focusing on sex and gender issues in the Ancient Mediterranean world; study of constructs of the female and the feminine. Readings from ancient and modern sources. Emphasis on ancient Greece, Rome, and Egypt.
Meets International Perspectives Requirement.

HIST 380: History of Women in Science, Technology, and Medicine
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: Sophomore classification
History of women's relationship to the fields of science, technology, and medicine, as students and professionals, consumers, subjects and patients, family members, workers and citizens. Concentrates especially on 19th and 20th century United States, concluding with an examination of current issues of special interest to women in science, technology, and medicine.
Meets U.S. Diversity Requirement

HIST 382: History and Philosophy of the Scientific Revolution.
(Cross-listed with PHIL). (3-0) Cr. 3. S.
The emergence of empirical science as the authoritative methodology for production of knowledge about the natural world in the period between Copernicus and Kant. Scientific progress achieved during the period, including the work of Galileo, Descartes, and Newton. The re-shaping of epistemology in the Western intellectual tradition. Implications for philosophy and historiography.

HIST 383: Technology, Public Science, and European Culture, 1715-Present
(3-0) Cr. 3.
Prereq: Sophomore classification
A survey from the Age of Enlightenment to the end of the twentieth century of the relationship between science, technology, and public or popular culture in a comparative European context (including Russia and the former Soviet Union).
Meets International Perspectives Requirement.

HIST 384: Roman Italy: An Introduction
(Cross-listed with CL ST). Cr. 2.
Prereq: Enrollment limited to students participating in CL ST 385/HIST 385. Instructor permission required.
Introduction to the topography, history, archaeology, monuments, and art of Rome from the Regal period through late Antiquity; attention given to the culture of modern Italy, preparatory to study abroad in Rome.
Meets International Perspectives Requirement.

HIST 385: Study Abroad: Roman Italy: Building the Empire
(Cross-listed with CL ST). Cr. 3.
Prereq: CL ST 384/HIST 384 and instructor's permission.
Supervised on-site instruction in the history, archaeology, monuments, and art of Rome and environs from the 8th center BCE to the 5th century CE; attention given to the culture of modern Italy.
Meets International Perspectives Requirement.

HIST 386: History of Women in America
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: Sophomore classification
A survey of social, economic, and political aspects of women's role from colonial era to present; emphasis on employment, education, concepts of sexuality, and changing nature of the home.
Meets U.S. Diversity Requirement

HIST 389: American Military History
(3-0) Cr. 3.
Prereq: Sophomore classification
American military experience from the Pequot War to Vietnam, including King Philip's War, the French & Indian Wars, the American Revolution, the War of 1812, the Mexican-American War, the Civil War, the Spanish-American War, World Wars I & II, and the Korean War.
Meets International Perspectives Requirement.

HIST 390: World Military History
(3-0) Cr. 3.
Prereq: Sophomore classification
Covers military history from the Napoleonic era through the mid- and late-19th century wars, the First and Second World Wars, and wars of national liberation and regional conflicts since 1945.
Meets International Perspectives Requirement.

HIST 391: American Diplomatic History
(3-0) Cr. 3.
Prereq: Sophomore classification
A study of US foreign relations during the twentieth century, including the rise to global power, the First World War, diplomacy during prosperity and depression, the Second World War, the Cold War, relations with Latin America, East and South Asia, and Africa, the search for markets, and the perceptions of American foreign policy held by the US, its allies and adversaries, and others.

HIST 396: Topics in History
(3-0) Cr. 3.
Prereq: Sophomore classification or permission of instructor
Specialized topics in history; topics vary each time offered.

HIST 396A: Topics in History: Europe
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Sophomore classification or permission of instructor
Specialized topics in history; topics vary each time offered.

HIST 396B: Topics in History: U.S. and North America
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Sophomore classification or permission of instructor
Specialized topics in history; topics vary each time offered.

HIST 396C: Topics in History: Global
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Sophomore classification or permission of instructor
Specialized topics in history; topics vary each time offered.

HIST 402: Greek Civilization
(Cross-listed with CL ST). (3-0) Cr. 3.
Prereq: Sophomore classification
Ancient Greece from the Bronze Age to the Hellenistic period; evolution of the Greek polis and its cultural contributions, with a particular emphasis on the writings of Herodotus and Thucydides.

HIST 403: Roman Civilization
(Cross-listed with CL ST). (3-0) Cr. 3.
Prereq: Sophomore classification
Ancient Rome from the Regal Period to the fall of the Western Empire; evolution of Roman institutions and Rome's cultural contributions studied through original sources.

HIST 405: Transformations of the Early Medieval World
(3-0) Cr. 3.
Prereq: Sophomore classification
Examines major political, religious, and cultural transformations in Western Europe and the Mediterranean, 300-1000. Major topics include the fall of Rome, rise of Christianity, Germanic kingdoms, and Carolingian empire.

HIST 406: The Birth of Europe in the High Middle Ages
(3-0) Cr. 3.
Prereq: Sophomore classification
Examines political, economic, religious, and cultural forms emerging in Europe, 1000-1300, that still characterize Western society to this day. Major topics include the medieval agricultural revolution, English and French monarchies, crisis of church and state, and growth of the papacy and personal religion.

HIST 407: Crises of the Late Middle Ages
(3-0) Cr. 3.
Prereq: Sophomore classification.
Examines major political, economic, religious, and intellectual crises that beset Europe, 1300-1500, paving the way for early modernity. Major topics include Black Death, 100 Years War, papal schism, and origins of Renaissance and Reformation.

HIST 408: Europe, 1500-1648
(3-0) Cr. 3.
Prereq: Sophomore classification
Renaissance; Protestantism and the Age of Catholic reform; social, cultural, and economic changes; global expansion; religious warfare.

HIST 414: European Cultural and Intellectual History
(3-0) Cr. 3.
Prereq: Sophomore classification
A study of the development of key themes in European thought: nature, man, God, society, history, and creativity from Rousseau to Post-Modernism.

HIST 419: History of Modern France
(3-0) Cr. 3.
Prereq: Sophomore classification
From absolutism to revolution and the rise of modern democracy.

HIST 420: France's Revolutionary Century, 1715-1815
(3-0) Cr. 3.
Prereq: Sophomore classification
An in-depth investigation of the French Revolution, its causes and consequences, beginning in the Ancien Regime and ending with the fall of Napoleon.

HIST 421: History of Russia I
(3-0) Cr. 3.
Prereq: Sophomore classification
Russia to 1850. Origins of Russian people; Byzantine influences; Mongol invasion; rise of Moscow; Westernization.
Meets International Perspectives Requirement.

HIST 422: History of Russia II
(3-0) Cr. 3.
Prereq: Sophomore classification
Russia since 1850. Reform and revolution; transformation of society; USSR as a world power; recent changes.
Meets International Perspectives Requirement.

HIST 424: History of Modern Germany
(3-0) Cr. 3.
Prereq: Sophomore classification.
Political, social, and cultural history of Germany from the 19th century to the present.

HIST 427: Crime and Policing in England 1550-1850
(3-0) Cr. 3.
Prereq: Sophomore classification
Course examines different forms and ideas of criminality and the nature and development of law enforcement in England between 1550 and 1856. Significant issues will include the nature of criminal records and statistics, the legal system, the politics of the law and its links with social relations, policing, female crime, juvenile delinquency, organized crime, riots, "social crime," and the treatment of crime in creative literary texts.

HIST 428: Punishment, Mentalities, and Society in England, 1550-1868
(3-0) Cr. 3.
Prereq: Sophomore classification
Explores the history of punishing criminals in England and shows how interdisciplinary perspectives, ideas, and practices of punishment are related to mentalities, and socio-economic change. Issues of significance examined: violence, civility, manners, madness, public punishment, execution, imprisonment, transportation, mercy, the rise of asylums, and penal reform.

HIST 429: "Monstrous London": London's Histories 1500-1800
(3-1) Cr. 3-4.
Prereq: Sophomore classification
Study of London's social, economic, cultural, political, and environmental history 1500-1800, using both quantitative and qualitative methods to examine contemporary and secondary sources. Course combines standard lecture and discussion format with one week of intensive study abroad for 4th hour of course credit.

HIST 431: Modern England
(3-0) Cr. 3.
Prereq: Sophomore classification
England since 1850. Parliamentary and constitutional development; social reform and economic change; imperial Britain; welfare state.

HIST 441: History of Modern Mexico and Central America
(3-0) Cr. 3.
Prereq: Sophomore classification.
Political, economic, and social development of Mexico and Central America in nineteenth and twentieth centuries.

HIST 442: Rebellions and Revolutions in Latin America
(3-0) Cr. 3.
Prereq: Sophomore classification.
Survey of rebellions, revolutionary movements, and social revolutions in the twentieth century, including Guatemalan, Cuban, Mexican, Chilean, and Nicaraguan cases.
Meets International Perspectives Requirement.

HIST 450: Colonial America
(3-0) Cr. 3.
Prereq: Sophomore classification
Exploration, colonization, and development of political, economic, religious, and cultural institutions of North American colonies before 1754. Topics also include social history, emergence of African-American slavery, relations with American Indians.

HIST 451: American Revolutionary Era
(3-0) Cr. 3.
Prereq: Sophomore classification
Participants, ideas, and events leading to independence and the foundation of the United States, 1754 to 1789. Topics include political, military, social, cultural history, also issues of gender and race relations.

HIST 453: Law and Society in U.S. History: Crime, Race, Family, Work and Property
(3-0) Cr. 3.
Prereq: Sophomore classification.
The development of both law and the legal system from colonial times to the present, highlighting their crucial role in aspects of American life such as marriage, family, employment, racial identification, and economic exchange. Topics will include important past legal disputes, the different levels of courts, the various actors in the legal process (e.g., police, prosecutors, prisoners, judges and juries), the relationship between the individuals and institutions that comprise the legal system.

HIST 456: American Family History
(3-0) Cr. 3.
Prereq: Sophomore classification
The impact on American families from colonial times onward of agricultural change, industrialization, urbanization, and wars and depressions.

HIST 460: The Great Plains
(3-0) Cr. 3.
Prereq: Sophomore Classification
History of the Great Plains from prehistoric period. Emphasis on agricultural and rural development, Native Americans, cattle ranching, land policy, agrarian reform movements and federal policy.

HIST 461: The Rural South
(3-0) Cr. 3.
Prereq: Sophomore classification
History of the American South from colonial period to present. Emphasis on economic, social, and political change in this rural region.

HIST 465: The American West
(3-0) Cr. 3.
Prereq: Sophomore classification
History of trans-Mississippi West from 1800 to present, concentrating on settlement and regional identity. Emphasis on the state, the environment, urbanization, agriculture, Native Americans, and minority communities.

HIST 468: History of Rural America
(3-0) Cr. 3.
Prereq: Sophomore classification
History of rural America from the colonial period to the present. Emphasizes immigration, ethnicity, religion, social and cultural change, and agriculture in relation to rural settlement, institution building, demographic change, gender, class, and political and economic development.

HIST 471: Global Environmental History
(Cross-listed with ENV S). (3-0) Cr. 3. F.
Prereq: Either one of HIST 201, 202, or 207; or 3 credits of Environmental Studies; and sophomore classification.
Survey of the interactions of human communities with their environments from the beginnings of human history to the present. Topics include the domestication of animals, the agricultural revolution, industrialization, urbanization, deforestation, hydraulic management, fossil fuel consumption, and climate change.

HIST 472: U. S. Environmental History
(Cross-listed with ENV S). (3-0) Cr. 3.
Prereq: Sophomore classification
Survey of the interactions of human communities with the North American environment. Focus on the period from presettlement to the present, with a particular concentration on natural resources, disease, settlement patterns, land use, and conservation policies.

HIST 473: Civil Rights and Ethnic Power
(Cross-listed with AF AM, US LS). (3-0) Cr. 3.
Prereq: Sophomore classification
Comparative history of the civil rights and ethnic power movements (African American, Chicano, American Indian, Puerto Rican, among others) in the U.S. from World War II to the present. Topics include institutional foundations, leadership, gender and racial dynamics, and the convergences and divergences of these differing ethnic struggles for rights.
Meets U.S. Diversity Requirement

HIST 474: Tradition and Transformation of China's Foreign Affairs
(3-0) Cr. 3.
Prereq: Sophomore classification
Evolution of China's external relations from the antiquities to our own times; conceptions, practices, and relationships that characterized the inter-state relations of the so-called "Chinese world order," interactions between "Eastern" and "Western," and "revolutionary" and "conventional" modes of international behaviors.

HIST 479: China and the Cold War
(3-0) Cr. 3.
Prereq: Sophomore classification
Important events in China's Cold War involvement, connections between domestic and foreign affairs, factors and rationales in China's foreign policy making the relationship between China's Cold War experience and recent developments.

HIST 480: Field Experience for Secondary Teaching Preparation
Cr. 0.5-2. Repeatable, maximum of 2 times. F.S.
Prereq: Permission of area coordinator required prior to enrollment
Observation and participation in a variety of school settings after admission to the teacher preparation program. (S/F grading may be used in some offerings of some sections.).

HIST 480A: Pre-Student Teaching Experience III: History/Social Sciences
(Cross-listed with C I). Cr. 2. Repeatable, maximum of 2 times. F.
Prereq: Admission to Teacher Education
Supervised participation in a 5-12 school setting. Permission of History/Social Sciences coordinator required prior to enrollment. 1/2 day of time needed. Clinical Supervision Level 3.

HIST 482: Birth, Death, Medicine, and Disease
(3-0) Cr. 3.
Prereq: Sophomore classification
History of medicine, sickness, and public health from ancient times to the twenty-first century in the US, Europe, and around the world. Topics include changing ideas of health and illness, development of doctors and hospitals, social and ethical issues in health care, and epidemics from cholera to AIDS.

HIST 488: American Stuff, Colonial Times to the Present
(3-0) Cr. 3.
Prereq: Sophomore classification
Inventions, innovations, artifacts, and material culture in the United States, from homespun cloth and the Colt revolver, through the transcontinental railroad and Model T, to fast food and the iPhone.

HIST 490: Independent Study
(3-0) Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 9 credits in history; permission of department chair
Reading and reports on problems selected in conference with each student. No more than 6 credits of Hist 490 may be counted toward graduation with a major in History. No credits of Hist 490 may count toward a minor in History.

HIST 495: Historiography and Research Writing
(3-0) Cr. 3. F.S.
Prereq: Senior history majors with at least 12 credits of 300+ level history courses
Variable topics seminar that focuses on historiographical and research skills and writing. Required of majors.

HIST 496: Advanced Topics in History
(3-0) Cr. 3.
Prereq: Sophomore classification or permission of instructor.
Specialized topics in history, topics vary each time offered.

HIST 496A: Advanced Topics in History: Europe
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Sophomore classification or permission of instructor.
Specialized topics in history, topics vary each time offered.

HIST 496B: Advanced Topics in History: U.S. and North America
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Sophomore classification or permission of instructor.
Specialized topics in history, topics vary each time offered.

HIST 496C: Advanced Topics in History: Global
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Sophomore classification or permission of instructor.
Specialized topics in history, topics vary each time offered.

HIST 498: Methods of Teaching History/Social Sciences
(Cross-listed with C I). (3-0) Cr. 3. F.S.
Prereq: Concurrent enrollment in HIST 480A; Admission to teacher education and 30 credits in subject-matter field
Concurrent enrollment in 480A; Admission to teacher education and 30 credits in subject-matter field. Theories and processes of teaching and learning secondary history/social sciences. Emphasis on development and enactment of current methods, assessments, and curriculum materials for providing appropriate learning experiences.

Courses primarily for graduate students, open to qualified undergraduates:

HIST 510: Proseminar in East Asian History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in East Asian history. Topics vary each time offered.

HIST 511: Proseminar in American History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 511A: Proseminar in American History: Colonial Period
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 511B: Proseminar in American History: Nineteenth Century
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 511C: Proseminar in American History: Twentieth Century
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 511D: Proseminar in American History: Environment
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 511E: Proseminar in American History: Social and Cultural
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 511F: Proseminar in American History: West
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in American history. Topics vary each time offered.

HIST 512: Proseminar in European History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in European history.

HIST 512A: Proseminar in European History, Ancient
(Cross-listed with CL ST). (3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in European history.

HIST 512B: Proseminar in European History: Medieval and Early Modern
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in European history.

HIST 512C: Proseminar in European History: Modern
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in European history.

HIST 513: Proseminar in Latin American History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Readings in Latin American history. Topics vary each time offered.

HIST 530: Proseminar in Modern Russian/Soviet History
(3-0) Cr. 3. Repeatable.
Prereq: HIST 422
Readings in modern Russian history. Topics vary each time offered.

HIST 550: Proseminar in European Rural and Agricultural History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 550B: Proseminar in European Rural and Agricultural History: Twentieth Century Europe
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 552: Proseminar in American Rural and Agricultural History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 552A: Proseminar in American Rural and Agricultural History: American Agriculture
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 552B: Proseminar in American Rural and Agricultural History: Agrarian Reform Movements
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 552C: Proseminar in American Rural and Agricultural History: Midwestern Rural Society
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 552D: Proseminar in American Rural and Agricultural History: Women in Rural Life
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor

HIST 575: Seminar in General History of Technology
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Permission of instructor
The history of technology with emphasis on the historical literature, differing interpretations of major problems, and problems identified for college-level teaching and for further scholarly research.

HIST 583: Historical Methods
(3-0) Cr. 3.
Study of evidence, theory, and methods.

HIST 583A: Historical Narrative
(3-0) Cr. 3.
Prereq: Permission of instructor.
Study of evidence, theory, and methods.

HIST 583B: Historical Methods: Statistical Evidence and Analysis
(3-0) Cr. 3.
Prereq: Permission of instructor.
Study of evidence, theory, and methods.

HIST 583C: Issues in Historiography
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Permission of instructor.
Study of evidence, theory, and methods.

HIST 585: Teaching Methods for the Modern Europe Survey
(2-2) Cr. 3. S.
Prereq: Graduate status or instructor approval.
Pedagogy and historiography of Europe, from the Protestant Reformation to the present. Pedagogical topics covered include general principles of survey-course construction, lecture technique, and textbook evaluation; historiographical topics will include the Reformation, the Enlightenment, the Industrial Revolution, the French Revolution, the rise of Nationalism, imperialism, the two World Wars, the Cold War and decolonization.

HIST 586: Proseminar in Women's History and Feminist Theory
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: Permission of instructor
Feminism as a movement and feminst theory from the early modern period to the present as it relates to the writing of women's history. Analysis of intepretations of European and U.S. women's history from patriarchal and postmodernist perspectives.

HIST 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor

HIST 593: Seminar in American History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 593A: Seminar in American History: Colonial Period
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 593B: Seminar in American History: Nineteenth Century
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 593C: Seminar in American History: Twentieth Century
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 593D: Seminar in American History: Environmental
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 593F: Seminar in American History: West
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 594: Seminar in European History
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 594A: Seminar in European History: Ancient
(Cross-listed with CL ST). (3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 594B: Seminar in European History: Medieval and Early Modern
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 594C: Seminar in European History: Modern
(3-0) Cr. 3. Repeatable.
Prereq: Permission of instructor
Topics vary each time offered.

HIST 599: Creative Component
Cr. 1-6. Repeatable, maximum of 6 credits.

Courses for graduate students:

HIST 610: Seminar on American Rural Life
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: Permission of instructor
Emphasis varies each time offered.

HIST 699: Research
Cr. 1-6. Repeatable.
Graduate student thesis research.

International Studies

Interdepartmental Undergraduate Major and Minor, Administered by the College of Liberal Arts and Sciences

Through a combination of coursework and study abroad, students who complete a secondary major or minor in International Studies can prepare for careers or advanced study in the international arena, such as foreign service, journalism, advocacy organizations, scientific or research institutions, business, nongovernmental development organizations (NGOs), humanitarian agencies, environmental organizations, human rights organizations, think tanks, international agriculture, and international engineering. Students in International Studies gain an understanding of global issues, learn to communicate across cultures, develop awareness of cultural ideas and attitudes, and are well positioned to become global leaders in their chosen field.

A secondary major and a minor in International Studies are available for undergraduates. The program requirements are structured around a combination of a designated Topical Module and a Geographic Region, both selected by the student. Each student's program of study is designed to reflect opportunities at Iowa State University as well as the academic, intellectual, and professional interests of the student.

Secondary Major

A student seeking a secondary major in International Studies must successfully complete two core courses plus courses in a selected Geographic Region and Topical Module; demonstrate proficiency in a language relevant to the selected geographic region (see below); and participate in a required study, service, or work abroad program (see below).

Requirements for the Secondary Major in International Studies:

- INTST 235 Introduction to International Studies
- INTST 430 Seminar in International Studies
- 9 credits of coursework (at least 6 of which are numbered 300 or above) from one of the following Geographic Regions:
  - Africa and the Middle East
  - Asia
  - Latin America
  - Western Europe
  - Russia, East Europe and Central Asia
- 9 credits of coursework (at least 6 of which are numbered 300 or above) from one of the following Topical Modules:
  - Global Environmental Issues
  - Globalization and Economic Development
  - International Issues in Science and Technology

- International Communication
- International Conflict
- Social and Cultural Change

Click here (https://iastate.box.com/shared/static/2egqdgi6k8da0qiipayf.pdf) **for courses approved for credit for the Geographic Regions and Topical Modules.**

- 3 additional credits of coursework selected from either the Geographic Region or Topical Module.
- Proficiency in a world language that is relevant to the selected geographic region. This can be achieved by completing the 202 level (or higher) of the language or by passing an approved exam.
- Study, service, or internship abroad for a minimum of 3 weeks, earning a minimum of 3 credits. The credits must be transferable Iowa State.

The major must include a minimum of 12 credits not used to meet any other department, college, or university requirement.

Minor

A student seeking a minor in International Studies must successfully complete two core courses plus courses in a selected Geographical Region and Topical Module; demonstrate proficiency in a language relevant to the selected geographic region (see below); and participate in a required study, service, or work abroad program (see below).

Requirements for the Minor in International Studies:

- INTST 235 Introduction to International Studies
- INTST 430 Seminar in International Studies
- 6 credits of coursework (at least 3 of which are numbered 300 or above) from one of the following Geographic Regions:
  - Africa and the Middle East
  - Asia
  - Latin America
  - Western Europe
  - Russia, East Europe and Central Asia
- 6 credits of coursework (at least 3 of which are numbered 300 or above) from one of the following Topical Modules:
  - Global Environmental Issues
  - Globalization and Economic Development
  - International Issues in Science and Technology
  - International Communication
  - International Conflict
  - Social and Cultural Change
- Proficiency in a world language that is relevant to the selected geographic region. This can be achieved by completing the 202 level (or higher) of the language or by passing an approved exam.
- Study, service, or internship abroad for a minimum of 3 weeks, earning a minimum of 3 credits. The credits must be transferable Iowa State.

Click here (https://iastate.box.com/shared/static/2egqdgi6k8da0qiipayf.pdf) **for courses approved for credit for the Geographic Regions and Topical Modules.**

The minor must include a minimum of 9 credits not used to meet any other department, college, or university requirement.

Language Proficiency

Students with a major or minor in International Studies fulfill the Language Proficiency requirement through one of the following options:

- Completion of two years of university-level language instruction in a single world language that is relevant to the selected geographic region, as demonstrated by completion of a foreign language course numbered 202 or higher. Students whose first language is not English must still meet this requirement if their first language is not relevant to their selected geographic region.
- Passing an examination given by the Department of World Languages and Cultures or otherwise certifying proficiency equivalent to two years of college-level study. Students proficient in languages not offered at ISU may petition for special consideration.
- Intensive study abroad experience that includes in-the-field-use of a language other than English. Individual prior approval of the International Studies Director is required for this option.

Study/Service/Work Abroad Experience

Students with a major or minor in International Studies are required to complete an international experience (study, service, or internship) of a minimum of three weeks in duration. Longer experiences are recommended but not required. Up to 12 credits of coursework taken abroad can be applied to the major it it is approved by the International Studies Program Director.

Courses primarily for undergraduates:

INTST 235: Introduction to International Studies
(3-0) Cr. 3. F.SS.
Overview of international studies, emphasizing cultural, geographic, economic, and political characteristics of major world areas and nations. Meets International Perspectives Requirement.

INTST 295: International Experience Abroad
Cr. 1-8. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 12 college-level credits
Supervised instruction in an international setting, augmented by practical living experience.
Meets International Perspectives Requirement.

INTST 350: Topics in International Studies
Cr. 2-4.

Meets International Perspectives Requirement.

INTST 395: Interdisciplinary Study Abroad
Cr. 1-4. Repeatable.
Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 395A: Interdisciplinary Study Abroad: Pre-Departure Seminar
Cr. 1-4. Repeatable.
Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 395B: Interdisciplinary Study Abroad: Humanities
Cr. 1-4. Repeatable.
Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 395C: Interdisciplinary Study Abroad: Communications
Cr. 1-4. Repeatable.
Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 395D: Interdisciplinary Study Abroad: Mathematics and Natural Science
Cr. 1-4. Repeatable.
Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 395E: Interdisciplinary Study Abroad: Social Sciences
Cr. 1-4. Repeatable.
Multi-faceted exploration of a selected world region directed at developing a comprehensive understanding of a selected culture's role in contemporary society.

INTST 430: Seminar in International Studies
(3-0) Cr. 3. S.
Prereq: INTST 235, junior classification or higher
Capstone seminar in international studies focused on economic development, women's issues, war and ethnic conflict, population, the environment, globalization, human rights, international trade and business and other issues. Students develop a project on a subject linked to their area of professional interest or academic specialization.
Meets International Perspectives Requirement.

INTST 446: International Issues and Challenges in Sustainable Development
(Cross-listed with AGRON, GLOBE). Cr. 3. F.S.
Prereq: 3-credit biology course, Sophomore or higher classification, permission of Instructor
Interdisciplinary study and analysis of agricultural systems, sustainable management, and impact on plants and animal biodiversity. International field experience in evaluating different agricultural systems and impact on biodiversity may be required. A program fee is charged to students for international study abroad.
Meets International Perspectives Requirement.

INTST 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: Permission of International Studies director and faculty supervisor
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered or to integrate areas of study appropriate to special problems with international foci. No more than 3 credits of IntSt 490 may be used in the International Studies major or minor.

INTST 491: Experiences Abroad: Learning to Think Globally
(Cross-listed with WLC). (1-0) Cr. 1. Repeatable, maximum of 2 credits.
Prereq: Minimum of 3 cr. of study abroad and/or internship abroad
Students returning from study abroad gain perspective on the personal, academic, and professional impact of their time spent abroad through readings and discussions. Students will be expected to make one presentation about the culture they experienced to an audience outside of ISU. Offered on a satisfactory-fail basis only.

Journalism and Mass Communication

The journalism and Mass Communication Major

The journalism and mass communication major prepares students for careers that involve all aspects of news and information. Emphasis is placed on generating ideas, organizing, writing, editing and presenting information for various media platforms and audiences. Students work with advisers to develop a program of study that prepares them for work in communication-specific areas including broadcast media, magazines

and/or newspapers, photo journalism, science communication, visual communication and digital media. The capstone professional internship experience, coupled with coursework that focuses heavily on writing, research, and professional abilities provide opportunities for students to practice and refine their skills.

To receive a bachelor of science degree in journalism and mass communication, a student must earn at least 120 credits. A minimum of 72 credits must come from courses other than ADVRT, P R, or JL MC. At least 50 of these credits must come from the liberal arts and sciences. Overall, at least 45 credits must be from 300-level or above. Journalism and mass communication majors are required to take:

STAT 101	Principles of Statistics (or another approved statistics course)	4

The degree requirements allow for a minimum of 34 credits and a maximum of 48 credits to be taken in JL MC, ADVRT, and P R. These include:

JL MC 101	Mass Media and Society	3
JL MC 110	Orientation to Journalism and Communication	1
JL MC 201	Reporting and Writing for the Mass Media (C+ or better)	3
One of the following two courses:		
JL MC 302	Intermediate Reporting and Writing for the Mass Media (C+ or better)	
JL MC 303	Reporting and Writing for the Electronic Media (C+ or better)	
JL MC 460	Law of Mass Communication	3
JL MC 462	Media Ethics, Freedom, Responsibility	3
JL MC 499A	Professional Media Internship: Required	3

Additional recommended courses and requirements for the journalism and mass communication major are available from the Greenlee School.

Students taking one major at the school may not seek a second major or a minor in the school. All Greenlee School majors are required to take a second major or minor outside the school as an area of expertise. All Greenlee School majors are required to take 499A.

Minor in Journalism and Mass Communication

Students cannot select more than one minor in the Greenlee School of Journalism and Communication. Minors in the Greenlee School are not available to Greenlee majors.

For a minor in journalism and mass communication, students complete 15 credits.

JL MC 101	Mass Media and Society	3
JL MC 242	Visual Principles for Mass Communicators	3
9 credits from the following:		9
JL MC 240X	Principles of Journalism	
JL MC 347	Science Communication	
JL MC 401	Mass Communication Theory	
JL MC 406	Media Management	
JL MC 453	Electronic Media Technology and Public Policy	
JL MC 461	History of American Journalism	
JL MC 464	Journalism and Literature	
JL MC 474	Communication Technology and Social Change	
JL MC 476	World Communication Systems	
JL MC 477	Ethnicity, Gender, Class and the Media	
JL MC 497	Special Topics in Communication	
Total Credits		15

Journalism and Mass Communication, B.S.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	JL MC 242 (suggested)	3
JL MC 110	1	LIB 160	1
JL MC 101	3	International Perspectives	3
Arts and Humanities	3	Natural Science	3
Natural Science	3	Arts and Humanities	3
Social Science	3	Arts and Humanities	3
	16		16

Sophomore

Fall	Credits	Spring	Credits
ENGL 250	3	JL MC 201	3
JL MC 300 level choice	3	U.S. Diversity	3
Foreign Language or Elective	4	World Languages and Cultures or Elective	4
Natural Science	2	Arts and Humanities	3

STAT 101	4 Social Science	3	
	16	16	

Junior

Fall	Credits	Spring	Credits	Summer	Credits
JL MC 302 or JL MC 303	3	JL MC 300-level Choice*	3	JL MC 499A	3
Minor/ Second Major Choice	3	JL MC 300-level Choice*	3		
Minor/ Second Major Choice	3	Minor/ Second Major Choice	3		
Social Science	3	Minor/ Second Major Choice 300+ Level	3		
Elective - 300+	3	Minor/ Second Major Choice 300+ Level	3		
	15		15		3

Senior

Fall	Credits	Spring	Credits
JL MC 462	3	JL MC 460	3
JL MC 400-level Choice*	3	Elective or Minor/ Second Major Choice 300+ Level	3
JL MC 300-level Choice*	3	Elective or Minor/ Second Major Choice 300+ Level	3
Minor/ Second Major Choice 300+ Level	3	Elective or Minor/ Second Major Choice	3
	12		12

* For 300 and 400-level choices, please choose from the list of selected courses available from an academic adviser. You may schedule an appointment with an adviser by either calling 515-294-4342 or visiting with Greenlee School office staff at 101 Hamilton Hall.
University Requirement: Students in all ISU majors must complete a three-credit course in U.S. Diversity, as well as a three-credit course in International Perspectives. The approved course lists are found at the following web addresses:(U.S. Diversity) http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses and (International Perspectives) http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current .
College of LAS Requirement: Minimum of 120 credits, including a minimum of 45 credits at the 300-level and above. You must also complete the LAS Foreign Language requirement and any unmet ISU admission requirements.
Minor or Second Major: Students are required to fulfill a secondary area of expertise. This requirement can be met by declaring a minor or a second major outside of the Greenlee School of Journalism and Communication.

Graduate Study

The Greenlee School of Journalism and Communication offers work for a master of science degree in journalism and mass communication.

Majors plan a program of study in one of two tracks:

I. Academic track – The School offers advanced academic preparation in communication theory and research, leading to the master of science degree. Graduate work prepares students to use and contribute to research and scholarship in the field of communication. This track requires a thesis based on original research, which must be defended successfully before a committee at the end of the program.

Areas of research emphasis include: science and risk communication, media effects, advertising, public relations, political communication, communication technology, law and ethics, international communication, visual communication and emerging media.

II. Professional track – The School offers advanced professional study in journalism and mass communication leading to the master of science degree. Graduate work prepares students for professional careers in a variety of mass communication fields. Students with limited training or experience in journalism and mass communication may include skills

courses in their programs, but the credits for those courses may not count toward the graduate degree. This track requires either a creative component which must be defended successfully before a committee at the end of the program.

All graduate students must complete 32 credits for graduation, comprised of four core classes, at least two electives outside the Greenlee School, and at least four thesis or creative component credits. The following core courses account for 10 credits of the needed 32 credits.

JL MC 501	Theories of Mass Communication	3
JL MC 502	Fundamentals of Communication Research Methods	3
JL MC 592	Introduction to Graduate Study in Journalism and Mass Communication	1
JL MC 598	Seminars in Mass Communication	1-3

Each student selects elective courses based on his/her area of emphasis and career goal, in consultation with the student's major professor and Program of Study Committee.

The Greenlee School graduate program offers minor work for students majoring in other departments. The M.S. minor requires:

JL MC 501, JL MC 510 and one other course in journalism and mass communication for a total of 9 credits taken within the Greenlee School.

Courses primarily for undergraduates:

JL MC 101: Mass Media and Society
(3-0) Cr. 3. F.S.SS.
Communication theory models and their application to the mass media; the mass communication process; organization, characteristics and responsibilities of the mass media; media literacy process.

JL MC 110: Orientation to Journalism and Communication
(1-0) Cr. 1. F.S.Alt. SS., offered irregularly.
Orientation to professional and pre-professional opportunities, writing for the mass media and curriculum requirements in the Greenlee School. Basic media writing preparation. Offered on a satisfactory-fail basis only.

JL MC 201: Reporting and Writing for the Mass Media
(1-4) Cr. 3.
Prereq: Greenlee majors only or departmental permission. Must pass departmental assessment exam in language skills before registering; ENGL 250; credit or concurrent enrollment in JL MC 110.
Generating story ideas, exercising news judgment and gathering information via interviews, observation and documentary sources to produce news and informational material for the mass media. Emphasis on analyzing and organizing information, as well as accuracy and principles of good writing. Use of AP Style.

JL MC 242: Visual Principles for Mass Communicators
(3-0) Cr. 3. F.S.
Understanding and analysis of the visual message. Visual perception, visual communication theory, design syntax, design elements and how they are applied in journalism and mass communication.

JL MC 302: Intermediate Reporting and Writing for the Mass Media
(2-2) Cr. 3.
Prereq: JL MC 110 and Minimum of C+ in JL MC 201
Writing for newspapers, magazines and digital media. Enhancing and refining skills in developing sources and generating story ideas. Information-gathering techniques, reporting and writing.

JL MC 303: Reporting and Writing for the Electronic Media
(2-2) Cr. 3.
Prereq: JL MC 110 and Minimum of C+ in JL MC 201
Researching, organizing, and writing for radio, television and digital media. Basic principles of news programming and storytelling across electronic media platforms. An emphasis on development, content and structure.

JL MC 306: Electronic Media Production
(2-2) Cr. 3. F.S.
Prereq: Minimum of C+ in Jl MC 201
Introduction to studio production using professional equipment. Course focus on visual concepts, maintenance and practical operation of studio equipment.

JL MC 307: Digital Video Production
(2-2) Cr. 3.
Prereq: Greenlee majors only.
Creation of video productions for use as communication tools in advertising, promotions, short documentaries and public relations. Technical and artistic fundamentals of video production including planning, scripting, shooting, lighting and digital editing.

JL MC 308: Electronic News Gathering and Production
(2-3) Cr. 3.
Prereq: Minimum of C+ in JL MC 201.
Field techniques in single-camera video production used to shoot and edit visual stories. Introduction to electronic news gathering.

JL MC 310: Fundamentals of Photojournalism
(2-2) Cr. 3. F.S.
Prereq: Minimum of C+ in JL MC 201
Basic photojournalism techniques. Includes camera operation, lighting, composition and photo reproduction techniques for print or computer-mediated applications. Emphasis on using the camera as a reporting tool. Basic use of digital imaging and editing software. Ethical issues involving photojournalism. A digital SLR camera is required.

JL MC 312: Advanced Techniques in Photojournalism
(2-2) Cr. 3. Alt. F., offered irregularly.Alt. S., offered irregularly.
Prereq: JL MC 310 or permission of instructor
Advanced techniques and problem solving, both ethical and technical, for photographers who seek to be members of newsgathering teams. Photographic storytelling using a combination of audio and still photography techniques to report stories for print and web publications. Hands on experience with latest digital imaging technology. A digital SLR camera is required.

JL MC 315: Multimedia Production
(2-2) Cr. 3. F.S.
Prereq: JL MC 308 or JL MC 310 or JL MC 316 or equivalent computer design proficiency
Visual storytelling concepts and principles for evaluating, constructing and designing information for the Web and other electronic publication systems. Issues of ethics and ownership of work pertinent to the new media.

JL MC 316: Introduction to Digital Publishing
(2-2) Cr. 3. F.S.
Prereq: Credit or enrollment in JL MC 242 and C+ or better in Jl MC 201
Digital publishing and beginning techniques in layout, photo editing and vector artwork. Application of visual principles to design simple print projects.

JL MC 317: Publishing for Mobile Devices
(2-2) Cr. 3. S.
Prereq: JL MC 316 or equivalent computer design proficiency and JL MC 310 or 315.
Creating, designing and publishing content for mobile devices (e.g., cell phones and tablets). Use of digital publishing tools (e.g., In Design). Exposure to animation and video editing software.

JL MC 344: Feature Writing
(2-2) Cr. 3.
Prereq: Minimum of C+ in JL MC 302 or P R 321
Reporting and writing short- and long- form stories for magazines, newspapers, corporate communication and the Web. Focus on departmental stories, personal essays, trend or conflict articles and personality profiles. Emphasis on immersion reporting. Majors may not apply both 344 and Engl 303 toward graduation.

JL MC 346: Public Affairs Reporting
(2-2) Cr. 3.
Prereq: Minimum of C+ in JL MC 302 or P R 321
Reporting and writing about government, business, and other institutions; identification of and access to public records; investigative reporting techniques; developing major stories about government and nonprofit organizations; and ethical issues.

JL MC 347: Science Communication
(Dual-listed with JL MC 547). (2-2) Cr. 3.
Prereq: Graduate classification. Nonmajors and minors by permission of instructor.
Reporting and writing about science and technology topics for general audiences. Outlets for stories include print, broadcast and online media. Story topics include reporting about basic, applied and social sciences, as well as ethical, political and policy issues related to science and technology.

JL MC 349: News and Feature Editing
(2-2) Cr. 3.
Prereq: Minimum of C+ in JL MC 302 or P R 321
Editing content for multiple platforms, including websites, magazines, newspapers, and newsletters. Adapting material for audiences, including selection and organization of text and visuals, grammar, punctuation, usage, logic and accuracy. Designing print and online layouts. Using search engine optimization and social media to promote content.

JL MC 354: Advanced Electronic Media Production
(2-3) Cr. 3.
Prereq: JL MC 206.
Application of advanced television techniques: writing, producing, and managing live and recorded information programs.

JL MC 390: Professional Skills Development
(Cross-listed with ADVRT, P R). Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Minimum of C+ in JL MC 201; other vary by topic. Instructor permission for non-majors.
Check with Greenlee School for course availability.

JL MC 401: Mass Communication Theory
(3-0) Cr. 3.
Prereq: Junior classification
Theory and research in mass communication processes and effects; the scientific process; methods of measuring, evaluating and reporting mass communication research.

JL MC 406: Media Management
(Dual-listed with JL MC 506). (3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Decision-making functions of media. Basic media market analysis, media organization and management, circulation and audience development, technological developments affecting management decisions, and relationships with labor and regulatory agencies that affect media operations.

JL MC 449: Editorial Strategies
(3-0) Cr. 3. S.
Prereq: JL MC 242, JL MC 316, JL MC 349 or concurrent enrollment; junior classification
Skills and strategies for editorial decision-making and management, including short and long range issue planning. Developing proposals, business plans and prototypes for content, design and layouts of publications for multiple platforms and diverse audiences, including new and existing online and print magazines, newspapers, newsletters and websites. Editing complex manuscripts, with continued emphasis on grammar, punctuation, usage, syntax and logic.

JL MC 453: Electronic Media Technology and Public Policy
(3-0) Cr. 3.
Prereq: Junior classification
Issues and policies affecting historical, contemporary and future developments of electronic media and their technologies.

JL MC 454: Critical Analysis and History of the Moving Image
(3-0) Cr. 3.
Prereq: Junior classification
Evolution of motion picture and television content and other visual technologies. Theories and techniques for evaluating and critiquing film and video.

JL MC 460: Law of Mass Communication
(3-0) Cr. 3.
Prereq: JL MC 110 and minimum of C+ in JL MC 201; junior classification. Nonmajors by permission of department.
First Amendment law, libel, privacy, obscenity, contempt, copyright, trademark, the Federal Communications Act; laws affecting advertising, legal publication, and other business activities of the media.

JL MC 461: History of American Journalism
(3-0) Cr. 3.
Prereq: Junior classification
Role of the mass media, including advertising and public relations, in shaping the social, economic and political history of America; impact of change in these areas on the development, traditions and philosophies of the media.

JL MC 462: Media Ethics, Freedom, Responsibility
(3-0) Cr. 3.
Prereq: JL MC 110 and minimum of C+ in JL MC 201. Greenlee majors only.
Ethics and professionalism in the practice of journalism, public relations and advertising.

JL MC 464: Journalism and Literature
(3-0) Cr. 3.
Prereq: Junior classification
A study of journalism's impact on literary writing and literature's impact on journalism, as seen through the works of esteemed American author-journalists.

JL MC 474: Communication Technology and Social Change
(3-0) Cr. 3.
Prereq: Junior classification
Examination of historical and current communication technologies, including how they shape and are shaped by the cultural and social practices into which they are introduced.
Meets International Perspectives Requirement.

JL MC 476: World Communication Systems
(Dual-listed with JL MC 576). (3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
World communication systems and social, political, and economic factors determining flow, character, and volume of news. Impact of media information, advertising and public relations on nations and societies. Comparative analysis of role and impact of traditional modes of communication, the mass media and computer-mediated systems.
Meets International Perspectives Requirement.

JL MC 477: Ethnicity, Gender, Class and the Media
(3-0) Cr. 3. F.S.SS.
Prereq: Junior classification
Portrayals of ethnic groups, gender, and social class in the media in news, advertising, information and entertainment; the effects of mass media on social issues and population groups.
Meets U.S. Diversity Requirement

JL MC 490: Independent Study in Communication
Cr. arr.
Prereq: Junior classification and contract with supervising professor to register
Independent studies are research-based. Students may study problems associated with a medium, a professional specialization, a philosophical or practical concern, a reportorial method or writing technique, or a special topic in their field. Credit is not given for working on student or professional media without an accompanying research component.
No more than 3 credits of Jl MC 490 may be used toward a degree in journalism and mass communication or advertising.

JL MC 497: Special Topics in Communication
(Cross-listed with ADVRT, P R). Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: Junior classification. See Schedule of Classes for possible pre-requisites.
Seminars or one-time classes on topics of relevance to students in communication.

JL MC 499: Professional Media Internship
Cr. 1-3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, formal faculty adviser approval.
Required of all Greenlee School majors. A 400-hour (for 3 credits) internship in the student's journalism and mass communication or advertising or public relations specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

JL MC 499A: Professional Media Internship: Required
Cr. 3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, formal faculty adviser approval.
Initial, required internship. A 400-hour (for 3 credits) internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

JL MC 499B: Professional Media Internship: Optional
Cr. 1-3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, formal faculty adviser approval.
Optional internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

JL MC 501: Theories of Mass Communication
(3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Historical overview of mass communication theories. Examination of major areas of research activity and theoretical development related to organization, functions, and effects of mass communication.

JL MC 502: Fundamentals of Communication Research Methods
(3-0) Cr. 3.
Prereq: JL MC 501 or concurrent enrollment.
Research methods in journalism and mass communication, including problem selection, sampling, hypothesis formulation, research design, data collection and analysis. Designing a research strategy appropriate for a variety of communication-related questions and assessing the appropriateness, validity, and generalizability of research results.

JL MC 506: Media Management
(Dual-listed with JL MC 406). (3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Decision-making functions of media. Basic media market analysis, media organization and management, circulation and audience development, technological developments affecting management decisions, and relationships with labor and regulatory agencies that affect media operations.

JL MC 510: Strategies of Communication
(3-0) Cr. 3.
Prereq: JL MC 501
The process of developing professional communication and persuasion strategies, with emphasis on problem definition, behavioral objectives, situation analysis, strategy formulation, and justification through application of communication theories and research.

JL MC 520: Public Relations Theory and Methods
(3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Overview of dominant theories and research methods applied to the study and practice of public relations.

JL MC 521: Theories of Visual Communication
(3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Explores the theoretical frameworks in visual communication, including concepts of perception, visual language, visual persuasion, and the social, political and cultural implications of the use of images. Understanding the function of images in changing knowledge, attitudes and behavior.

JL MC 547: Science Communication
(Dual-listed with JL MC 347). (2-2) Cr. 3.
Prereq: Graduate classification. Nonmajors and minors by permission of instructor.
Reporting and writing about science and technology topics for general audiences. Outlets for stories include print, broadcast and online media. Story topics include reporting about basic, applied and social sciences, as well as ethical, political and policy issues related to science and technology.

JL MC 560: Risk Perception and Communication
(3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Study of risk communication principles, models and theories applicable to any risk communication situation. Emphasis on science, technology and risk issues, such as food, health, agriculture and the environment. Examines roles of scientists and communicators in cultivating a public informed about scientific and technological issues.

JL MC 561: Media and Society: Interrelationships
(3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Media roles and functions in society including interrelationships between the media and a variety of social actors and forces. Theories and practices regarding social networking and communication via social media; influence of social media and social networking.

JL MC 574: Communication Technologies and Social Change
(3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
Personal, organizational, and social implications of the use of communication technologies. Includes theories and empirical research across the continuum of perspectives, from techno-utopianism through an anti-technology stance.
Meets International Perspectives Requirement.

JL MC 576: World Communication Systems
(Dual-listed with JL MC 476). (3-0) Cr. 3.
Prereq: Graduate classification or instructor permission.
World communication systems and social, political, and economic factors determining flow, character, and volume of news. Impact of media information, advertising and public relations on nations and societies. Comparative analysis of role and impact of traditional modes of communication, the mass media and computer-mediated systems.
Meets International Perspectives Requirement.

JL MC 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor

JL MC 590A: Special Topics: Media Studies
Cr. arr. Repeatable.
Prereq: Permission of instructor

JL MC 590B: Special Topics: Professional Specialization
Cr. arr. Repeatable.
Prereq: Permission of instructor

JL MC 590C: Special Topics: Research Problems and Methods
Cr. arr. Repeatable.
Prereq: Permission of instructor

JL MC 590D: Special Topics: Technique and Style
Cr. arr. Repeatable.
Prereq: Permission of instructor

JL MC 590E: Special Topics: Specialized Communication
Cr. arr. Repeatable.
Prereq: Permission of instructor

JL MC 591: Professional Internship
Cr. 1-2. F.S.SS.
Prereq: Permission of instructor
Supervised internship experience. Offered on a satisfactory-fail basis only.

JL MC 592: Introduction to Graduate Study in Journalism and Mass Communication
(1-0) Cr. 1.
Prereq: Graduate classification in JL MC.
Overview of advanced study in journalism and mass communication with special emphasis on requirements for obtaining the master of science degree.

JL MC 598: Seminars in Mass Communication
Cr. 1-3. Repeatable, maximum of 3 credits.
Prereq: graduate classification or instructor permission.
Seminar in Mass Communication.

JL MC 598A: Seminars in Mass Communication: Audiences and Effects
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598B: Seminars in Mass Communication: Communication Technology
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598C: Seminars in Mass Communication: Professional Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598D: Seminars in Mass Communication: Development Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598E: Seminars in Mass Communication: Evaluation Methods
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598F: Seminars in Mass Communication: International Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598G: Seminars in Mass Communication: Mass Communication History
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598H: Seminars in Mass Communication: Mass Communication Law
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598I: Seminars in Mass Communication: Media Management
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598J: Seminars in Mass Communication: Research Methods
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598K: Seminars in Mass Communication: Society and Mass Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598L: Seminars in Mass Communication: Journalism and Mass Communication Education
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598M: Seminars in Mass Communication: Visual Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598N: Seminars in Mass Communication: Broadcast Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598O: Seminars in Mass Communication: Communication Theory
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598P: Seminars in Mass Communication: Computer Mediated Communication
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 598Q: Seminars in Mass Communication: Science, Technology and Risk Communication.
Cr. 1-3. Repeatable.
Prereq: Graduate classification or instructor permission.

JL MC 599: Creative Component
Cr. arr. Repeatable.
Prereq: Approved creative component proposal

Courses for graduate students:

JL MC 699: Thesis Research
Cr. arr. Repeatable.
Prereq: Approved thesis proposal

Liberal Studies

The Bachelor of Liberal Studies degree (B.L.S.) was established by the three Iowa Regent universities primarily to meet the needs of Iowans who want to earn a college degree but whose circumstances present obstacles to completing a traditional on-campus degree program. The degree may be earned from Iowa State University, the University of Iowa, or the University of Northern Iowa.

The B.L.S. is a general studies degree in the liberal arts. There is no traditional major. Instead, students take coursework in three areas of distribution. These areas may be focused in a single discipline or diversified over several disciplines. With the assistance of a B.L.S. adviser, students can structure a program that meets their individual educational, vocational or personal goals.

Up to three-fourths of the total degree requirements can be transferred from accredited institutions. Work done in community colleges or other accredited colleges and universities can be applied toward the degree, as can applicable courses taken at any of the three Iowa Regent universities, whether on or off campus.

The B.L.S. program has no residence requirements. To complete the degree, students may earn credits through distance-learning formats as well as regular on-campus courses. Students may also earn credits by proficiency or test-out examinations.

Admission

Admission to the B.L.S. program is open to persons who meet either of the following levels of previous educational attainment:

- Hold the associate in arts (A.A.) or associate in science (A.S.) degree from an accredited two-year college. (Holders of the associate in applied science or associate in applied arts degree are not automatically eligible, although some courses may be found applicable upon review.)
- Have at least 60 semester credits of collegiate work acceptable toward graduation at ISU with a total cumulative grade point average of at least 2.00 (a C average).

Requirements for the B.L.S. Degree

The B.L.S. candidate must earn a total of 120 credits in accordance with requirements listed below. Courses taken at Iowa State University on a pass/not pass basis may be counted toward graduation only as electives. No more than 9 credits of 490 (Independent Study) courses in a single discipline may be counted toward graduation.

General Education Requirements 46 cr.	
Basic English Composition	6
World language *	8
Arts and humanities	12
Mathematics, statistics, or computer science	3
Natural sciences	8
Social sciences	9
Distribution Requirements **	36
Electives	38
Total Credits	120

*The requirement may be met by completion of three or more years of high school study in one world language. A list of courses acceptable in the general education groups can be obtained from the college website (http://www.las.iastate.edu/students/academics/general-education).

**A minimum of 12 credits is required in each of three of the five distribution areas listed below.

Humanities (literature, philosophy, history, religion, art and music appreciation)

Communications and arts (journalism, speech, writing, drama, art, world language)

Natural sciences and mathematical disciplines (chemistry, physics, biology, geological and atmospheric sciences, mathematics, statistics, computer science)

Social sciences (sociology, psychology, economics, political science, anthropology, geography)

Professional fields (business, education, family and consumer sciences, agriculture, engineering)

At least 24 upper-level credits are required in the three distribution areas with a minimum of 6 upper-level credits in each of the areas.

Other Requirements

Included in the total of 120 credits must be the following:

45 upper-level credits from a four-year college

30 credits from ISU earned during the junior/and or senior year.

Three credits of course work in U.S. Diversity and 3 credits in International Perspectives.

A grade average of at least 2.00 (a C average) in all coursework applied to the B.L.S. degree, in all upper-level coursework, and in all work completed after admission to the B.L.S. program.

Proficiency in upper-level communication demonstrated by completion of an approved composition/communication course from a four-year college.

Linguistics

Linguistics is a cross-disciplinary program in the College of Liberal Arts and Sciences designed to meet the needs of students interested in various aspects of language—its structure, history, varieties, meanings, and uses. The program includes courses in anthropology, communication disorders, computer science, English, psychology, and speech communication and world languages and cultures, thus providing a multi-disciplinary approach to the study of human language.

Courses in linguistics serve as background for students interested in any career that involves working with language, such as teaching English both as a first and as a second language, second language studies, psycholinguistics, cross-cultural communication, linguistic anthropology, computational linguistics, speech-language pathology, and audiology.

In the College of Liberal Arts and Sciences, courses in linguistics can be applied as electives or as part of the group requirements. They may also be used in a minor or in a major.

Majors in linguistics complete a minimum of 36 hours in linguistics with a grade of C or better in each linguistics course. Courses specifically required are:

LING 119	Introduction to World Languages	3
LING 120	Computers and Language	3
LING 207	Introduction to Symbolic Logic	3

LING 219	Introduction to Linguistics	3
LING 220	Descriptive English Grammar	3
LING 371	Phonetics and Phonology	3
LING 413	Psychology of Language	3
LING 420	History of the English Language	3
LING 437	Grammatical Analysis	3

In addition, linguistics majors must choose 9 credits of elective courses. Discuss choices with the adviser. Suggested areas of further study are:

Communication Disorders

LING 275	Introduction to Communication Disorders	3
LING 286	Communicating with the Deaf	3
LING 471	Language and Reading Development in Children	3
CMDIS 480B	Topics in Communication Disorders: Articulation and Phonological Disorders	3

Computers and Linguistics

LING 331	Theory of Computing	3
LING 510	Introduction to Computers in Applied Linguistics	3
LING 526	Computer-Assisted Language Learning	3

Second Language Studies

ENGL 324X	Introduction to Teaching ESL Literacy	
ENGL 325X	Teaching Methods for ESL Learners: Oral Communication Skills	
LING 425	Second Language Learning and Teaching	3
LING 518	Teaching English as a Second Language Methods and Materials	3
LING 524	Literacy: Issues and Methods for Nonnative Speakers of English	3
LING 525	Research and Teaching of Second Language Pronunciation	3

Sociolinguistics and Language

LING 305	Language, Thought and Action	3
ENGL 322X	Language and Society	3
LING 422	Women, Men, and the English Language	3
LING 514	Sociolinguistics	3
LING 527	Discourse Analysis	3

Spanish Linguistics

LING 351	Introduction to Spanish-English Translation	3
LING 352	Introduction to Spanish Phonology	3
LING 354	Introduction to Spanish-English Interpretation	3
LING 462	Contrastive Analysis of Spanish/ English for Translators	3
LING 463	Hispanic Dialectology	3

Additional courses in linguistics are available but not fully in the catalog yet. These include LING 319X, 320X, 322, 324, and 325. They also include courses for study abroad, especially LING 395X. Majors in linguistics must show proficiency in a foreign language equivalent to that achieved after two years of university-level study. Alternatively, majors in linguistics can demonstrate university-level study in two foreign languages of at least one year each.

Minors in linguistics are individually tailored to the interests of the student, who consults with the linguistics adviser to develop the minor program of study. All minors must have a minimum of 15 credits in linguistics, of which 6 must be in courses numbered over 300. All programs must include LING 219 Introduction to Linguistics.

Communication Proficiency requirement: The LAS College requires a grade of C or better in ENGL 250.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	
LIB 160	Information Literacy	1
Continuing ENGL Proficiency is based on one course from ENGL 314, a WLC 370-379 course, or a CL ST 370-379 course.		

For information about using linguistics courses in an interdisciplinary studies major, see Liberal Arts and Sciences, Cross-Disciplinary Studies.

Linguistics, B.A.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	LING 101	1
LIB 160	1	Humanities Choice	3
Foreign Language/Elective	4	Math Choice	3
LING 119	3	PSYCH 101	3
LING 120	3	Foreign Language/Elective	4
Natural Science Choice	3		
	17		14

Sophomore

Fall	Credits	Spring	Credits
ENGL 250	3	LING 371	3
LING 219	3	Foreign Language 202	4
ANTHR 201	3	LING 220	3
Humanities Choice	3	Humanities Choice	3
Foreign Language 201	4	Social Science Choice	3
	16		16

Junior

Fall	Credits	Spring	Credits
LING 309	3	LING 207	3
LING 437	3	LING 413	3
ENGL 305, 314 or WLC 370-378	3	LING 420	3
Natural Science Choice	3	Natural Science Choice	3
Elective	3	Elective	3
	15		15

Senior

Fall	Credits	Spring	Credits
LING Area of Concentration	3	LING Area of Concentration	3
U.S. Diversity	3	Electives	10
Electives	8		
	14		13

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 300/400 level

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses.

Graduate Study

A graduate minor in linguistics permits students to investigate various aspects of linguistics, emphasizing the ability to think about language in a systematic and disciplined way and to apply the methods of the field to research problems in their own disciplines. Graduate courses for the minor may be cross-listed with courses in Anthropology, Communication Disorders, Computer Science, English, Psychology, and World Languages and Cultures.

For the master's degree, a declared minor consists of 9 credits in linguistics including two foundation courses:

LING 511	Introduction to Linguistic Analysis	3
One of the following:		3
LING 514	Sociolinguistics	
LING 527	Discourse Analysis	
LING 537	Corpus Approaches to Grammatical Analysis	
And one elective from the list of courses approved for graduate credit		3
Total Credits		9

For the Ph.D. degree, the minor consists of 12 credits in linguistics including:

LING 511	Introduction to Linguistic Analysis	3
LING 537	Corpus Approaches to Grammatical Analysis	3
And two electives from the list of courses approved for graduate credit		6
Total Credits		12

Additional courses beyond those listed below may be used as electives. The chair of the supervisory committee can provide information about these.

At least one member of the linguistics faculty will serve on a student's program of study committee. A list of faculty members may be obtained from the Linguistics program website. Ph.D. candidates will write one section of the preliminary examination on an area of linguistics. Students in Teaching English as a Second Language/Applied Linguistics are not eligible for a graduate minor in linguistics.

Courses primarily for undergraduates:

LING 101: Introduction to the Study of Linguistics
(1-0) Cr. 1. S.
Cross-disciplinary perspectives on the study of linguistics. Applications of linguistics to real world problems. Careers in linguistics.

LING 119: Introduction to World Languages
(Cross-listed with WLC). (3-0) Cr. 3.
Study of language diversity and the personal, social and political effects of diversity. Language families, attitudes toward language and language use, language and culture, multilingualism, foreign language learning, written codes, official languages, and language policy.
Meets International Perspectives Requirement.

LING 120: Computers and Language
(Cross-listed with ENGL). (3-0) Cr. 3.
Introduction to the use of linguistic knowledge in computer applications today and the basic computational techniques used in such applications. The development of these techniques throughout the history of computational linguistics. How the study of language has contributed to the advancement of technology and how certain computational problems have influenced the way linguists study language.

LING 207: Introduction to Symbolic Logic
(Cross-listed with PHIL). (3-0) Cr. 3. S.
Introduction to fundamental logical concepts and logical symbolism. Development of natural deduction through first order predicate logic with identity. Applications to arguments in ordinary English and to philosophical issues. Linguistics majors should take LING/PHIL 207 as early as possible.

LING 219: Introduction to Linguistics
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.
Prereq: Sophomore classification
Introduction to linguistic concepts and principles of linguistic analysis with English as the primary source of data. Sound and writing systems, sentence structure, vocabulary, and meaning. Issues in the study of usage, regional and social dialects, language acquisition, and language change.

LING 220: Descriptive English Grammar
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.
Prereq: ENGL 250
Overview of grammatical structures and functions. Parts of speech; phrase, clause, and sentence structure; sentence types and sentence analysis; rhetorical grammar and sentence style; terminology. Not a remedial, English composition, or ESL course.

LING 275: Introduction to Communication Disorders
(Cross-listed with CMDIS). (3-0) Cr. 3.
Survey of nature, causes, and types of major communication disorders including phonological, adult and child language, voice, cleft palate, fluency, and hearing disorders.

LING 286: Communicating with the Deaf
(Cross-listed with CMDIS). (3-0) Cr. 3.
Learn to communicate with the deaf using Signed English and Signed Pidgin English. Other topics covered include types, causes, and consequences of hearing loss, hearing technology (hearing aids, assistive listening devices, and cochlear implants), education of hearing-impaired children, Deaf culture, and the history of manual communication.
Meets U.S. Diversity Requirement

LING 305: Language, Thought and Action
(Cross-listed with SP CM). (3-0) Cr. 3.
Prereq: ENGL 250
The study of symbolic processes and how meaning is conveyed in words, sentences, and utterances; discussion of modern theories of meaning; and an exploration of relationships among language, thought and action.

LING 309: Introduction to Culture and Language
(Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 recommended
Introduction to study of language, culture and society from an anthropological perspective. Focus on language and thought, ethnography of speaking, discourse and narrative, writing and literacy, and media communication. Discussion of key theories and methods of linguistic anthropology.
Meets International Perspectives Requirement.

LING 322: Language and Society
(Cross-listed with ENGL). Cr. 3. S.
Prereq: ENGL/LING 219
Introduction to variation in language use in society. Survey of factors affecting language use, including background characteristics of language users, location, and purpose of interaction in addition to institutional, state, and national language policies.

LING 324: Introduction to Teaching ESL Literacy
(Cross-listed with ENGL). Cr. 3. F.
Prereq: ENGL/LING 219
Introduction to the issues and methods involved in teaching literacy skills to English as a second language (ESL) learners. The nature of literacy and materials and methods for developing ESL literacy at the middle school, high school, and adult ages across multiple levels of competency.

LING 325: Teaching Methods for ESL Learners: Oral Communication Skills
(Cross-listed with ENGL). Cr. 3. S.
Prereq: ENGL/LING 219
Issues and methods in teaching oral communication skills (listening, speaking, pronunciation) to English as a second language (ESL) learners. The nature of oral language ability. Materials and Methods for developing oral communication skills at middle school, high school, and adult contexts.

LING 331: Theory of Computing
(Cross-listed with COM S). (3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228, MATH 166, and in COM S 230 or CPR E 310; ENGL 250
Models of computation: finite state automata, pushdown automata and Turing machines. Study of grammars and their relation to automata. Limits of digital computation, unsolvability and Church-Turing thesis. Chomsky hierarchy and relations between classes of languages.

LING 351: Introduction to Spanish-English Translation
(Cross-listed with SPAN). (3-0) Cr. 3. F.S.
Prereq: SPAN 301, SPAN 303 or SPAN 304
Introduction to the theory, methods, techniques, and problems of translation. Consideration of material from business, literature, and the social sciences. Taught in Spanish.
Meets International Perspectives Requirement.

LING 352: Introduction to Spanish Phonology
(Cross-listed with SPAN). (3-0) Cr. 3. F.S.
Prereq: SPAN 301, SPAN 303 or SPAN 304
An introductory study of the articulation, classification, distribution, and regional variations of the sounds of the Spanish language. Taught in Spanish.
Meets International Perspectives Requirement.

LING 354: Introduction to Spanish-English Interpretation
(Dual-listed with LING 554). (Cross-listed with SPAN). (3-0) Cr. 3. F.S.
Prereq: SPAN 351
Introduction to the theory, methods, techniques, and problems of consecutive and simultaneous interpretation. Consideration of material from business, agriculture, law, design, medicine, literature, advertisement, and sports. Taught in Spanish.
Meets International Perspectives Requirement.

LING 371: Phonetics and Phonology
(Cross-listed with CMDIS). (3-0) Cr. 3.
Prereq: ENGL 219
Analysis of speech through study of individual sounds, their variations, and relationships in context; English phonology; practice in auditory discrimination and transcription of sounds of American English; description of speech sounds in terms of their production, transmission, and perception.

LING 395: Study Abroad
Cr. 3-10. Repeatable, maximum of 2 times.
Instruction in issues of language policy, practice and learning. Observation and experience with language use outside of the United States.
Meets International Perspectives Requirement.

LING 413: Psychology of Language
(Cross-listed with PSYCH). (3-0) Cr. 3.
Prereq: PSYCH 101
Introduction to psycholinguistics. Topics may include origin of language, speech perception, language comprehension, reading, bilingualism, brain bases of language, and computational modeling of language processes.

LING 420: History of the English Language
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.
Prereq: ENGL 219 or LING 219, ENGL 220 or LING 220
Comparison of English to other languages by family background and by type. Analysis of representative Old, Middle, Early Modern and present-day English texts, including both literary works and non-literary documents.

LING 422: Women, Men, and the English Language
(Cross-listed with ENGL, W S). (3-0) Cr. 3. S.
Prereq: ENGL 219 or LING 219
The ways men and women differ in using language in varied settings and the ways in which language both creates and reflects gender divisions.
Meets U.S. Diversity Requirement

LING 425: Second Language Learning and Teaching
(Cross-listed with ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 219 or LING 219; junior classification
The process of second language learning and principles and techniques of teaching second languages. Learning and teaching in specific situations and for particular purposes. Current applications of technology in teaching and assessment.

LING 437: Grammatical Analysis
(Cross-listed with ENGL). (3-0) Cr. 3. F.
Prereq: ENGL 220 or LING 220; ENGL 219 or LING 219 or introductory course in linguistics; junior classification
Theories and methods for analysis of syntax and morphology.

LING 462: Contrastive Analysis of Spanish/ English for Translators
(Cross-listed with SPAN). (3-0) Cr. 3.
Prereq: SPAN 351
Linguistic study of the major differences between the Spanish and English grammatical systems and their applications in the translation of Spanish to English. Taught in Spanish.

LING 463: Hispanic Dialectology
(Cross-listed with SPAN). (3-0) Cr. 3.
Prereq: SPAN 352
Intensive study of the phonology, morphosyntax and lexicon of the Hispanic dialects of Spain and Latin America in their historical context. Taught in Spanish.
Meets International Perspectives Requirement.

LING 471: Language and Reading Development in Children
(Cross-listed with CMDIS). (3-0) Cr. 3.
Prereq: CMDIS 275 or PSYCH 230 or ENGL 219 or LING 219
Theories and developmental processes related to the components of language(semantics, syntax, morphology, phonology, and pragmatics); the development of metalinguistic knowledge; theories and developmental processes of reading.

LING 480: Topics in Communication Disorders
(Cross-listed with CMDIS). (3-0) Cr. 3. F.S.
Prereq: CMDIS/LING 275, CMDIS/LING 371, and BIOL 255; permission of instructor.
Guided examination of topics in preparation for graduate work in Speech-Language Pathology or Audiology. Primary course delivery by WWW.

LING 480A: Topics in Communication Disorders: Anatomy and Physiology of Speech and Hearing
(Cross-listed with CMDIS). (3-0) Cr. 3. F.S.
Prereq: CMDIS/LING 275, CMDIS/LING 371, and BIOL 255; permission of instructor.
Guided examination of topics in preparation for graduate work in Speech-Language Pathology or Audiology. Primary course delivery by WWW.

LING 480B: Topics in Communication Disorders: Articulation and Phonological Disorders
(Cross-listed with CMDIS). (3-0) Cr. 3. F.S.
Prereq: CMDIS/LING 275, CMDIS/LING 371, and BIOL 255; permission of instructor.
Guided examination of topics in preparation for graduate work in Speech-Language Pathology or Audiology. Primary course delivery by WWW.

LING 480C: Topics in Communication Disorders: Evaluation and diagnosis of communication disorders
(Cross-listed with CMDIS). (3-0) Cr. 3. F.S.
Prereq: CMDIS/LING 275, CMDIS/LING 371, and BIOL 255; permission of instructor.
Guided examination of topics in preparation for graduate work in Speech-Language Pathology or Audiology. Primary course delivery by WWW.

LING 486: Methods in Elementary School World Language Instruction
(Cross-listed with C I, WLC). (3-0) Cr. 3. F.
Prereq: 25 credits in a world language
Planning, implementation, and assessment of standards-based, student-centered, and thematic instruction in the elementary (K-8) classroom. Special emphasis on K-8 students' communicative skills, cultural knowledge, and content learning.

LING 487: Methods in Secondary School World Language Instruction
(Cross-listed with C I, WLC). (3-0) Cr. 3. F.
Prereq: 25 credits in a world language, admission to the teacher education program, OPI
Theories and principles of contemporary world language learning and teaching. Special emphasis on designing instruction and assessments for active learning.

LING 490B: Independent Study: Linguistics
(Cross-listed with ENGL). Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 9 credits in English beyond ENGL 250 appropriate to the section taken, junior classification, permission of Undergraduate Studies Committee or Linguistics Adviser
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 9 credits of ENGL 490 may be used toward graduation.

LING 490D: Independent Study: Linguistic Anthropology
(Cross-listed with ANTHR). Cr. 1-5. Repeatable, maximum of 9 credits.
Prereq: 9 credits in anthropology.
No more than 9 credits of Anthr 490 may be counted toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

LING 510: Introduction to Computers in Applied Linguistics
(Cross-listed with ENGL). (3-0) Cr. 3. F.
Prereq: Graduate classification
Use of software and web applications for language teaching, linguistic analysis, and statistical analysis. Issues and problems in applied linguistics related to computer methods.

LING 511: Introduction to Linguistic Analysis
(Cross-listed with ENGL). (3-0) Cr. 3. F.
Prereq: Graduate classification
Principles and methods of linguistic analysis with emphasis on phonology, morphology, and syntax. Description of linguistic variation and current theoretical approaches to linguistics.

LING 512: Second Language Acquisition
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theory, methods, and results of second language acquisition research with emphasis on approaches relevant to second language teaching.

LING 513: Language Assessment Practicum
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.SS.
Prereq: ENGL 519 or LING 519
Advanced practicum in language assessment.

LING 514: Sociolinguistics
(Cross-listed with ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theories and methods of examining language in its social setting. Analysis of individual characteristics (e.g., age, gender, ethnicity, social class, region), interactional factors (e.g., situation, topic, purpose) and national policies affecting language use.

LING 515: Statistical Natural Language Processing
(Cross-listed with ENGL, HCI). (3-0) Cr. 3.
Prereq: STAT 330 or equivalent, recommended ENGL 219 or LING 219, or ENGL 511 or LING 511
Introduction to computational techniques involving human language and speech in applications such as information retrieval and extraction, automatic text categorization, word prediction, intelligent Web searching, spelling and grammar checking, speech recognition and synthesis, statistical machine translation, n-grams, POS-tagging, word-sense disambiguation, on-line lexicons and thesauri, markup languages, corpus analysis, and Python programming language.

LING 518: Teaching English as a Second Language Methods and Materials
(Cross-listed with ENGL). (3-0) Cr. 3. F.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Introduction to approaches, methods, techniques, materials, curricular design, and assessment for various levels of ESL instruction. Attention to issues related to the teaching of listening, speaking, reading, writing, vocabulary, pronunciation, and culture.

LING 519: Second Language Assessment
(Cross-listed with ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 511 or LING 511
Principles of second language assessment including reliability, validity, authenticity and practicality. Constructing, scoring, interpreting, and evaluating second language tests for a variety of situations.

LING 520: Computational Analysis of English
(Cross-listed with ENGL, HCI). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 510 or LING 510, and ENGL 511 or LING 511
Concepts and practices for analysis of English by computer with emphasis on the applications of computational analysis to problems in applied linguistics such as corpus analysis and recognition of learner language in computer-assisted learning and language assessment.

LING 524: Literacy: Issues and Methods for Nonnative Speakers of English
(Cross-listed with ENGL). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theoretical and practical issues and techniques in the teaching of literacy in a variety of contexts, involving children and adults at basic skill levels and teens and adults in academic and vocational programs.

LING 525: Research and Teaching of Second Language Pronunciation
(Cross-listed with ENGL). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Theoretical and practical issues and techniques in the teaching of second language pronunciation as it relates to other areas of language, especially listening and speaking skills. Topics will include segmental and suprasegmental features; intelligibility; pronunciation in language assessment; classroom, technology and individual instruction; and research issues. Topics will be relevant to those intending to teach or research in various contexts.

LING 526: Computer-Assisted Language Learning
(Cross-listed with ENGL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ENGL 511 or LING 511 or equivalent
Theory, research, and practice in computer use for teaching nonnative speakers of English. Methods for planning and evaluating computer-based learning activities.

LING 527: Discourse Analysis
(Cross-listed with ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Methods and theoretical foundations for linguistic approaches to discourse analysis. Applications of discourse analysis to the study of texts in a variety of settings, including academic and research contexts.

LING 528: English for Specific Purposes
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 511 or LING 511 or an introductory course in linguistics
Issues and techniques in analyzing, teaching, and assessing English for specific purposes. Topics include theories of specific purpose language use, analysis of learner needs in target language contexts, and corpus-informed syllabus and materials development for teaching and assessment.

LING 537: Corpus Approaches to Grammatical Analysis
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 220 or LING 220; ENGL 219, LING 219, ENGL 511, LING 511, or introductory course in linguistics; graduate classification
Corpus-informed analysis of syntax in authentic writing and speech, with emphasis on approaches used in applied linguistics.

LING 554: Introduction to Spanish-English Interpretation
(Dual-listed with LING 354). (Cross-listed with SPAN). (3-0) Cr. 3. F.S.
Prereq: SPAN 351
Introduction to the theory, methods, techniques, and problems of consecutive and simultaneous interpretation. Consideration of material from business, agriculture, law, design, medicine, literature, advertisement, and sports. Taught in Spanish.
Meets International Perspectives Requirement.

LING 588: Supervised Practice Teaching in Teaching English as a Second Language
(Cross-listed with ENGL). (1-5) Cr. 3. F.S.SS.
Prereq: 9 credits toward the TESL/TEFL Certificate, 15 credits toward the TESL/AL master's degree, or 18 credits completed toward the ESL Endorsement option.
Intensive observation of ESL instruction and supervised practice in teaching learners of English in a context appropriate to the student teacher's goals. ENGL 588 cannot be used for teacher licensure and cannot be taken during student teaching.

LING 590: Special Topics
(Cross-listed with ENGL). Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

LING 590B: Special Topics: Teaching English as a Second Language (TESL)/Applied Linguistics
(Cross-listed with ENGL). Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

LING 590G: Special Topics: Applied Linguistics and Technology
(Cross-listed with ENGL). Cr. arr. Repeatable.
Prereq: Permission of the Director of Graduate Education according to guidelines available online

LING 591: Studies in Applied Linguistics
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in TESL/Applied Linguistics
Intensive study of applied linguistic theory as it relates to specific issues in language acquisition, teaching, or use.

LING 591B: Directed Readings: Teaching English as a Second Language (TESL)/Applied Linguistics
(Cross-listed with ENGL). Cr. arr. Repeatable.

LING 591G: Directed Readings: Applied Linguistics and Technology
(Cross-listed with ENGL). Cr. arr. Repeatable.

Courses for graduate students:

LING 623: Research Methods in Applied Linguistics
(Cross-listed with ENGL). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 511 or LING 511, ENGL 517 or LING 517, ENGL 519 or LING 519
Survey of research traditions in applied linguistics. Focus on theoretical and practical aspects of quantitative and qualitative approaches to applied linguistic study, including experimental and quasiexperimental methods, classroom observation and research, introspective methods, elicitation techniques, case studies, interactional analysis, ethnography, and program evaluation. Computational tools and resources for linguistic research will be highlighted.

LING 626: Computer-Assisted Language Testing
(Cross-listed with ENGL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ENGL 510 or LING 510, ENGL 511 or LING 511, ENGL 519 or LING 519
Principles and practice for the use and study of computers and the Internet in second language assessment.

LING 630: Seminar in Applied Linguistics
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable.
Prereq: ENGL 510 or LING 510, ENGL 511 or LING 511
Topic changes each semester. Topics include advanced methods in natural language processing, technology and literacy in a global context, feedback in CALL programs, technology and pronunciation, and advances in language assessment.

LING 688: Practicum in Technology and Applied Linguistics
(Cross-listed with ENGL). (1-5) Cr. 3. F.S.SS.
Prereq: ENGL 510 or LING 510, ENGL 626 or LING 626, or equivalent; at least 2nd year PhD student in Applied Linguistics and Technology
Focus on integrating theoretical knowledge with practical expertise. Assess client needs; develop, integrate, and evaluate solutions. Practical understanding of computer applications used in multimedia development. Create web-based or CD-ROM-based multimedia materials. Work with advanced authoring applications.

Mathematics

Undergraduate Study

For the undergraduate curriculum in liberal arts and sciences, major in mathematics, leading to the degree bachelor of science, see Liberal Arts and Sciences, Curriculum.

The program in mathematics offers training suitable for students planning to enter secondary school teaching, to work in mathematics and computation for industry or government, or to continue their studies in graduate school. Students may satisfy the major requirements in several ways, suitable for various career objectives. Graduates can construct rigorous arguments to demonstrate mathematical facts. They can communicate their mathematical methods to others and can justify their assumptions.

Traditional Program

The traditional program of study for mathematics majors gives students a thorough grounding in mathematics. Graduates understand a broad range of mathematical topics and are familiar with a broad range of mathematical models. They have skills for solving problems in diverse situations. The program allows flexibility for specialization, and students are encouraged to steer their education according to career objectives.

MATH 101	Orientation in Mathematics	1
MATH 165	Calculus I	4

MATH 166	Calculus II	4
MATH 201	Introduction to Proofs	3
MATH 265	Calculus III	4
MATH 317	Theory of Linear Algebra	3-4
or MATH 407	Applied Linear Algebra	
MATH 301	Abstract Algebra I	3
MATH 414	Analysis I	3
MATH 266	Elementary Differential Equations	3-4
or MATH 267	Elementary Differential Equations and Laplace Transforms	
One of the following:		2
MATH 492	Undergraduate Seminar	
C I 480C	Pre-Student Teaching Experience III: Mathematics [1]	
Additional Mathematics courses at the 300 level or above		15
Total Credits		45-47

[1] C I 480C is available only for students seeking secondary school certification.

The courses listed above must include one of the sequences:

MATH 301 & MATH 302	Abstract Algebra I and Abstract Algebra II	6
MATH 373 & MATH 481	Introduction to Scientific Computing and Numerical Methods for Differential Equations	6
MATH 304 & MATH 314	Combinatorics and Graph Theory	6
MATH 414 & MATH 415	Analysis I and Analysis II	6
MATH 435 & MATH 436	Geometry I and Geometry II	6

Communication Proficiency requirement:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition [2]	3
One of the following: [3]		3
MATH 491	Undergraduate Thesis [4]	
ENGL 302	Business Communication	
ENGL 303	Free-Lance Writing for Popular Magazines	
ENGL 305	Creative Writing: Nonfiction	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	

[2] The college requires a grade of C or better.

[3] with grade C- or better

[4] with Departmental approval

Mathematics Plus

The Mathematics Plus option is for students who wish to establish a clear strength in a field of application of mathematics. They obtain the mathematics major by pursuing study of mathematics, through the upper division level, complementary to their application area. This program makes double majors more feasible and is appropriate for students who plan on employment or graduate study in the application field. It is not intended for students who plan on graduate study in mathematics. For more information, see the mathematics department web site or consult an adviser in mathematics.

Secondary Education

For certification requirements for teaching of mathematics in grades 5-12, see the Mathematics Department and School of Education web sites or consult an adviser.

Recommendations

The department strongly recommends that each student majoring in mathematics include in the program substantial supporting work beyond the minimum general education requirement of the college in one or more areas of application of mathematics, such as other mathematical sciences, engineering, natural science, economics or finance. Particularly useful are:

COM S 207	Fundamentals of Computer Programming	3
COM S 208	Intermediate Computer Programming	3
PHIL 207	Introduction to Symbolic Logic	3
PHYS 221	Introduction to Classical Physics I	5
PHYS 222	Introduction to Classical Physics II	5
STAT 201	Introduction to Statistical Concepts and Methods	4

It also recommends that students contemplating graduate study in mathematics acquire a reading knowledge of French, German, or Russian.

Credits Not Counted

Credits earned in the following cannot be counted toward graduation by mathematics majors:

MATH 104	Introduction to Probability	3
MATH 105	Introduction to Mathematical Ideas	3
MATH 140	College Algebra	3
MATH 143	Preparation for Calculus	4
MATH 145	Applied Trigonometry	3
MATH 150	Discrete Mathematics for Business and Social Sciences	3
MATH 151	Calculus for Business and Social Sciences	3
MATH 160	Survey of Calculus	4

MATH 181	Calculus and Mathematical Modeling for the Life Sciences I	4
MATH 182	Calculus and Mathematical Modeling for the Life Sciences II	4
MATH 195	Mathematics for Elementary Education I	3
MATH 196	Mathematics for Elementary Education II	3

Minor in Mathematics

The department offers a minor in mathematics, which may be earned by credit in the following:

MATH 201	Introduction to Proofs	3
MATH 265	Calculus III	4
One of the following		
MATH 317	Theory of Linear Algebra	4
MATH 407	Applied Linear Algebra	3
One of the following		
MATH 301	Abstract Algebra I	3
MATH 304	Combinatorics	3
MATH 314	Graph Theory	3
MATH 350	Number Theory	3
MATH 421	Logic for Mathematics and Computer Science	3
MATH 435	Geometry I	3
MATH 436	Geometry II	3
One of the following		
MATH 266	Elementary Differential Equations	3
MATH 267	Elementary Differential Equations and Laplace Transforms	4
MATH 331	Topology	3
MATH 341	Introduction to the Theory of Probability and Statistics I	3
MATH 365	Complex Variables with Applications	3
MATH 373	Introduction to Scientific Computing	3
MATH 414	Analysis I	3

With 5-12 Teacher Certification

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	MATH 166	4
LIB 160	1	STAT 201	4
MATH 101	1	C I 204	3
MATH 165	4	C I 219	1
PSYCH 230	3	C I 280L	0.5
General Education	6	General Education	6
	18		18.5

Sophomore

Fall	Credits	Spring	Credits
MATH 201	3	MATH 266 or 267 - Differential Equations	3-4
MATH 265	4	MATH 317	4
ENGL 250	3	C I 333	3
C I 202	3	COM S 107 or 207 - Programming	3
General Education	4	General Education	3
Take Praxis-I by October 1		2.5 GPA for Admission to Teacher Ed	
	17		16-17

Junior

Fall	Credits	Spring	Credits
MATH 301	3	MATH 342[2]	3
MATH 341	3	MATH 397	3
MATH 435	3	MATH 436	3
C I 406	3	C I 280A	2
Communication Choice[1]	3	C I 426	3
General Education	3	C I 395	3
	18		17

Senior

Fall	Credits	Spring	Credits
MATH 414	3	C I 417C	14
MATH 497	3		
C I 480C	2		
SP ED 401	3		
General Education	4		
	15		14

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 300/400 level. Three of the required 45 300+ level credits must be earned in a general education group outside the group of your major. You must also complete the LAS foreign language requirement and any high school unmet admissions requirements.

Students pursuing licensure to teach grades 5 – 12 must meet the general education and professional teacher education requirements established by the University Teacher Education Program. (Check http://www.education.iastate.edu/te/) for the requirements.

[1] ENGL 302, 305, 309, or 314, or JL MC 201.

[2] Recommended

Without Teacher Certification

Freshman

Fall	Credits	Spring	Credits
MATH 101	1	MATH 166	4
MATH 165	4	Social Science Choice	3
ENGL 150	3	Arts & Humanities Choice	3
LIB 160	1	Natural Science Choice	3
Natural Science Choice	3	Electives	2
Electives	3		
	15		15

Sophomore

Fall	Credits	Spring	Credits
MATH 201	3	MATH 267	4
MATH 265	4	MATH 317	4
Social Science Choice	3	ENGL 250	3
Arts & Humanities Choice	3	Social Science Choice	3
Electives	2	Electives	1
	15		15

Junior

Fall	Credits	Spring	Credits
MATH Two-Course Sequence[1]	3	MATH Two-Course Sequence[1]	3
MATH 301 or 414	3	MATH 301 or 414	3
Arts & Humanities Choice	3	Communication Choice[2]	3
Foreign Language/Electives	4	Foreign Language/Electives	
Natural Science Choice		Electives	2
	13		11

Senior

Fall	Credits	Spring	Credits
MATH Choice, Level 300+	3	MATH Choice, Level 300+	3
MATH 492 or MATH Choice, Level 300+	2-3	MATH 492 or MATH Choice, Level 300+	2-3
Arts & Humanitites Choice	3	Electives	9-10
Electives	6-7		
	14-16		14-16

Students in all ISU majors must meet the U.S. Diversity and the International Perspectives requirements. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. These courses may be courses that apply to other requirements.

The LAS General Education requirements for Mathmatics majors are 12 credits Arts and Humanities, 8 credits Natural Science, and 9 credits Social Science from the approved lists: http://www.las.iastate.edu/academics/generaldeducation/.

LAS majors require a minimum of 120 credits, including a minimum of 45 credits at the 300/400 level. Three of the required 45 300+ level credits must be earned in a general educational group outside the group of the major. Students must also meet the LAS foreign-language requirement and complete any unmet admission requirements.

[1] Every mathematics major must complete at least one of the following sequences:

a. Algebra -- MATH 301 AND MATH 302
b. Analysis -- MATH 414 and MATH 415
c. Discrete -- MATH 304 and MATH 314
d. Geometry -- MATH 435 and MATH 436
e. Numerical -- MATH 373 and MATH 481

If you use 301/302 or 414/415, then add an additional MATH Elective (300+).

Note that some courses are taught only in fall or only in spring, so plan appropriately.

[2] ENGL 302, 305, 309, or 314, or JL MC 201, or MATH 491.

Graduate Study

The department offers programs leading to a Master of Science or Doctor of Philosophy degree in mathematics or applied mathematics, as well as minor work for students whose major is in another department. The department also offers a program leading to the degree of Master of School Mathematics (M.S.M.).

Students desiring to undertake graduate work leading to the M.S. or Ph.D. degree should prepare themselves by taking several upper division mathematics courses. It is desirable that these credits include introduction to analysis and abstract algebra.

The M.S. degree requires a student to take at least 30 credit hours and to write a creative component or thesis.Additionally, students must pass a comprehensive oral examination over their coursework and their creative component or thesis. See the online Mathematics Graduate Handbook for specific requirements.

The Ph.D. degree requires a student to take 48 credit hours of coursework in addition to research hours, pass written qualifying examinations, pass an oral preliminary exam, and perform an original research project culminating in a dissertation which is defended by an oral exam. Ph.D. candidates must have at least one year of supervised teaching experience. See the on-line Mathematics Graduate Handbook for specific requirements.

The M.S.M. degree is primarily for in-service secondary mathematics teachers. Students desiring to pursue the M.S.M degree should present some undergraduate work in mathematics beyond calculus. Candidates for the M.S.M. degree must write an approved creative component and pass a comprehensive oral examination over their course work and their creative component.

Courses primarily for undergraduates:

MATH 010: High School Algebra
(4-0) Cr. 0. F.S.
For students who do not have adequate facility with topics from high school algebra or do not meet the algebra admission requirement. The course is divided into tracks of one- and two-semester lengths. For most students a diagnostic exam will determine which track must be taken. Students will receive a grade in MATH 25 or MATH 30 respectively depending on the level of material covered. Satisfactory completion of MATH 30 is recommended for students planning to take MATH 140, MATH 143, MATH 145, MATH 150, or MATH 151, while MATH 25 is sufficient for MATH 104, MATH 105, MATH 195, STAT 101 or STAT 105. Students must complete MATH 30 to remove a deficiency in the algebra admission requirement. Topics include signed numbers, polynomials, rational and radical expressions, exponential and logarithmic expressions, and equations. Offered on a satisfactory-fail basis only.

MATH 025: High School Algebra
(4-0) Cr. 0. F.S.
Students should initially enroll in MATH 10. See description of MATH 10. Offered on a satisfactory-fail basis only.

MATH 030: High School Algebra
(4-0) Cr. 0. F.S.
Students should initially enroll in MATH 10. See description of MATH 10. Offered on a satisfactory-fail basis only.

MATH 101: Orientation in Mathematics
(1-0) Cr. 1. F.S.
For new majors. Campus resources and opportunities available to students. Careers and programs of study in mathematics. Mathematical reasoning, culture and resources. Description of main branches of mathematics. Offered on a satisfactory-fail basis only.

MATH 104: Introduction to Probability
(3-0) Cr. 3. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry
Permutations, combinations, probability, expected value, and applications. Either MATH 104 or MATH 150 may be counted toward graduation, but not both.

MATH 105: Introduction to Mathematical Ideas
(3-0) Cr. 3. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry.
Introduction to contemporary mathematics with an emphasis on use of mathematics to solve real world problems. Typical topics are the mathematics of voting, methods of fair division and apportionment, and elementary game theory.

MATH 106: Discovering Mathematics
(3-0) Cr. 3. F.S.
Inquiry-based approach to mathematics, emphasizing the art, history, and beauty of the subject. Typical topics are mathematics from art, music, puzzles, patterns, and reasoning.

MATH 140: College Algebra
(3-1) Cr. 3. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry; or MATH 30.
Coordinate geometry, quadratic and polynomial equations, functions, graphing, rational functions, exponential and logarithmic functions, inverse functions, quadratic inequalities, systems of linear equations. Prepares students for MATH 160. Students in the College of Liberal Arts and Sciences may not count MATH 140 toward the General Education Requirements.

MATH 143: Preparation for Calculus
(4-0) Cr. 4. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry; or MATH 140.
Preparation for MATH 160, MATH 165, and MATH 181. Functions, graphing, basic trigonometry, logarithms, exponentials. Emphasis on co-variational reasoning. Students in the College of Liberal Arts and Sciences may not count MATH 143 toward General Education Requirements. Only one of MATH 143 and MATH 145 may count toward graduation.

MATH 145: Applied Trigonometry
(3-0) Cr. 3. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry; or minimum of C- in MATH 140.
Mathematical ideas regarding the conception of space. General trigonometry, with an emphasis on the calculation of lengths, areas, and angles. The Law of Sines and the Law of Cosines. Polar, cylindrical, and spherical coordinate systems. Conic sections and quadric surfaces. Students in the College of Liberal Arts and Sciences may not count MATH 145 toward the General Education Requirements. Only one of MATH 143 and MATH 145 may count toward graduation.

MATH 150: Discrete Mathematics for Business and Social Sciences
(2-1) Cr. 3. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry
Linear equations and inequalities, matrix algebra, linear programming, discrete probability. Either MATH 104 or MATH 150 may be counted toward graduation, but not both.

MATH 151: Calculus for Business and Social Sciences
(2-1) Cr. 3. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry
Differential calculus, applications to max-min problems, integral calculus and applications. Will not serve as prerequisite for MATH 265 or MATH 266. Only one of MATH 151, MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 160: Survey of Calculus
(4-0) Cr. 4. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of geometry; or MATH 143; or MATH 140
Analytic geometry, derivatives and integrals of elementary functions, simple differential equations, and applications. Will not serve as a prerequisite for MATH 265 or MATH 266. Only one of MATH 151, MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 165: Calculus I
(4-0) Cr. 4. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of geometry, 1 semester of trigonometry; or MATH 143
Differential calculus, applications of the derivative, introduction to integral calculus. Only one of MATH 151 or MATH 160 or the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 166: Calculus II
(4-0) Cr. 4. F.S.SS.
Prereq: Minimum of C- in MATH 165 or high math placement scores
Integral calculus, applications of the integral, infinite series, parametric curves and polar coordinates. Only one of MATH 151, MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 166H: Calculus II, Honors
(4-0) Cr. 4. F.
Prereq: Permission of instructor and MATH 165 or high math placement scores
Integral calculus, applications of the integral, infinite series, parametric curves, and polar coordinates. Additional material of a theoretical, conceptual, computational, or modeling nature. Some of the work may require more ingenuity than is required for MATH 166. Preference will be given to students in the University Honors Program. Only one of MATH 151 or MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 181: Calculus and Mathematical Modeling for the Life Sciences I
(4-0) Cr. 4. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry, 1 semester of trigonometry; or MATH 143
Exponential and logarithm functions, difference equations, derivatives, and applications of the derivative. Examples taken from biology. Only one of MATH 151, MATH 160, the sequence MATH 165- MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 182: Calculus and Mathematical Modeling for the Life Sciences II
(4-0) Cr. 4. S.
Prereq: MATH 181
Integration, first and second order differential equations, applications of the definite integral, introduction to multivariable calculus. Examples taken from biology. Only one of MATH 151, MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 195: Mathematics for Elementary Education I
(2-2) Cr. 3. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years high school algebra, 1 year of high school geometry, enrollment in elementary education or early childhood education
Whole number operations through analysis of properties, theoretical and hands-on models, mathematical analysis of elementary students' thinking; standard and non-standard algorithms; structure of the decimal system; linear measurement; two- and three-dimensional geometric shapes and spatial sense; number theory; algebra as it relates to elementary curricula/teaching profession. Students in the College of Liberal Arts and Sciences may not count MATH 195 toward General Education Requirements.

MATH 196: Mathematics for Elementary Education II
(2-2) Cr. 3. F.S.
Prereq: Minimum of C- in MATH 195 and enrollment in elementary education or early childhood education.
Integer, fraction and decimal operations through analysis of properties, theoretical and hands-on models, mathematical analysis of elementary students' thinking; standard and non-standard algorithms; two- and three-dimensional measurement; probability and statistics; proportional reasoning; algebra as it relates to elementary curricula/teaching profession.

MATH 201: Introduction to Proofs
(3-0) Cr. 3. F.S.
Prereq: MATH 166 or MATH 166H
Logic and techniques of proof including induction. Communicating mathematics. Writing proofs about sets, functions, real numbers, limits, sequences, infinite series and continuous functions.

MATH 207: Matrices and Linear Algebra
(3-0) Cr. 3. F.S.SS.
Prereq: 2 semesters of calculus
Systems of linear equations, determinants, vector spaces, linear transformations, orthogonality, least-squares methods, eigenvalues and eigenvectors. Emphasis on applications and techniques. Only one of MATH 207 and MATH 317 may be counted toward graduation.

MATH 265: Calculus III
(4-0) Cr. 4. F.S.SS.
Prereq: Minimum of C- in MATH 166 or MATH 166H
Analytic geometry and vectors, differential calculus of functions of several variables, multiple integrals, vector calculus.

MATH 265H: Calculus III, Honors
(4-0) Cr. 4. F.S.
Prereq: Permission of the instructor; and MATH 166 or MATH 166H
Analytic geometry and vectors, differential calculus of functions of several variables, multiple integrals, vector calculus. Additional material of a theoretical, conceptual, computational, or modeling nature. Some of the work may require more ingenuity than is required in MATH 265. Preference will be given to students in the University Honors Program.

MATH 266: Elementary Differential Equations
(3-0) Cr. 3. F.S.SS.
Prereq: Minimum of C- in MATH 166 or MATH 166H
Solution methods for ordinary differential equations. First order equations, linear equations, constant coefficient equations. Eigenvalue methods for systems of first order linear equations. Introduction to stability and phase plane analysis.

MATH 267: Elementary Differential Equations and Laplace Transforms
(4-0) Cr. 4. F.S.SS.
Prereq: Minimum of C- in MATH 166 or MATH 166H
Same as MATH 266 but also including Laplace transforms and series solutions to ordinary differential equations.

MATH 268: Laplace Transforms
(1-0) Cr. 1. F.S.SS.
Prereq: MATH 266
Laplace transforms and series solutions to ordinary differential equations. Together, MATH 266 and MATH 268 are the same as MATH 267.

MATH 269: Systems of Differential Equations
(1-0) Cr. 1. F.S.SS.
Prereq: Familiarity with ordinary differential equations of first and second order, permission of department.
Systems portion of MATH 266 and MATH 267: Eigenvalue methods for systems of first order linear equations. Introduction to stability and phase plane analysis. For students supplementing transfer courses in differential equations in order to earn credit in MATH 266 or 267. Students with credit in MATH 266 or MATH 267 may not earn credit in MATH 269.

MATH 290: Independent Study
Cr. 1-3. Repeatable.
Prereq: Permission of the instructor.
Independent study.

MATH 290H: Independent Study, Honors
Cr. 1-3. Repeatable.
Prereq: Permission of the instructor.
Independent study.

MATH 297: Intermediate Topics for School Mathematics
(2-2) Cr. 3. F.
Prereq: Enrollment in elementary education and minimum of C- in MATH 196
Mathematical reasoning and topics in Euclidean and non-Euclidean geometry, including transformations, congruence, and similarity; exploration of probability with simulations; linearity and connections to Calculus; fractals and fractal dimension.

MATH 301: Abstract Algebra I
(3-0) Cr. 3. F.S.
Prereq: MATH 166 or MATH 166H, MATH 317 or MATH 407, and grade of C- or better in MATH 201
Theory of groups. Homomorphisms. Quotient groups. Introduction to rings. Emphasis on writing proofs.

MATH 302: Abstract Algebra II
(3-0) Cr. 3. S.
Prereq: MATH 301
Theory of rings and fields. Introduction to Galois theory. Emphasis on writing proofs.

MATH 304: Combinatorics
(3-0) Cr. 3. F.
Prereq: MATH 166 or MATH 166H; MATH 201 or experience with proofs
Enumeration strategies involving permutations, combinations, partitions, binomial coefficients, inclusion-exclusion principle, recurrence relations, generating functions. Additional topics selected from probability, algebraic combinatorics, and applications.

MATH 314: Graph Theory
(3-0) Cr. 3. S.
Prereq: MATH 166 or MATH 166H; MATH 201 or experience with proofs
Structure and extremal properties of graphs. Topics are selected from: trees, networks, colorings, paths and cycles, connectivity, planarity, directed graphs, matchings, Ramsey theory, forbidden structures, enumeration, applications.

MATH 317: Theory of Linear Algebra
(4-0) Cr. 4. F.S.
Prereq: Credit or enrollment in MATH 201
Systems of linear equations, determinants, vector spaces, inner product spaces, linear transformations, eigenvalues and eigenvectors. Emphasis on writing proofs and results. Only one of MATH 207 and MATH 317 may be counted toward graduation.

MATH 331: Topology
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 301
Set theory, metric spaces, topological spaces, continuity, connectedness, homeomorphisms, compactness, and topological invariants. Examples from surfaces, knots, and various abstract objects. Emphasis on writing proofs.

MATH 341: Introduction to the Theory of Probability and Statistics I
(Cross-listed with STAT). (3-0) Cr. 3. F.S.
Prereq: MATH 265 (or MATH 265H)
Probability; distribution functions and their properties; classical discrete and continuous distribution functions; multivariate probability distributions and their properties; moment generating functions; simulation of random variables and use of the R statistical package. Credit for both STAT 341 and STAT 447 may not be applied toward graduation.

MATH 342: Introduction to the Theory of Probability and Statistics II
(Cross-listed with STAT). (3-0) Cr. 3. F.S.
Prereq: STAT 341; MATH 207 or MATH 317
Transformations of random variables; sampling distributions; confidence intervals and hypothesis testing; theory of estimation and hypothesis tests; linear model theory; use of the R statistical package for simulation and data analysis.

MATH 350: Number Theory
(Cross-listed with COM S). (3-0) Cr. 3. S.
Prereq: MATH 201 or COM S 230
Divisibility, integer representations, primes and divisors, linear diophantine equations, congruences, and multiplicative functions. Applications to cryptography.

MATH 365: Complex Variables with Applications
(3-0) Cr. 3. S.
Prereq: MATH 265
Functions of a complex variable, including differentiation, integration and series expansions, residues, evaluation of integrals, conformal mapping.

MATH 373: Introduction to Scientific Computing
(3-0) Cr. 3. F.
Prereq: MATH 265
Vector and matrix programming and graphing in MATLAB for scientific applications. Polynomial interpolation and approximation. Systems of linear equations and numerical linear algebra. Numerical differentiation and integration. Newton methods for solving nonlinear equations and optimization in one and several variables. Fast Fourier transform. Emphasis on effective use of mathematical software and understanding of its strengths and limitations.

MATH 385: Introduction to Partial Differential Equations
(3-0) Cr. 3. F.S.
Prereq: MATH 265 and one of MATH 266, MATH 267
Separation of variables methods for elliptic, parabolic, and hyperbolic partial differential equations. Topics from Fourier series, Sturm-Liouville theory, Bessel functions, spherical harmonics, and method of characteristics.

MATH 397: Teaching Secondary Mathematics Using University Mathematics
(2-2) Cr. 3. S.
Prereq: MATH 201, MATH 301
Coursework in university mathematics including calculus, abstract algebra, discrete mathematics, geometry, and other topics as it relates to teaching mathematics in grades 5-12.

MATH 398: Cooperative Education
Cr. R. Repeatable, maximum of 2 times. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

MATH 407: Applied Linear Algebra
(Dual-listed with MATH 507). (3-0) Cr. 3. F.
Prereq: MATH 317; or MATH 207 and experience writing proofs
Advanced topics in applied linear algebra including eigenvalues, eigenvalue localization, singular value decomposition, symmetric and Hermitian matrices, nonnegative and stochastic matrices, matrix norms, canonical forms, matrix functions. Applications to mathematical and physical sciences, engineering, and other fields.

MATH 414: Analysis I
(3-0) Cr. 3. F.S.SS.
Prereq: Minimum of C- in MATH 201
A careful development of calculus of functions of one real variable: real number properties, sequences and series, limits, continuity, differentiation, and integration.

MATH 415: Analysis II
(3-0) Cr. 3. S.
Prereq: MATH 414; MATH 265; and MATH 317 or MATH 407
Sequences and series of functions of a real variable, uniform convergence, power series, metric spaces, calculus of functions of two or more real variables.

MATH 421: Logic for Mathematics and Computer Science
(Cross-listed with COM S). (3-0) Cr. 3. S.
Prereq: MATH 301 or MATH 207 or MATH 317 or COM S 230
Propositional and predicate logic. Topics selected from Horn logic, equational logic, resolution and unification, foundations of logic programming, reasoning about programs, program specification and verification, model checking and binary decision diagrams, temporal logic and modal logic.

MATH 424: Introduction to High Performance Computing
(Cross-listed with COM S, CPR E). (2-2) Cr. 3. F.
Prereq: MATH 265; MATH 207 or MATH 317
UNIX, serial programming for high performance, OpenMP for high performance, shared memory parallelization. Semester project required.

MATH 435: Geometry I
(3-0) Cr. 3. F.
Prereq: MATH 207 or MATH 317
Euclidean geometry. Points, lines, circles, triangles, congruence, similarity, properties invariant under rigid motions. Synthetic, analytic, and axiomatic methods.

MATH 436: Geometry II
(3-0) Cr. 3. S.
Prereq: MATH 435
Continuation of Euclidean geometry with topics from elliptic, projective, or hyperbolic geometry. Emphasis on analytic methods.

MATH 439: Mathematics of Fractals and Chaos
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 265 and either MATH 266 or MATH 267
Iteration of maps; classification of periodic points; bifurcation theory; chaos; Julia sets and the Mandelbrot set; fractals and fractal dimension.

MATH 474: Mathematics of Finance
(3-0) Cr. 3. S.
Prereq: MATH 265; STAT 101 or 104 or 105 or 201 or 226.
Applications of mathematical methods to problems in finance. Lagrange Multiplier Method, applications to mean-variance portfolio selection and utility maximization, binomial asset pricing model. Binary Martingales, Optional Stopping Theorem, Central Limit Theorem, applications to financial derivative pricing.

MATH 481: Numerical Methods for Differential Equations
(Cross-listed with COM S). (3-0) Cr. 3. S.
Prereq: MATH 265 and either MATH 266 or MATH 267; knowledge of a programming language
First order Euler method, high order Runge-Kutta method, and multistep method for solving ordinary differential equations. Finite difference and finite element methods for solving partial differential equations. Local truncation error, stability, and convergence for finite difference method. Numerical solution space, polynomial approximation, and error estimate for finite element method.

MATH 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: Permission of instructor.
No more than 9 credits of Math 490 or Math 490H may be counted toward graduation.

MATH 490H: Independent Study: Honors
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: Permission of the instructor.
No more than 9 credits of Math 490 or 490H may be counted toward graduation.

MATH 491: Undergraduate Thesis
Cr. 2-3.
Writing and presenting a formal mathematics paper. Upon approval by the department, the paper will satisfy the departmental advanced English requirement.

MATH 492: Undergraduate Seminar
(2-0) Cr. 2. F.S.
Prereq: MATH 317 or MATH 407
Introduction to independent mathematical thought, with emphasis on oral communication of an advanced topic. Seminar content varies.

MATH 495: Special Topics
Cr. arr. Repeatable, maximum of 9 credits.
Prereq: Permission of instructor
Topics of current interest.

MATH 497: Teaching Secondary School Mathematics
(Cross-listed with C I). (3-0) Cr. 3. F.
Prereq: 15 credits in college mathematics. If in a teacher licensure program, concurrent enrollment in C I 426 or C I 526.
Develop an understanding of instructional planning, lesson implementation, and assessment in grades 5-12 mathematics, with a focus on reform-based mathematics, equity, and conceptual understanding.

Courses primarily for graduate students, open to qualified undergraduates:

MATH 501: Introduction to Real Analysis
(3-0) Cr. 3. F.
Prereq: MATH 265 and (MATH 207 or MATH 317)
A development of the real numbers. Study of metric spaces, completeness, compactness, sequences, and continuity of functions. Differentiation and integration of real-valued functions, sequences of functions, limits and convergence, equicontinuity.

MATH 502: Topology
(3-0) Cr. 3. S.
Prereq: MATH 414 or MATH 501
Introduction to general topology. Topological spaces, continuous functions, connectedness, compactness. Topics selected from countability and separation axioms, metrization, and complete metric spaces. Topics in algebraic topology.

MATH 504: Abstract Algebra I
(3-0) Cr. 3. F.
Prereq: MATH 302
Algebraic systems and their morphisms, with emphasis on groups and rings.

MATH 505: Abstract Algebra II
(3-0) Cr. 3. S.
Prereq: MATH 504
Continuation of Math 504. Algebraic systems and their morphisms, with emphasis on modules and fields.

MATH 507: Applied Linear Algebra
(Dual-listed with MATH 407). (3-0) Cr. 3. F.
Prereq: MATH 317; or MATH 207 and experience writing proofs
Advanced topics in applied linear algebra including eigenvalues, eigenvalue localization, singular value decomposition, symmetric and Hermitian matrices, nonnegative and stochastic matrices, matrix norms, canonical forms, matrix functions. Applications to mathematical and physical sciences, engineering, and other fields.

MATH 510: Linear Algebra
(3-0) Cr. 3. F.
Prereq: MATH 317 or MATH 407 or (MATH 207 and one of MATH 301 or MATH 414)
Advanced topics in linear algebra including canonical forms; unitary, normal, Hermitian and positive-definite matrices; variational characterizations of eigenvalues.

MATH 511: Functions of a Single Complex Variable
(3-0) Cr. 3. S.
Prereq: MATH 414 or MATH 501
Theory of analytic functions, integration, topology of the extended complex plane, singularities and residue theory, maximum principle, conformal mapping, meromorphic functions, argument principle.

MATH 515: Real Analysis I
(3-0) Cr. 3. F.
Prereq: MATH 414 or MATH 501
Lebesgue measure and Lebesgue integral, one variable differentiation theory, Fubini and Tonelli theorems in R^n, Lp spaces.

MATH 516: Real Analysis II
(3-0) Cr. 3. S.
Prereq: MATH 515
Metric spaces, topological spaces, compactness, abstract theory of measure and integral, differentiation of measures, Banach spaces.

MATH 517: Finite Difference Methods
(3-0) Cr. 3. S.
Prereq: MATH 481 or MATH 561
Finite difference methods for partial differential equations. Methods for elliptic equations; explicit and implicit methods for parabolic and hyperbolic equations; stability, accuracy, and convergence theory, including von Neumann analysis, modified equations, and the Courant-Friedrichs-Lewy condition.

MATH 519: Methods of Applied Mathematics I
(3-0) Cr. 3. F.
Prereq: MATH 414 or MATH 501
Techniques of classical and functional analysis with applications to differential equations and integral equations. Vector spaces, metric spaces, Hilbert and Banach spaces, Sobolev spaces and other function spaces, contraction mapping theorem, distributions, Fourier series and Fourier transform, linear operators, spectral theory of differential and integral operators, Green's functions and boundary value problems, weak solutions of partial differential equations and variational methods, calculus in Banach spaces and applications.

MATH 520: Methods of Applied Mathematics II
(3-0) Cr. 3. S.
Prereq: MATH 519
Continuation of Math 519.

MATH 525: Numerical Analysis of High Performance Computing
(Cross-listed with COM S, CPR E). (3-0) Cr. 3. S.
Prereq: CPR E 308 or MATH 481; experience in scientific programming; knowledge of FORTRAN or C
Introduction to parallelization techniques and numerical methods for distributed memory high performance computers. A semester project in an area related to each student's research interests is required.

MATH 533: Cryptography
(Cross-listed with CPR E, INFAS). (3-0) Cr. 3. S.
Prereq: MATH 301 or CPR E 310 or COM S 330
Basic concepts of secure communication, DES and AES, public-key cryptosystems, elliptic curves, hash algorithms, digital signatures, applications. Relevant material on number theory and finite fields.

MATH 535: Steganography and Digital Image Forensics
(Cross-listed with CPR E, INFAS). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E E 524 or MATH 317 or MATH 407 or COM S 330
Basic principles of covert communication, steganalysis, and forensic analysis for digital images. Steganographic security and capacity, matrix embedding, blind attacks, image forensic detection and device identification techniques. Related material on coding theory, statistics, image processing, pattern recognition.

MATH 540: Seminar in Mathematics Education
(1-0) Cr. 1. SS.
Prereq: Enrollment in the Master of School Mathematics program or professional studies in education
Research studies in mathematics learning and teaching, exemplary practices in mathematics education, and current state and national trends in the mathematics curriculum in grades K-12. Students in MSM take each of 540A, 540B, and 540C. Topics are offered on a 3-year cycle. A. Assessment, equity, and teaching of statistics. Offered SS 2017. B. Geometry and discrete mathematics, and problem solving. Offered SS 2018. C. Teaching of analysis, algebra, and the use of technology. Offered SS 2016.

MATH 540A: Seminar in Mathematics Education: Assessment, equity, and teaching of statistics.
(1-0) Cr. 1.
Prereq: Enrollment in the Master of School Mathematics program or professional studies in education
Research studies in mathematics learning and teaching, exemplary practices in mathematics education, and current state and national trends in the mathematics curriculum in grades K-12. Topics are offered on a 3-year cycle. Offered SS 2017.

MATH 540B: Seminar in Mathematics Education: Geometry and discrete mathematics, and problem solving.
(1-0) Cr. 1.
Prereq: Enrollment in the Master of School Mathematics program or professional studies in education
Research studies in mathematics learning and teaching, exemplary practices in mathematics education, and current state and national trends in the mathematics curriculum in grades K-12. Offered on a 3-year cycle. Offered SS 2018.

MATH 540C: Seminar in Mathematics Education: Teaching of analysis, algebra, and the use of technology.
(1-0) Cr. 1.
Prereq: Enrollment in the Master of School Mathematics program or professional studies in education
Research studies in mathematics learning and teaching, exemplary practices in mathematics education, and current state and national trends in the mathematics curriculum in grades K-12. Topics are offered on a 3-year cycle. Offered SS 2016.

MATH 545: Intermediate Calculus
(4-0) Cr. 4.
Prereq: 3 semesters of calculus and enrollment in the master of school mathematics program
Offered on a 3-year cycle, offered SS. 2016. The fundamental concepts of calculus which are critical to the effective understanding of the material in first year calculus. Emphasis is on a constructivist approach to learning, cooperative groups, problem solving, and use of technology.

MATH 546: Algorithms in Analysis and Their Computer Implementation
(2-2) Cr. 3.
Prereq: 3 semesters in calculus or concurrent enrollment in 545 and enrollment in the master of school mathematics program
Offered on a 3- year cycle, offered SS. 2016. The use of technology in secondary mathematics with an emphasis on the exploration, creation, and implementation of algorithms.

MATH 547: Discrete Mathematics and Applications
(4-0) Cr. 4.
Prereq: Enrollment in the master of school mathematics program
Offered on a 3-year cycle, offered SS. 2018. Applications of graph theory, game theory, voting theory, recursion, combinatorics, and algebraic structures. Issues in integrating discrete topics into the secondary curriculum. Use of the computer to explore discrete mathematics.

MATH 549: Intermediate Geometry
(3-0) Cr. 3.
Prereq: MATH 435 or equivalent and enrollment in the master of school mathematics program
Offered on a 3-year cycle, offered SS. 2018. A study of geometry with emphasis on metrics, the group of isometries, and the group of similarities. Specific spaces studied normally include the Euclidean plane, the 2-sphere, projective 2-space, and hyperbolic geometry. Emphasis on analytical methods. Incorporation of geometry software.

MATH 554: Introduction to Stochastic Processes
(Cross-listed with STAT). (3-0) Cr. 3. F.
Prereq: STAT 542
Markov chains on discrete spaces in discrete and continuous time (random walks, Poisson processes, birth and death processes) and their long-term behavior. Optional topics may include branching processes, renewal theory, introduction to Brownian motion.

MATH 557: Ordinary Differential Equations and Dynamical Systems
(3-0) Cr. 3. F.
Prereq: MATH 415 or MATH 501
The initial-value problem, existence and uniqueness theorems, continuous dependence on parameters, linear systems, stability and asymptotic behavior of solutions, linearization, dynamical systems, bifurcations, and chaotic behavior.

MATH 561: Numerical Analysis I
(3-0) Cr. 3. F.
Prereq: MATH 414 or MATH 501
Approximation theory, including polynomial interpolation, spline interpolation and best approximation; numerical differentiation and integration; numerical methods for ordinary differential equations.

MATH 562: Numerical Analysis II
(3-0) Cr. 3. S.
Prereq: MATH 317
Numerical linear algebra including LU factorization, QR factorization, linear least squares, singular value decompositions, eigenvalue problems, and iterative methods for large linear systems.

MATH 565: Continuous Optimization
(3-0) Cr. 3. S.
Prereq: MATH 265 and one of MATH 317, 507, 510
Theory and methods for constrained and unconstrained optimization. Steepest-descent, conjugate gradient, Newton and quasi-Newton, line search and trust-region, first and second order necessary and sufficient conditions, linear, quadratic and general nonlinear programming.

MATH 566: Discrete Optimization
(3-0) Cr. 3. F.
Prereq: MATH 317 or MATH 507 or MATH 510
Algorithms for linear programming, integer and combinatorial optimization. Linear programming, duality theory, simplex algorithm; the solution of the shortest-path, minimum spanning tree, max-flow/min-cut, minimum cost flow, maximum matching, and traveling salesman problems; integer linear programming, branch-and-bound, local and global search algorithms; matroids and greedy algorithms.

MATH 577: Linear Systems
(Cross-listed with AER E, E E, M E). (3-0) Cr. 3. F.
Prereq: E E 324 or AER E 331 or MATH 415; and MATH 207
Linear algebra review. Least square method and singular value decomposition. State space modeling of linear continuous-time systems. Solution of linear systems. Controllability and observability. Canonical description of linear equations. Stability of linear systems. State feedback and pole placements. Observer design for linear systems.

MATH 578: Nonlinear Systems
(Cross-listed with AER E, E E, M E). (3-0) Cr. 3. S.
Prereq: E E 577
Linear vs nonlinear systems. Phase plane analysis. Bifurcation and center manifold theory. Lyapunov stability. Absolute stability of feedback systems. Input-output stability. Passivity theory and feedback linearization. Nonlinear control design techniques.

MATH 590: Independent Study
Cr. arr. Repeatable.

MATH 591: Orientation for Mathematics Graduate Students I
(0.5-0) Cr. 0.5. F.
Fall semester orientation seminar. Required for graduate students in Mathematics and Applied Mathematics. Topics include teaching at the university level and communication of mathematics. Offered on a satisfactory-fail basis only.

MATH 592: Orientation for Mathematics Graduate Students II
(0.5-0) Cr. 0.5. S.
Spring semester orientation seminar. Required for graduate students in Mathematics and Applied Mathematics. Topics include teaching at the university level and communication of mathematics. Offered on a satisfactory-fail basis only.

MATH 595: Special Topics
Cr. arr. Repeatable.

MATH 599: Creative Component
Cr. arr.

Courses for graduate students:

MATH 601: Mathematical Logic
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 504
Model theory of propositional and predicate logic, the Soundness Theorem, the Compactness Theorem, the Goedel-Henkin Completeness Theorem, the Incompleteness Theorem, computability theory. As time permits: modal and temporal logic, set theory (the continuum hypothesis). Emphasis on the relationship between `provable' and `true' and the relationship between `computable' and `definable'.

MATH 605: Design Theory and Association Schemes
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 504
Combinatorial designs and Latin squares. Construction methods including finite fields. Error-correcting codes. Adjacency matrices and algebraic combinatorics.

MATH 606: Enumerative Combinatorics and Ordered Sets
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 504
Ordered sets and lattices. Generating functions. Moebius inversion and other enumeration methods.

MATH 607: Graph Theory
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 314 or MATH 504
Structural theory of graphs. Topics include basic structures (trees, paths and cycles), networks, colorings, connectivity, topological graph theory, Ramsey theory, forbidden graphs and minors, applications.

MATH 608: Extremal Graph Theory
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MATH 607
Study of extremal graph problems and methods. Topics include canonical Ramsey theory, generalizations of Turan's theorem, Szemeredi's regularity lemma, random graph theory.

MATH 610: Seminar
Cr. arr.

MATH 615: General Theory of Algebraic Structures I
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 504
First semester of full-year course. Subalgebras, homomorphisms, congruence relations, and direct products. Lattices and closure operators. Varieties and quasivarieties of algebras, free algebras, Birkhoff's theorems, clones, Mal'cev conditions. Advanced topics.

MATH 616: General Theory of Algebraic Structures II
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 615
Continuation of MATH 615.

MATH 617: Category Theory
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 504
Categories and functors and their applications.

MATH 618: Representation Theory
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MATH 504
Representations of algebraic structures. Content varies by semester.

MATH 624: Manifolds, Tensors and Differential Geometry
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 501 or MATH 515
Topics selected from: Geometry of curves and surfaces. Manifolds, coordinate systems. Tangent and cotangent vectors, vector fields. Tensors, differential forms, Riemannian metrics. Connections, covariant differentiation, curvature tensors. Applications to physics and engineering.

MATH 633: Functional Analysis
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MATH 515
Fundamental theory of normed linear spaces and algebras, such as topology and continuity, duality and spectral theory, emphasizing aspects that provide a framework for the study of the spectrum of an operator, analytic function theory, and modern operator theory.

MATH 641: Foundations of Probability Theory
(Cross-listed with STAT). (3-0) Cr. 3. F.
Prereq: MATH 414 or MATH 501 or equivalent course.
Sequences and set theory; Lebesgue measure, measurable functions. Absolute continuity of functions, integrability and the fundamental theorem of Lebesgue integration. General measure spaces, probability measure, extension theorem and construction of Lebesgue-Stieljes measures on Euclidean spaces. Measurable transformations and random variables, induced measures and probability distributions. General integration and expectation, Lp-spaces and integral inequalities. Uniform integrability and absolute continuity of measures. Probability densities and the Radon-Nikodym theorem. Product spaces and Fubini-Tonelli theorems.

MATH 642: Advanced Probability Theory
(Cross-listed with STAT). (3-0) Cr. 3. S.
Prereq: STAT 641, or STAT 543 and MATH 515.
Probability spaces and random variables. Kolmogorov's consistency theorem. Independence, Borel-Cantelli lemmas and Kolmogorov's 0 - 1 Law. Comparing types of convergence for random variables. Sums of independent random variables, empirical distributions, weak and strong laws of large numbers. Convergence in distribution and its characterizations, tightness, characteristic functions, central limit theorems and Lindeberg-Feller conditions. Conditional probability and expectation. Discrete parameter martingales and their properties and applications.

MATH 645: Advanced Stochastic Processes
(Cross-listed with STAT). (3-0) Cr. 3. S.
Weak convergence. Random walks and Brownian motion. Martingales. Stochastic integration and Ito's Formula. Stochastic differential equations and applications.

MATH 646: Mathematical Modeling of Complex Physical Systems
(Cross-listed with PHYS). (3-0) Cr. 3. S.
Modeling of the dynamics of complex systems on multiple scales: Classical and dissipative molecular dynamics, stochastic modeling and Monte-Carlo simulation; coarse grained nonlinear dynamics, interface propagation and spatial pattern formation.

MATH 655: Partial Differential Equations I
(3-0) Cr. 3. F.
Prereq: MATH 515 or MATH 519
Study of model problems of elliptic, parabolic and hyperbolic types, first order equations, conservation laws, transform methods, introduction to linear partial differential equations of arbitrary order, fundamental solutions.

MATH 656: Partial Differential Equations II
(3-0) Cr. 3. S.
Prereq: MATH 655
Sobolev spaces, general theory of second order linear elliptic, parabolic and hyperbolic partial differential equations, first order linear hyperbolic systems, variational methods, fixed point methods.

MATH 666: Finite Element Methods
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MATH 516 or MATH 520 or MATH 561 or MATH 656
Weak and variational formulations of elliptic problems; weak derivatives and Sobolev spaces; Lax-Milgram theorem, Bramble-Hilbert lemma; examples of finite element spaces; polynomial approximation theory; error estimates for finite element methods; implementation issues; mixed finite element methods for Stokes problems; applications.

MATH 680: Advanced Topics
Cr. 3. Repeatable.

MATH 680A: Advanced Topics: Algebra
Cr. 3. Repeatable.

MATH 680B: Advanced Topics: Analysis
Cr. 3. Repeatable.

MATH 680C: Advanced Topics: Applied Mathematics
Cr. 3. Repeatable.

MATH 680D: Advanced Topics: Combinatorics
Cr. 3. Repeatable.

MATH 680E: Advanced Topics: Differential Equations
Cr. 3. Repeatable.

MATH 680F: Advanced Topics: Linear Algebra
Cr. 3. Repeatable.

MATH 680G: Advanced Topics: Logic and Foundations
Cr. 3. Repeatable.

MATH 680H: Advanced Topics: Number Theory
Cr. 3. Repeatable.

MATH 680I: Advanced Topics: Numerical Analysis
Cr. 3. Repeatable.

MATH 680J: Advanced Topics: Optimization
Cr. 3. Repeatable.

MATH 680K: Advanced Topics: Probability
Cr. 3. Repeatable.

MATH 680L: Advanced Topics: Topology
Cr. 3. Repeatable.

MATH 699: Research
Cr. arr. Repeatable.

Meteorology

Offered by the Department of Geological and Atmospheric Sciences.

The study of Meteorology involves the description of the earth's atmosphere and the processes responsible for its behavior. Students majoring in Meteorology earn the bachelor of science. The major satisfies guidelines specified by the American Meteorological Society and meets education requirements for employment with the National Weather Service and the World Meteorlogical Organization. Successful preparation for professional or graduate work in Meteorology requires that the student develop and integrate a diverse range of skills and knowledge bases. These include weather observing, the physics and dynamics of the global atmosphere, application of new weather technologies, advanced mathematical tools, computer programming and modeling, and effective oral and written communication. The faculty view the senior thesis (MTEOR 499 Senior Research), in particular, as a capstone experience in which students demonstrate they have achieved this integration. Also, contemporary meteorology is an earth-system science with ties to a variety of human experiences. The electives and general education requirements of the college are further experiences that the meteorology student must integrate with their core meteorology knowledge in order to function effectively in a globally-oriented profession.

Minor - Meteorology

The department offers a minor in Meteorology which may be earned by completing 15 credits including MTEOR 111 Synoptic Applications (only 1 credit may count toward the minor), MTEOR 206 Introduction to Weather and Climate and MTEOR 301 General Meteorology. Further information concerning programs of study, including sample degree programs, is available from the department.

The program requires the following courses:

MTEOR 111	Synoptic Applications	1
MTEOR 201	Introductory Seminar	R
MTEOR 206	Introduction to Weather and Climate	3
MTEOR 301	General Meteorology	4
MTEOR 311	Introduction to Synoptic Meteorology	2
MTEOR 341	Atmospheric Physics I	3
MTEOR 342	Atmospheric Physics II	3
MTEOR 411	Synoptic Meteorology	3
MTEOR 417	Mesoscale Forecasting Laboratory	3
MTEOR 432	Instrumentation and Measurements	3
MTEOR 443	Dynamic Meteorology I	3
MTEOR 454	Dynamic Meteorology II	3
MTEOR 499	Senior Research	2
Total Credits		33

An additional 9 credits must be chosen from:

MTEOR 402	Watershed Hydrology	3
MTEOR 404	Global Change	3
MTEOR 405	Environmental Biophysics	3
MTEOR 406	World Climates	3
MTEOR 407	Mesoscale Meteorology	3
MTEOR 452	Climate Modeling	3
MTEOR 490	Independent Study	1-3
GEOL 415	Paleoclimatology	3
or C E 372	Engineering Hydrology and Hydraulics	
MTEOR 435	Radar Applications in Meteorology	3
MTEOR 489	Survey of Remote Sensing Technologies	3
MTEOR 489L	Satellite Remote Sensing Laboratory	1
GEOL 452	GIS for Geoscientists	3

Supporting work is required in areas at least equivalent to:

One of the following sequnces		4
CHEM 163 & 163L	College Chemistry and Laboratory in College Chemistry	
Or		
CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	
COM S 207	Fundamentals of Computer Programming	3
PHYS 221	Introduction to Classical Physics I	5
PHYS 222	Introduction to Classical Physics II	5
MATH 165	Calculus I	4
MATH 166	Calculus II	4
MATH 265	Calculus III	4
MATH 266	Elementary Differential Equations	3
STAT 105	Introduction to Statistics for Engineers	3
SP CM 212	Fundamentals of Public Speaking	3
Total Credits		38

A grade of C or better (not C-) is required in each of the following courses to meet minimum graduation requirements for a bachelor of science degree in Meteorology:

MTEOR 206	Introduction to Weather and Climate	3
MTEOR 301	General Meteorology	4

Several co-op programs are available for upper division undergraduates. Although a range of opportunities exists for men and women who

terminate their studies with a bachelor of science, students who meet the necessary academic standards are encouraged to continue their studies in a graduate program. For these students, additional coursework is recommended in a mathematical or physical science. Other students can choose a wide range of supporting courses that will contribute to their particular area of interest in meteorology.

Communication Proficiency requirement: The LAS College requires a C or better in ENGL 250. The department requires a grade of C or better in ENGL 309.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	
ENGL 309	Proposal and Report Writing	3

Path 1 for students preparing to start in calculus

Freshman

Fall	Credits	Spring	Credits
CHEM 163 or 177[1]	4	MTEOR 206	3
CHEM 163L or 177L[1]	1	MATH 166	4
ENGL 150	3	PHYS 221	5
LIB 160	1	Humanities/Social Science Choice	3
MATH 165	4		
MTEOR 111	1		
MTEOR 112	1		
Humanities/Social Science Choice	3		
	18		15

Sophomore

Fall	Credits	Spring	Credits
MATH 265	4	MATH 266	3
MTEOR 201	0	MTEOR 301	4
MTEOR 227	3	SP CM 212	3
ENGL 250	3	STAT 105	3
PHYS 222	5	Humanities/Social Science Choice	3
	15		16

Junior

Fall	Credits	Spring	Credits
MTEOR 311	2	MTEOR 342	3
MTEOR 341	3	MTEOR 443	3
Foreign Language/Elective	4-3	Foreign Language/Elective	4-3
Humanities/Social Science Choice	3	ENGL 309	3
Humanities/Social Science	3	Humanities/Social Science Choice	3
	15-14		16-15

Senior

Fall	Credits	Spring	Credits
MTEOR 411	3	MTEOR 417	3
MTEOR 454	3	MTEOR 432	3
MTEOR 499	2	Meteorlogy Elective/Elective Choice[2,3]	3
Meteorology Elective/ elective Choice[2,3]	3	Meteorology Elective/ Elective Choice[2,3]	3
Meteorlogy Elective/Elective choice[2,3]	3	Humanities/Social Science Choice	3
	14		15

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.** You must also complete the Communication Proficiency and LAS World Language Requirements. Six semesters of one foreign language in high school satisfies the World Language requirement.

Students in all ISU majors must complete a 3 credit course in U.S. diversity and a 3 -credit course in international perspectives. Discuss with your adviser how the two courses that you select can be applied to address general education requirements. Check for a list of approved courses at: http://www.registrar.iastate.edu/courses/div-ip-guide.html

1 Students taking CHEM 177 should plan to take CHEM 178 as well.

2 Student must select at least 9 credits from a list of optional courses.

3 Students should select a humanities or social science course based on need. If these LAS requirements have been satisfied, students may select a meteorology elective or alternate course. Students should discuss possible alternate course options with their adviser.

Path 2 for students needing preparatory mathematics

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	MATH 165	4
CHEM 163	4	MTEOR 206	3
CHEM 163L	1	SP CM 212	3
LIB 160	1	Humanities/Social Science Choice	3
MATH 140	3	Humanities/Social Science Choice	3
MATH 143	4		

MTEOR 112	1		
	17		16

Sophomore

Fall	Credits	Spring	Credits
MATH 166	4	MATH 265	4
MTEOR 111	1	MTEOR 301	4
MTEOR 201	0	PHYS 222	5
MTEOR 227	3	STAT 105	3
PHYS 221	5		
ENGL 250	3		
	16		16

Junior

Fall	Credits	Spring	Credits
MTEOR 311	2	MTEOR 342	3
MTEOR 341	3	MTEOR 443	3
Foreign Language/Elective	4-3	Foreign Language/Elective	4-3
Humanities/Social Science Choice	3	ENGL 309	3
MATH 266	3	Humanities/Social Science Choice	3
	15-14		16-15

Senior

Fall	Credits	Spring	Credits
MTEOR 411	3	MTEOR 417	3
MTEOR 454	3	MTEOR 432	3
MTEOR 499	2	Meteorology Elective/ Elective Choice[2,3]	3
Meteorology Elective/ Elective Choice[2,3]	3	Meteorlogy Elective/Elective Choice[2,3]	3
Meteorology Elective/ Elective Choice[2,3]	3	Humanities/Social Science Choice	3
	14		15

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.** You must also complete the Communication Proficiency and LAS World Language Requirements. Six semesters of one foreign language in high school satisfies the World Language requirement.

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1 Students taking CHEM 177 should plan to take CHEM 178 as well.

2 Student must select at least 9 credits from a list optional courses.

3 Students should select a humanities or social science course based on need. If these LAS requirements have been satisfied, students may select a meteorology elective or alternate course. Students should discuss possible alternate course options with their adviser.

Courses primarily for undergraduates:

MTEOR 107: Severe and Hazardous Weather

(2-0) Cr. 1. F.

Understanding of atmospheric processes that play a role in creating severe and hazardous weather. Focus on thunderstorms, tornadoes, hurricanes, floods, blizzards, ice storms, and temperature extremes. Impacts on lives and property.

MTEOR 111: Synoptic Applications

(1-0) Cr. 1. Repeatable. F.

Prereq: Credit or enrollment in MATH 165

Current weather discussions and introduction to synoptic-scale interpretation of meteorology. Application and use of calculus in meteorology. Course restricted to majors. Others with permission of instructor.

MTEOR 112: Geoscience Orientation

(Cross-listed with GEOL). (1-0) Cr. 1. F.

Orientation course for students enrolled in the Earth, Wind and Fire Learning Community. Provides an introduction to Iowa State University and meteorology, geology, and Earth science programs for students enrolled in the department's learning community. Activities include academic and social activities, talks and presentations on academic success, resume writing, and study abroad, as well as research talks by faculty members.

MTEOR 113: Spring Geoscience Orientation for Earth, Wind and Fire Learning Community

(Cross-listed with GEOL). (0.5-0) Cr. 0.5. S.

Spring orientation course for students enrolled in the Earth, Wind and Fire Learning Community. Students are introduced to interview strategies, the importance of creating a professional image on social media, and the basics of financial literacy. Focused on professionalism and resilience, in this course students use their individual strengths to work in teams on a research project that applies their quantitative, data analysis, management, and communication skills. Activities include academic and social events, and two field trips.

MTEOR 160: Water Resources of the World
(Cross-listed with AGRON, ENV S, GEOL). (3-0) Cr. 3. S.
Study of the occurrence, history, development, and management of world water resources. Basic hydrologic principles including climate, surface water, groundwater, and water quality. Historical and current perspectives on water policy, use, and the role of water in society and the environment. Meets International Perspectives Requirement.

MTEOR 201: Introductory Seminar
Cr. R. F.
Prereq: Credit or enrollment in PHYS 221
An overview of the atmospheric sciences, the meteorology program at Iowa State, and the major research journals used in the discipline.

MTEOR 206: Introduction to Weather and Climate
(Cross-listed with AGRON). (3-0) Cr. 3. F.S.
Basic concepts in weather and climate, including atmospheric measurements, radiation, stability, precipitation, winds, fronts, forecasting, and severe weather. Applied topics include global warming, ozone depletion, world climates and weather safety.

MTEOR 227: Computational Meteorology I
(3-1) Cr. 3. F.
Prereq: Credit or concurrent enrollment in MTEOR 206, credit or concurrent enrollment in PHYS 221
An introduction to computer programming using FORTRAN with focus on meteorological applications. Emphasis on basics of good programming techniques and style through extensive practice in top-down design, writing, running, and debugging small programs. Topics include operations and functions, selective execution, repetitive execution, arrays, input/output, file processing, and subprograms. This course is designed for majors.

MTEOR 265: Scientific Balloon Engineering and Operations
(Cross-listed with AER E). (0-2) Cr. 1. F.
Engineering aspects of scientific balloon flights. Integration of science mission objectives with engineering requirements. Operations team certification. FAA and FCC regulations, communications, and command systems. Flight path prediction and control.

MTEOR 290: Independent Study
Cr. 1-4. Repeatable.
Prereq: Permission of instructor
Independent study for freshman and sophomore students.

MTEOR 298: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing the work period.

MTEOR 301: General Meteorology
(4-0) Cr. 4. S.
Prereq: MATH 166, credit or enrollment in PHYS 222
Global distribution of temperature, wind, and atmospheric constituents; atmospheric thermodynamics, radiative transfer, global energy balance, storms and clouds, introductory dynamics.

MTEOR 311: Introduction to Synoptic Meteorology
(1-2) Cr. 2. F.
Prereq: MTEOR 301
Concepts of weather map plotting and analysis. Introduction to forecasting and to the use of real-time UNIDATA computer products.

MTEOR 321: Meteorology Internship
Cr. 1-2. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: MTEOR 311; junior or senior standing; permission of co-op program coordinator; acceptance by sponsoring agency
Supervised practical experience in a professional meteorological agency. Experiences may include providing weather information for radio, TV, utilities, government agencies, construction, or agribusiness.

MTEOR 324: Energy and the Environment
(Cross-listed with ENSCI, ENV S, GEOL). (3-0) Cr. 3. S.
Renewable and non-renewable energy resources. Origin, occurrence, and extraction of fossil fuels. Nuclear, wind, geothermal, biomass, hydroelectric, and solar energy. Biofuels. Energy efficiency. Environmental effects of energy production and use, including air pollution, acid precipitation, coal ash, mountaintop removal mining, oil drilling, hydraulic fracturing, groundwater contamination, nuclear waste disposal, and global climate change. Carbon sequestration and geoengineering solutions for reducing atmospheric CO2 concentrations.

MTEOR 341: Atmospheric Physics I
(3-0) Cr. 3. F.
Prereq: PHYS 222, credit or enrollment in MATH 266, MTEOR 301.
Basic laws of thermodynamics, thermodynamics of water vapor, mixtures of gases, stability, hydrostatics, cloud physics.

MTEOR 342: Atmospheric Physics II
(3-0) Cr. 3. S.
Prereq: MTEOR 341
Precipitation physics, radar, atmospheric radiation, atmospheric optics, atmospheric electricity.

MTEOR 398: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing the work period.

MTEOR 402: Watershed Hydrology
(Dual-listed with MTEOR 502). (Cross-listed with ENSCI, GEOL, NREM). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

MTEOR 404: Global Change
(Dual-listed with MTEOR 504). (Cross-listed with AGRON, ENSCI, ENV S). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

MTEOR 405: Environmental Biophysics
(Dual-listed with MTEOR 505). (Cross-listed with AGRON, ENSCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)
Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

MTEOR 406: World Climates
(Cross-listed with AGRON, ENSCI). (3-0) Cr. 3. S.
Prereq: AGRON 206/MTEOR 206
Distribution and causes of different climates around the world. Effects of climate and climate variations on human activities including society, economy and agriculture. Current issues such as climate change and international efforts to assess and mitigate the consequences of a changing climate. Semester project and in-class presentation required. Meets International Perspectives Requirement.

MTEOR 407: Mesoscale Meteorology
(Dual-listed with MTEOR 507). (Cross-listed with AGRON). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Math 166 and Mteor 443
Physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure.

MTEOR 411: Synoptic Meteorology
(Dual-listed with MTEOR 511). (1-4) Cr. 3. F.
Prereq: MTEOR 311, Credit or enrollment in MTEOR 454
Current weather forecasting and discussion. Applications of atmospheric physics and dynamics in real-time weather situations. Use of UNIDATA computer products.

MTEOR 416: Hydrologic Modeling and Analysis
(Dual-listed with MTEOR 516). (Cross-listed with ENSCI, GEOL). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in Earth science, meteorology, or engineering; junior standing
Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

MTEOR 417: Mesoscale Forecasting Laboratory
(1-5) Cr. 3. S.
Prereq: Credit or enrollment in MTEOR 411
Real-time computer analysis of current weather, with emphasis on small-scale features. Studies of severe weather, lake-effect snow, CSI, cold-air damming.

MTEOR 432: Instrumentation and Measurements
(2-2) Cr. 3. S.
Prereq: Credit or enrollment in MATH 266, PHYS 222
Principles of meteorological sensing and data analysis. Thermometry, barometry, hygrometry, anemometry, precipitation measurements, radiometry, radar, remote sensing, visibility, and cloud height. Calibration and measurement uncertainties. Digital signal processing. Field trip to the National Weather Service. Labs emphasize dataloggers and modern weather stations.

MTEOR 435: Radar Applications in Meteorology
(3-0) Cr. 3. F.
Prereq: Credit or enrollment in MTEOR 341
Fundamentals of radar meteorology with emphasis on applications. Topics presented include theory of radar, engineering principles, Doppler radar, polarimetric radar, and applications to remote sensing of clouds and precipitation.

MTEOR 443: Dynamic Meteorology I
(3-0) Cr. 3. S.
Prereq: MTEOR 341
Conservation laws, governing equations, circulation and vorticity. Development of quasi-geostrophic theory.

MTEOR 452: Climate Modeling
(Dual-listed with MTEOR 552). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: Mteor 301
Developing and working with climate models based on fundamental physical principles that govern the climate systems of the Earth and other planets. Emphasis on coupled, nonlinear-system interactions of physical processes such as circulation dynamics, radiative transfer, and cloud/precipitation physics, starting with fairly simple 0- and 1-dimensional analytical and numerical models based on energy, mass, and momentum conservation. Observational study of seasonally evolving weather patterns that form climates around the world.

MTEOR 454: Dynamic Meteorology II
(3-0) Cr. 3. F.
Prereq: MTEOR 443
Planetary boundary layer, linear perturbation theory, atmospheric wave motions, baroclinic and convective instability, mesoscale circulations.

MTEOR 471: History of Modern Meteorology
(Dual-listed with MTEOR 571). (1-0) Cr. 1. Alt. S., offered even-numbered years.
Prereq: MTEOR 341, MTEOR 342, MTEOR 411, MTEOR 443, MTEOR 452
Development of meteorological theories and numerical weather prediction, discoveries of important meteorological phenomena, and impact of weather and climate on important historical events.

MTEOR 489: Survey of Remote Sensing Technologies
(Dual-listed with MTEOR 589). (Cross-listed with E E, GEOL, NREM). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

MTEOR 489L: Satellite Remote Sensing Laboratory
(Dual-listed with MTEOR 589L). (Cross-listed with E E, GEOL, NREM). (0-3) Cr. 1. S.
Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589
Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

MTEOR 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in meteorology, permission of instructor
No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490A: Independent Study: Synoptic Meteorology.
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in meteorology, permission of instructor
No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490B: Independent Study: Dynamic Meteorology.
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in meteorology, permission of instructor
No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490C: Independent Study: Physical Meteorology.
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in meteorology, permission of instructor
No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490D: Independent Study: Instrumentation.
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in meteorology, permission of instructor
No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 490E: Independent Study: Hydrology.
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in meteorology, permission of instructor
No more than 9 credits in Mteor 490 may be counted toward graduation.

MTEOR 498: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

MTEOR 499: Senior Research
(2-0) Cr. 2. F.
Required of all senior meteorology majors. Research projects in collaboration with faculty. Written and oral presentations of results at the end of the semester.

Courses primarily for graduate students, open to qualified undergraduates:

MTEOR 502: Watershed Hydrology
(Dual-listed with MTEOR 402). (Cross-listed with ENSCI, GEOL, NREM). (2-3) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Examination of watersheds as systems, emphasizing the surface components of the hydrologic cycle. Combines qualitative understanding of hydrological processes and uncertainty with quantitative representation. Laboratory emphasizes field investigation and measurement of watershed processes.

MTEOR 504: Global Change
(Dual-listed with MTEOR 404). (Cross-listed with AGRON, ENSCI). (3-0) Cr. 3. S.
Prereq: Four courses in physical or biological sciences or engineering; junior standing
Recent changes in global biogeochemical cycles and climate; models of future changes in the climate system; impacts of global change on agriculture, water resources and human health; ethical issues of global environmental change. Also offered online Alt. F, even-numbered years.

MTEOR 505: Environmental Biophysics
(Dual-listed with MTEOR 405). (Cross-listed with AGRON, ENSCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MATH 165 or MATH 182 or equivalent and some computer programming experience (any language)
Description of the physical microenvironment in which organisms live. Emphasis on the movement of energy (heat and radiation) and mass (water and carbon) among organisms, the soil, and atmosphere. Applications to humans, other animals, plants, and plant communities.

MTEOR 507: Mesoscale Meteorology
(Dual-listed with MTEOR 407). (Cross-listed with AGRON). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Math 166 and Mteor 443
Gallus. The physical nature and practical consequences of mesoscale atmospheric phenomena. Mesoscale convective systems, fronts, terrain-forced circulations. Observation, analysis, and prediction of mesoscale atmospheric structure. Semester project and in-class presentation required.

MTEOR 511: Synoptic Meteorology
(Dual-listed with MTEOR 411). (1-4) Cr. 3. F.
Prereq: MTEOR 311, Credit or enrollment in MTEOR 454
Current weather forecasting and discussion. Applications of atmospheric physics and dynamics in real-time weather situations. Use of UNIDATA computer products.

MTEOR 516: Hydrologic Modeling and Analysis
(Dual-listed with MTEOR 416). (Cross-listed with ENSCI, GEOL). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Four courses in Earth science, meteorology, or engineering; junior standing
Study of the basic principles of hydrologic modeling, including rainfall-runoff analysis, lumped and distributed modeling, conceptual and physical models, parameter estimation and sensitivity analysis, input and validation data, uncertainty analysis, and the use of models in surface water hydrology. A range of common models are applied to study hydrologic topics such as flood forecasting and land use change impacts. Previous experience with Matlab or other programming language is needed.

MTEOR 518: Microwave Remote Sensing
(Cross-listed with AGRON, E E). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Math 265 or equivalent
Microwave remote sensing of Earth's surface and atmosphere using satellite-based or ground-based instruments. Specific examples include remote sensing of atmospheric temperature and water vapor, precipitation, ocean salinity, and soil moisture.

MTEOR 542: Physical Meteorology
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: MTEOR 342, MATH 266, PHYS 222
Planetary atmospheres, radiative equilibrium models, radiative transfer, the upper atmosphere, remote sounding from satellites.

MTEOR 543: Advanced Dynamic Meteorology I
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MTEOR 455
The first half of a two semester sequence. Governing equations, scale analysis, simple types of wave motion in the atmosphere, instability theory.

MTEOR 544: Advanced Dynamic Meteorology II
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: MTEOR 543
Continuation of 543. General circulation and dynamics of zonally symmetric circulations, atmospheric energetics, nonlinear dynamics of planetary waves.

MTEOR 552: Climate Modeling
(Dual-listed with MTEOR 452). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: Mteor 301
Developing and working with climate models based on fundamental physical principles that govern the climate systems of the Earth and other planets. Emphasis on coupled, nonlinear-system interactions of physical processes such as circulation dynamics, radiative transfer, and cloud/precipitation physics, starting with fairly simple 0- and 1-dimensional analytical and numerical models based on energy, mass, and momentum conservation. Observational study of seasonally evolving weather patterns that form climates around the world.

MTEOR 571: History of Modern Meteorology
(Dual-listed with MTEOR 471). (1-0) Cr. 1. Alt. S., offered even-numbered years.
Prereq: MTEOR 341, MTEOR 342, MTEOR 411, MTEOR 443, MTEOR 452
Development of meteorological theories and numerical weather prediction, discoveries of important meteorological phenomena, and impact of weather and climate on important historical events.

MTEOR 589: Survey of Remote Sensing Technologies
(Dual-listed with MTEOR 489). (Cross-listed with E E, GEOL, NREM). (3-0) Cr. 3. F.
Prereq: Four courses in physical or biological sciences or engineering
Electromagnetic-radiation principles, active and passive sensors, multispectral and hyperspectral sensors, imaging radar, SAR, thermal imaging, lidar. Examples of applications. Also offered online S.

MTEOR 589L: Satellite Remote Sensing Laboratory
(Dual-listed with MTEOR 489L). (Cross-listed with E E, NREM). (0-3) Cr. 1. S.
Prereq: Completion or concurrent enrollment in MTEOR/GEOL/NREM/EE 489/589
Processing and analysis of satellite sensor data (optical and radar). Provides practical applications in an environmental context.

MTEOR 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590A: Special Topics: Boundary-layer Meteorology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590B: Special Topics: Tropical Meteorology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590C: Special Topics: Mesoscale Meteorology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590D: Special Topics: Global Climate Systems
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590E: Special Topics: Climate Modeling
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590F: Special Topics: Numerical Weather Prediction
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590G: Special Topics: Satellite Observations
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590H: Special Topics: Statistical Methods in Meteorology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590I: Special Topics: Field Observations
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590J: Special Topics: Low Frequency Modes
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590K: Special Topics: Cloud Physics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590L: Special Topics: Atmospheric Radiation
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590M: Special Topics: Hydrology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590N: Special Topics: Geophysical Fluid Dynamics
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 590O: Special Topics: Radar Meteorology
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

MTEOR 595: Graduate Seminar
(Cross-listed with GEOL). Cr. 1. Repeatable. F.S.
Prereq: Senior or graduate classification
Weekly seminar on topics of current research interest. All students seeking a graduate degree in geology must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

MTEOR 595A: Graduate Seminar: Presentation Required
(Cross-listed with GEOL). (1-0) Cr. 1. Repeatable. F.S.
Prereq: Senior or graduate classification
Weekly seminar on topics of current research interest. All students seeking a graduate degree in geology must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

MTEOR 595B: Graduate Seminar: Attendance Only
(Cross-listed with GEOL). Cr. R. Repeatable. F.S.
Prereq: Senior or graduate classification
Attendance only. Weekly seminar on topics of current research interest. All students seeking a graduate degree in geology must enroll during each semester of residence. Students pursuing a non-thesis option for the M.S. in Earth Science must enroll for one semester. Offered on a satisfactory-fail basis only.

Courses for graduate students:

MTEOR 605: Boundary-Layer Meteorology
(Cross-listed with AGRON). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MTEOR 443 or equivalent-level course in engineering fluids
Atmospheric boundary-layer structure and dynamics. Diurnal and seasonal variations, turbulent fluxes and turbulence kinetic energy. Measurements and empirical relations for wind and temperature near the ground. Numerical simulation and applications to wind energy.

MTEOR 699: Research
Cr. arr. Repeatable.

Music

Administered by the Department of Music and Theatre

Undergraduate Study

The Department of Music and Theatre offers a strong undergraduate music program, where students study with full-time faculty professionals in a supportive environment that encourages students to become their best.

The music curriculum provides:

1. A comprehensive program of professional studies for students who wish to prepare for careers in music, including teaching, performance, and composition, and for students who plan to pursue graduate studies in music.
2. Courses in music literature, theory and areas of performance for all students, regardless of major.

The department embodies the land-grant philosophy of service to the people of the state with a faculty of active scholars, teachers, and artists committed to excellence in teaching, creative/scholarly work, and arts outreach. The department is an accredited institutional member of the National Association of Schools of Music (NASM).

The Theatre Program is administered by the Department of Music and Theatre (see Index, Theatre and Performing Arts.)

Curricula Available to Music Majors

Students interested in pursuing an emphasis in music theater should see Index, Theater and Performing Arts.

Bachelor of Music

This curriculum leads to the degree bachelor of music. This degree is more specialized and contains fewer general education requirements than the bachelor of arts degree with a major in music. Students in this curriculum choose between options in education, performance, and composition. To obtain a bachelor of music degree, a student must earn a minimum of 125-146.5 credits (depending on the option chosen) including a minimum of 32 credits in residence at Iowa State University

and a minimum of 45 advanced credits in courses numbered 300 or above and must meet all of the requirements specified below.

Courses taken on a pass/not pass basis may be counted toward the required total credits, and may be used to meet the advanced credit requirement, if appropriate, but may not be used to satisfy any other graduation requirement.

Degree Requirements

GENERAL EDUCATION REQUIREMENTS (Students choosing the music education option should consult their advisers.) 32 cr.		
Social Science:		6
Humanities:		6
MUSIC 383	History of Music I	3
MUSIC 384	History of Music II	3
Natural Sciences		3
Mathematics, Natural Sciences:		6
Electives (not Music)		5
OTHER REQUIREMENTS 15 Cr.		
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition *	3
LIB 160	Information Literacy	1
World Languages and Cultures		8
MUSIC CORE 47 CR.		
MUSIC 120	Introduction to Music Literature and Styles	3
MUSIC 224	Music Theory I	3
MUSIC 225	Aural Theory I	2
MUSIC 234	Music Theory II	3
MUSIC 235	Aural Theory II	1
MUSIC 334	Music Theory III	3
MUSIC 335	Aural Theory III	1
MUSIC 344	Music Theory IV	3
MUSIC 345	Aural Theory IV	1
MUSIC 361	Conducting I	2
All of the following are required, 12 cr. minimum total		12
MUSIC 119	Applied Music for Majors	
MUSIC 219	Applied Music: Majors	
MUSIC 319	Applied Music: Majors	
MUSIC 419	Applied Music: Majors	
One of the following		3
MUSIC 472	History of American Music	
MUSIC 473	Music of the Baroque and Classical Eras	
MUSIC 475	Music of the Romantic Era	
MUSIC 476	Music of the Twentieth Century	
MUSIC 434	Applied Theory: Improvising and Arranging	3
Ensembles: see Ensemble Requirement and Options below for details		7
MUSIC 420	Junior/Senior Recital	R
OPTION: select from the list below		31-53.5
Total Credits		125-147.5

Select one of the following options:

52.5 Vocal Education K-12 (Also see Index, Teacher Education.) MUSIC CLASSES TAKEN BY OTHER BACHELOR OF MUSIC STUDENTS REQUIRE MINIMUM GRADE C-, AND SUPPLEMENTAL MUSIC OPTION COURSES REQUIRE MINIMUM GRADE C.

MUSIC 248	Technology in Music Instruction	2
MUSIC 266	Introduction to Music Education	2
MUSIC 327B	Functional Piano: Voice Majors	2
MUSIC 358A	Lab Ensemble: Choral	R
MUSIC 360	Voice Pedagogy	2
MUSIC 362A	Conducting II: Choral Conducting Techniques	2
MUSIC 366	Methods of Music Education	2
MUSIC 367	Choral Literature	2
MUSIC 374	Instrumental Methods for Vocalists	1
8 credits of each of the following:		16
MUSIC 417R	Student Teaching: Music-Elementary	
MUSIC 417S	Student Teaching: Music-Secondary	
MUSIC 465	Choral Materials and Methods	2
MUSIC 466	Program Development and Evaluation in Music Education	2
Credit in the following:		3.5
MUSIC 280K	Pre-Student Teaching Experience I: Music	
MUSIC 480K	Pre-Student Teaching Experience III: Music (repeatable)	
One of the following		3
MUSIC 301	Opera Studio	
THTRE 354	Musical Theatre I	
THTRE 355	Musical Theatre II	
C I 204 or C I 205X		
C I 204	Social Foundations of Education in the United States	3
C I 406 or C I 405X		
C I 406	Social Justice Education and Teaching: Secondary	3
C I 426	Principles of Secondary Education	3
SP ED 401	Teaching Secondary Students with Exceptionalities in General Education	3
Total Credits		53.5

51.5-52.5 Instrumental Education K-12 (Also see Index, Teacher Education.) MUSIC CLASSES TAKEN BY OTHER BACHELOR OF MUSIC STUDENTS REQUIRE MINIMUM GRADE C-, AND SUPPLEMENTAL MUSIC OPTION COURSES REQUIRE MINIMUM GRADE C.

MUSIC 248	Technology in Music Instruction	2
MUSIC 266	Introduction to Music Education	2
MUSIC 350	Instrumental Techniques: Strings	1
MUSIC 351	Instrumental Techniques: Clarinet, Flute, Saxophone	2
MUSIC 352	Instrumental Techniques: Oboe, Bassoon	1
MUSIC 353	Instrumental Techniques: Trumpet, Horn	1
MUSIC 354	Instrumental Techniques: Trombone, Baritone, Tuba	1
MUSIC 355	Instrumental Techniques: Percussion	1
MUSIC 358B	Lab Ensemble: Instrumental	R
MUSIC 362B	Conducting II: Instrumental Conducting Techniques	2
MUSIC 366	Methods of Music Education	2
One of the following		1-2
MUSIC 368	Marching Band and Jazz Ensemble Techniques (2 cr.)	
MUSIC 490A	Independent Study: Education (String Ped. 1 cr.)	
MUSIC 375	Choral Methods for Instrumentalists	1
MUSIC 464	Instrumental Administration, Materials, and Methods	2
MUSIC 466	Program Development and Evaluation in Music Education	2
8 credits of each of the following:		16
MUSIC 417R	Student Teaching: Music-Elementary	
MUSIC 417S	Student Teaching: Music-Secondary	
Credit in the following:		3.5
MUSIC 280K	Pre-Student Teaching Experience I: Music	
MUSIC 480K	Pre-Student Teaching Experience III: Music (repeatable)	
C I 204 or C I 205X		
C I 204	Social Foundations of Education in the United States	3
C I 406 or C I 405X		
C I 406	Social Justice Education and Teaching: Secondary	3
C I 426	Principles of Secondary Education	3
SP ED 401	Teaching Secondary Students with Exceptionalities in General Education	3
Total Credits		52.5-53.5

31 Voice

MUSIC 327B	Functional Piano: Voice Majors	2
Additional credits in these courses		8
MUSIC 319A	Applied Music: Majors: Voice	
MUSIC 419A	Applied Music: Voice	
MUSIC 324	English and Italian Diction for Singing	2
MUSIC 325	French and German Diction for Singing	2
MUSIC 360	Voice Pedagogy	2
One of the following		3
MUSIC 440	Seminar in Music Theory	
MUSIC 446	Sound Synthesis Design for Electronic Music	
MUSIC 415A	Literature and Pedagogy in Applied Music: Voice (Lit.)	2
Second world language		8
Electives		2
Total Credits		31

31 Piano

Additional credits in these courses		12
MUSIC 119B	Applied Music for Majors: Piano	
MUSIC 219B	Applied Music: Majors: Piano	
MUSIC 319B	Applied Music: Majors: Piano	
MUSIC 419B	Applied Music: Piano	
5 credits from:		5
MUSIC 321	Advanced Ensemble (5 credits of 321 topics)	
MUSIC 327A	Functional Piano: Keyboard majors.	2
5 credits from:		5
MUSIC 415B	Literature and Pedagogy in Applied Music: Piano (Lit. & Ped.)	
One of the following		3
MUSIC 440	Seminar in Music Theory	
MUSIC 446	Sound Synthesis Design for Electronic Music	
Electives		4
Total Credits		31

31 Organ

Credits from these courses		4
MUSIC 119B	Applied Music for Majors: Piano	
MUSIC 219B	Applied Music: Majors: Piano	
Additional credits in these courses		8
MUSIC 319C	Applied Music: Majors: Organ	
MUSIC 419C	Applied Music: Organ	
5 credits from:		5

MUSIC 415C	Literature and Pedagogy in Applied Music: Organ (Lit. & Ped.)	
One of the following		3
MUSIC 472	History of American Music	
MUSIC 473	Music of the Baroque and Classical Eras	
MUSIC 475	Music of the Romantic Era	
MUSIC 476	Music of the Twentieth Century	
One of the following		3
MUSIC 440	Seminar in Music Theory	
MUSIC 446	Sound Synthesis Design for Electronic Music	
Second world language		8
Total Credits		31

31 String instruments

Additional credits in these courses		12
MUSIC 119D	Applied Music for Majors: Strings	
MUSIC 219D	Applied Music: Majors: Strings	
MUSIC 319D	Applied Music: Majors: Strings	
MUSIC 419D	Applied Music: Strings	
Additional credits in these courses		6
MUSIC 181	Symphony Orchestra	
MUSIC 321	Advanced Ensemble	
One of the following		3
MUSIC 440	Seminar in Music Theory	
MUSIC 446	Sound Synthesis Design for Electronic Music	
MUSIC 415D	Literature and Pedagogy in Applied Music: Strings (Lit. & Ped.)	4
Electives		6
Total Credits		31

31 Wind or percussion instrument

Additional credits in theses courses		12
MUSIC 119	Applied Music for Majors	
MUSIC 219	Applied Music: Majors	
MUSIC 319	Applied Music: Majors	
MUSIC 419	Applied Music: Majors	
3 credits from:		3
MUSIC 321	Advanced Ensemble	
Musice 300 level or above		3
One of the following		3
MUSIC 440	Seminar in Music Theory	
MUSIC 446	Sound Synthesis Design for Electronic Music	
MUSIC 415	Literature and Pedagogy in Applied Music	4
Electives		6
Total Credits		31

31 Composition

4 credits from:		4
MUSIC 290C	Special Problems: Composition	
12 credits from:		12
MUSIC 490C	Independent Study: Composition	
MUSIC 246	Introduction to Creative Digital Music	2
MUSIC 362A	Conducting II: Choral Conducting Techniques	2
MUSIC 362B	Conducting II: Instrumental Conducting Techniques	2
6 credits from the following		6
MUSIC 346	Computer Music Programming Design	
MUSIC 440	Seminar in Music Theory	
MUSIC 446	Sound Synthesis Design for Electronic Music	
MUSIC 490B	Independent Study: Theory	
MUSIC 490I	Independent Study: Electronic Music	
Electives		3
Total Credits		31

Bachelor of Arts—Music Major

A more general degree than the bachelor of music, the bachelor of arts degree requires no formal specialization. It includes more general education requirements and provides a broader course of academic study.

For the undergraduate curriculum in Liberal Arts and Sciences, major in music, leading to the degree bachelor of arts, see Liberal Arts and Sciences, Curriculum.

Candidates for the degree bachelor of arts with a music major will normally complete 48 credits of music including the following required courses:

4 credits:		4
MUSIC 119	Applied Music for Majors	
MUSIC 120	Introduction to Music Literature and Styles	3
4 credits:		4
MUSIC 219	Applied Music: Majors	
MUSIC 224	Music Theory I	3
MUSIC 225	Aural Theory I	2
MUSIC 234	Music Theory II	3
MUSIC 235	Aural Theory II	1
MUSIC 319	Applied Music: Majors	2
MUSIC 334	Music Theory III	3
MUSIC 335	Aural Theory III	1

MUSIC 344	Music Theory IV	3
MUSIC 345	Aural Theory IV	1
MUSIC 383	History of Music I	3
MUSIC 384	History of Music II	3
4 credits from		4
MUSIC 111	Wind Ensemble	
MUSIC 113	Jazz Ensemble	
MUSIC 115	Symphonic Band	
MUSIC 141	Lyrica Women's Choir	
MUSIC 151	Oratorio Chorus	
MUSIC 161	Iowa State Singers	
MUSIC 181	Symphony Orchestra	
MUSIC 321	Advanced Ensemble	
MUSIC 301	Opera Studio	
Music Electives		8
Total Credits		48

Bachelor of arts students whose chief professional interest lies in research are encouraged to minor in world languages and cultures, history, literature, or philosophy.

General Requirements

Entrance Audition.

In order to be accepted as a music major, a prospective student must pass an entrance audition for the applied faculty in his/her performance area (piano, organ, woodwinds, strings, percussion, brass, or voice). Passing the audition is dependent on the demonstration of performance skills appropriate for college level instruction and the potential to perform at a professional level. In addition, the number of students accepted must balance with the space available in the corresponding applied studios. Once accepted, a student must complete a placement examination in keyboard skills. This examination is normally given by members of the departmental faculty the week preceding the opening of classes for fall semester.

Seminars and Recitals.

All music majors enrolled for applied music courses will attend a weekly 1-hour seminar in their areas, departmental recitals, and 12 recitals of their choosing each semester.

Ensemble Requirement.

See the options above for additional ensemble requirements.

All Bachelor of Music students:

Enrollment in an ensemble course, chosen from the lists below, each semester of full-time enrollment (except during student teaching) is required.

Students in a music education options:

At least six semesters of large ensemble and one semester of chamber music ensemble, chosen from the lists below, are required. One semester of 114A may count as a large ensemble.

Bachelor of Music students in options other than education:

At least 2 semesters of large ensemble and one semester of chamber music ensemble, chosen from the lists below, are required.

Large Ensembles:

MUSIC 111	Wind Ensemble	1
MUSIC 115	Symphonic Band	1
MUSIC 141	Lyrica Women's Choir	1
MUSIC 151	Oratorio Chorus	1
MUSIC 161	Iowa State Singers	1
MUSIC 181	Symphony Orchestra	1

Chamber music ensembles:

MUSIC 113	Jazz Ensemble	1
MUSIC 161	Iowa State Singers	1
MUSIC 301	Opera Studio	1-3
MUSIC 321	Advanced Ensemble	1

Continuation Examination

To be approved for continuation as a music major on the junior level, and enroll in Music 319, a student must pass a continuation examination taken normally at the end of the fourth semester as a music major. Before taking this examination, the student must complete the requisite forms as well as write an essay including:

1. his/her personal goals
2. a self-assessment of his/her progress thus far
3. an assessment of what he/she expects to accomplish before graduation

The student taking the Continuation Examination performs for a Continuation Examination Committee. Requirements include the performance of three works representing different periods or styles selected by, and studied with, the applied teacher, a self-prepared piece, and sight reading. The student must display acceptable solo ability and performance techniques in at least one of the applied areas. A written evaluation will be given each student following his/her performance. This evaluation will include a candid assessment of the student's potential to achieve his/her goals. In addition, the student may arrange to meet with members of the Continuation Examination Committee at a later date to discuss the results of his/her Continuation Examination. See Piano Proficiency below. For details and forms go to: http://www.music.iastate.edu

Piano Proficiency Requirement

All music majors must demonstrate proficiency in functional skills at the piano. Keyboard music majors (students whose primary instrument is piano or organ) accomplish this through courses in their curricula. All other students accomplish this by satisfactorily completing Music 228.All entering non-keyboard music majors with previous piano experience meet with the class piano instructor, usually the week before classes start in the fall semester, to determine the appropriate piano class (127, 128, 227, 228) for their initial piano enrollment. Some students are deemed to have met the piano proficiency at this time. Non-keyboard music majors with no previous piano experience should enroll in Music 127, Class Piano I. Continuous enrollment in piano classes is REQUIRED until successful completion of the piano proficiency requirement. **Important:** The piano proficiency must be met, either through completion of Music 228 or demonstration of proficiency, to pass the continuation examination. Failure to do so could delay a student's graduation. All students must fulfill the piano proficiency requirement in order to pass the continuation examination and enroll in Music 319.

Graduation Proficiency

To be recommended for graduation, a music student should demonstrate to the music faculty mature acquaintance with performance styles, technique, and repertoire. All music majors will participate in departmental recitals to the satisfaction of the department. Candidates for the bachelor of music degree will present a graduation recital.

* The LAS College requires a grade of C or better in ENGL 250 (or ENGL 250H). In addition the Communication Proficiency must be certified through one of the following options:

1. Certification of writing skills, by the instructor, after completion of one of the following:

MUSIC 120	Introduction to Music Literature and Styles	3
MUSIC 383	History of Music I	3
MUSIC 384	History of Music II	3
MUSIC 472	History of American Music	3
MUSIC 473	Music of the Baroque and Classical Eras	3
MUSIC 475	Music of the Romantic Era	3

(Passing one of these courses does not automatically satisfy the requirements for Communication Proficiency.)

2. Satisfactory completion of an advanced writing course:

ENGL 302	Business Communication	3
ENGL 305	Creative Writing: Nonfiction	3
ENGL 314	Technical Communication	3

Learning Outcomes and Assessment

Music graduates will understand and demonstrate:

1. Knowledge of music cultural heritage and history
2. Appreciation for musical creativity, reasoning, and the aesthetic value of music
3. Knowledge of organization and structures of music
4. Analytical skills necessary for listening, performing, and teaching
5. Skills necessary to perform music from a variety of periods, styles, and genres
6. Necessary abilities to communicate ideas musically, verbally, and in writing
7. Awareness of the diversity of musical ideas throughout the world's cultures
8. For Music Education students: success in meeting the ISU Teaching Standards as outlined by the University Teacher Education Program

Assessment measures include the continuation examination, graduating senior surveys and exit interviews, public performances, senior projects, course grades, teacher certification (for music education students), and the National Association of Schools of Music accreditation review.

Minor in Music

Candidates for the minor in music will complete 19 credits in music including:

MUSIC 224	Music Theory I	3
MUSIC 234	Music Theory II	3
Two of the following		6
MUSIC 102	Introduction to Music Listening	
MUSIC 120	Introduction to Music Literature and Styles	
or MUSIC 302	Masterpieces of Music and Art in Western Culture.	
MUSIC 304	History of American Rock 'n' Roll	
MUSIC 383	History of Music I	
4 credits chosen from the following		4
MUSIC 111	Wind Ensemble	
MUSIC 113	Jazz Ensemble	
MUSIC 115	Symphonic Band	
MUSIC 141	Lyrica Women's Choir	
MUSIC 151	Oratorio Chorus	
MUSIC 161	Iowa State Singers	
MUSIC 181	Symphony Orchestra	
MUSIC 301	Opera Studio	
MUSIC 321	Advanced Ensemble	
MUSIC 118	Applied Music: Non-majors	
MUSIC 318	Applied Music: Non-majors	
MUSIC 290F	Special Problems: Applied Music	

At least 6 of the 19 credits must be in courses numbered 300 and above taken at ISU with a grade of C or better. The minor must include at least 9 credits that are not used to meet any other department, college, or university requirement.

Students pursuing a music minor must meet the audition requirements and/or prerequisites for all courses they wish to take.

Minor in Music Technology

Candidates for the minor in music technology will complete 15 credits including:

MUSIC 246	Introduction to Creative Digital Music	2
MUSIC 346	Computer Music Programming Design	3
MUSIC 446	Sound Synthesis Design for Electronic Music	3
7 credits from the following		7
COM S 107	Applied Computer Programming	
COM S 207	Fundamentals of Computer Programming	
or COM S 22	Introduction to Object-oriented Programming	
COM S 208	Intermediate Computer Programming	
COM S 228	Introduction to Data Structures	
COM S 309	Software Development Practices	
COM S 327	Advanced Programming Techniques	
CPR E 329	Software Project Management	
E E 201	Electric Circuits	
E E 224	Signals and Systems I	
E E 324	Signals and Systems II	
M E 451	Engineering Acoustics	
PHYS 198	Physics of Music	
S E 319	Software Construction and User Interfaces	
MUSIC 101	Fundamentals of Music	
or MUSIC 10	Basic Musicianship	
MUSIC 102	Introduction to Music Listening	
MUSIC 118	Applied Music: Non-majors	
MUSIC 120	Introduction to Music Literature and Styles	
or MUSIC 302	Masterpieces of Music and Art in Western Culture.	
MUSIC 224	Music Theory I	
MUSIC 225	Aural Theory I	
MUSIC 234	Music Theory II	
MUSIC 235	Aural Theory II	
MUSIC 290F	Special Problems: Applied Music	
MUSIC 304	History of American Rock 'n' Roll	
MUSIC 318	Applied Music: Non-majors	
MUSIC 383	History of Music I	
MUSIC 384	History of Music II	
MUSIC 472	History of American Music	
MUSIC 490I	Independent Study: Electronic Music	
Total Credits		15

Music courses that may be taken by music majors to meet the requirements for the Music Technology minor are limited to the following:

MUSIC 246	Introduction to Creative Digital Music	2
MUSIC 346	Computer Music Programming Design	3
MUSIC 446	Sound Synthesis Design for Electronic Music	3
MUSIC 490I	Independent Study: Electronic Music	arr †
MUSIC 590I	Special Topics: Electronic Music	arr †

† Arranged with instructor.

At least six of the fifteen credits must be taken at Iowa State University in courses numbered 300 or above with a grade of C or higher. The minor must include at least nine credits not used to meet any other department, college, or university requirement. Students pursuing a minor in music technology must meet the audition requirements and/or prerequisites for all music courses they wish to take.

Music, B.A.

Freshman

Fall	Credits	Spring	Credits
MUSIC 119	2	MUSIC 119	2
MUSIC 127[1]	1	MUSIC 120	3
MUSIC 224	3	MUSIC 128	1
MUSIC 225	2	MUSIC 234	3
Music ensemble [2]	1	MUSIC 235	1
ENGL 150	3	Music ensemble[3]	1
LIB 160	1	Arts & Humanities	3
MATH	3		
	16		14

Sophomore

Fall	Credits	Spring	Credits
MUSIC 219	2	MUSIC 219	2
MUSIC 227[1]	1	MUSIC 228[1]	1
MUSIC 334	3	MUSIC 344	3
MUSIC 335	1	MUSIC 345	1
MUSIC 383	3	MUSIC 384	3
Music: ensemble[2]	1	Music: Ensemble[2]	1
ENGL 250	3	Social Science	3
		Elective	2

		(Continuation Examination)	
	14		16

Junior

Fall	Credits	Spring	Credits
MUSIC 319	2	World Language/Elective	4
Music Elective	3	Arts & Humanities	3
World Language/Elective	4	Natural Science	3
Natural Science	3	Electives	6
Social Science	3		
	15		16

Senior

Fall	Credits	Spring	Credits
Music Elective	1	Natural Science	2
Arts & Humanities	3	Electives	12
Social Science	3		
Electives	9		
	16		14

1 A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses. Students with a concentration in piano or organ do not take Class Study in Piano. Students not required to take four semesters of class piano will take additional music elective credits.

2 Four credits chosen from the following ensembles are required: 111, 113, 115, 141, 151, 161, 191, 321.

3 ENGL 150 requires concurrent enrollment in LIB 160.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.** The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (http://www.las.iastate.edu/academics/generaleducation/index.shtml) All ISU students must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. A list of approved courses can be found at:: (http://www.registrar.iastate.edu/courses/div-ip-guide.html (http://www.registrar.iastate.edu/courses/div-ip-guide.html)) The courses taken to meet these requirements may also be used to meet other requirements.

Scheduling of the general education requirements where specific courses are not indicated can be flexible. Music courses are best kept in the order/semesters indicated. (Most music courses are offered on semester each year.)

B.Mus. - organ

B.Mus. - piano

B.Mus. - strings

B.Mus. - wind or percussion instrument

Music, B.Mus. - Instrumental: K-12 Certification

Freshman

Fall	Credits	Spring	Credits
MUSIC 119	2	MUSIC 119	2
MUSIC 127[1]	1	MUSIC 120	3
MUSIC 224	3	MUSIC 128[1]	1
MUSIC 225	2	MUSIC 234	3
Ensemble	1	MUSIC 235	1
ENGL 150[c]	3	MUSIC 351/354/355[**]	1-2
LIB 160[c]	1	MUSIC 358B	0
Gen. Ed. (American History)	3	Ensemble	1
Gen. Ed. (Math)	3	PSYCH 230	3
		MUSIC 266[c]	2
		Apply to Teacher Education Program	
		MUSIC 280K	0.5
	19		17.5-18.5

Sophomore

Fall	Credits	Spring	Credits
MUSIC 219	2	MUSIC 219	2
MUSIC 227	1	MUSIC 228[1]	1
MUSIC 334	3	MUSIC 344	3
MUSIC 335	1	MUSIC 345	1
MUSIC 350/352/353[**]	1	MUSIC 351/354/355[**]	1-2
MUSIC 358B	0	MUSIC 358B	0
MUSIC 383	3	MUSIC 384	3
Ensemble	1	Ensemble	1
ENGL 250	3	SP CM 212	3
PHYS 198[fall only]	3	MUSIC 248	2
C I 204	3	MUSIC 368 (odd springs) or MUSIC 364 (even springs) or MUSIC 490A (arr.)[++]	1-2
		Continuation Exam	
	21		18-20

Junior

Fall	Credits	Spring	Credits
MUSIC 319	2	MUSIC 319	2
MUSIC 350/352/353[**]	1	MUSIC 351/354/355[**]	1-2
MUSIC 358B	0	MUSIC 362B	2
MUSIC 361	2	MUSIC 358B	0
MUSIC 366[c]	2	MUSIC 480K	1

MUSIC 480K	1	MUSIC 368 (odd springs) or MUSIC 464 (even springs) or MUSIC 490 (arr.)++	1-2
Adv. History or Theory*	3	Adv. History or Theory*	3
Ensemble	1	Ensemble	1
SP ED 401c	3	World Language	4
PSYCH/C I 333	3	C I 406	3
World Language	4		
	22		18-20

Senior

Fall	Credits	Spring	Credits
MUSIC 419	2	MUSIC 417S	8
MUSIC 350/352/353**	1	MUSIC 417R	8
MUSIC 358B	0		
MUSIC 466	2		
MUSIC 356			
Ensemble	1		
Gen. Ed. - Science	3		
C I 426	3		
MUSIC 480KC	1		
Gen. Ed. - Humanities	3		
MUSIC 420	0		
	16		16

1 A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses. Students with a concentration in piano or organ do not take Class Study in Piano.

** Students should take the major area (WW or brass) with which they are lest familiar first to gain more experience in lab band. However, WW players planning to gain additional skills on a 2nd WW, might choose to take that area first. Non-WW players should take 351 before 352. 358B must be taken concurrently with each tech course (350-355).

++ Alternate year courses. String players take 490B and 464. WW and brass players take 368 and 464.

c These courses which appear in the same semester must be taken concurrently.

The LAS world language requirement must be met. The U.S. diversity and international perspectives requirements are automatically met with courses required for this degree option (C I 406 and MUSIC 383).

Many general education and education (C I = Curriculum and Instruction) courses can easily be taken in different semesters than indicated as well as summer. Music courses are best kept in the order/semesters indicated (Most music courses are offered on semester each year).

Music, B.Mus. - organ

Freshman

Fall	Credits	Spring	Credits
ENGL 150c	3	Humanities	3
MUSIC 119C	2	Social Science	3
MUSIC 224	3	MUSIC 120	3
MUSIC 225	2	MUSIC 119C	2
Music Ensemble	1	MUSIC 234	3
Math/Natural Science	3	MUSIC 235	1
Social Science	3	Music Ensemble	1
LIB 160	1		
	18		16

Sophomore

Fall	Credits	Spring	Credits
MUSIC 219C	2	MUSIC 219C	2
MUSIC 334	3	MUSIC 384	3
MUSIC 335	1	MUSIC 344	3
MUSIC 383	3	MUSIC 345	1
Music Ensemble	1	Music Ensemble	1
PHYS 198	3	Humanities	3
ENGL 250	3	General Education Elective	3
		MUSIC 327 (Continuation Examiniation)	2
	16		18

Junior

Fall	Credits	Spring	Credits
MUSIC 119B	1	MUSIC 119B	1
MUSIC 319C	3	MUSIC 319C	3
MUSIC 361	2	MUSIC 415C	2
Music History/Theory - 400 Level*	3	Music History/Theory - 400 Level*	3
Music Ensemble	1	Music Ensemble	1
World Language/Elective	4	World Language/Elective	4
		Math/Natural Science	3
	14		17

Senior

Fall	Credits	Spring	Credits
MUSIC 119B	1	MUSIC 119B	1
MUSIC 419C	3	MUSIC 419C	3
Music History/Theory - 400 Level*	3	Music History/Theory - 400 Level*	3
Music Ensemble	1	Music Ensemble	1
Second World Language	4	MUSIC 415C	3
General Education Elective	2	Second World Language	4
		MUSIC 420	0
	14		15

c ENGL 150 requires concurrent enrollment in LIB 160.

The BM degree requires a minimum of 124.5 credits, **including a minimum of 45 credits at the 300/400 level.** The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (http://www.las.iastate.edu/academics/generaleducation/index.shtml) All ISU students must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives (which is satisfied with MUSIC 383). A list of approved courses can be found at:: (http://www.registrar.iastate.edu/courses/div-ip-guide.html (http://www.registrar.iastate.edu/courses/div-ip-guide.html)) The courses taken to meet these requirements may also be used to meet other requirements.

Flexibility in scheduling. Many general education courses can easily be taken in different semesters than indicated. Music courses are best kept in the order/semesters indicated. (Most music courses are offered on semester each year.)

* Some advanced theory and history courses (organ major requires 2 of each) are not offered every semester. Semesters of offerings are listed in the course descriptions in the catalog at: http://www.music.iastate.edu/info/advising.

Music, B.Mus. - piano

Freshman

Fall	Credits	Spring	Credits
ENGL 150[c]	3	Humanities	3
MUSIC 119B	3	MUSIC 119B	3
MUSIC 224	3	MUSIC 234	3
MUSIC 225	2	MUSIC 235	1
Music Ensemble	1	MUSIC 120	3
LIB 160	1	Music Ensemble	1
Math/Natural Science	3		
	16		14

Sophomore

Fall	Credits	Spring	Credits
MUSIC 219B	3	MUSIC 219B	3
MUSIC 334	3	MUSIC 344	3
MUSIC 335	1	MUSIC 345	1
MUSIC 383	3	MUSIC 384	3
Music Ensemble	1	Music Ensemble	1
ENGL 250	3	Elective	2
Elective	2	MUSIC 327	2
		MUSIC 321	1
		(Continuation Examination)	
	16		16

Junior

Fall	Credits	Spring	Credits
MUSIC 319B	3	MUSIC 319B	3
MUSIC 321	1	MUSIC 321	1
MUSIC 361	2	MUSIC 415B	3
Music History/Theory - 400 Level	3	Music History/Theory - 400 Level	3
Music Ensemble	1	Music Ensemble	1
PHYS 198	3	World Language/Elective	4
World Language/Elective	4		
	17		15

Senior

Fall	Credits	Spring	Credits
MUSIC 321	1	MUSIC 321	1
MUSIC 419B	3	MUSIC 419B	3
Music Ensemble	1	Music History/Theory - 400 Level*	3
General Education Elective	2	Math/Natural Science	3
General Education Elective	3	Humanities	3
Social Science	3	Social Science	3
MUSIC 415B	2	MUSIC 420	0
	15		16

c ENGL 150 requires concurrent enrollment in LIB 160.

The BM degree requires a minimum of 124.5 credits, **including a minimum of 45 credits at the 300/400 level.** The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (http://www.las.iastate.edu/academics/generaleducation/index.shtml) All ISU students must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives (which is satisfied with MUSIC 383). A list of approved courses can be found at:: (http://www.registrar.iastate.edu/courses/div-ip-guide.html (http://www.registrar.iastate.edu/courses/div-ip-guide.html)) The courses taken to meet these requirements may also be used to meet other requirements.

Flexibility in scheduling. Many general education courses can easily be taken in different semesters than indicated. Music courses are best kept in the order/semesters indicated. (Most music courses are offered on semester each year.)

* Some advanced theory and history courses (piano major requires 1 history, 2 theory) are not offered every semester. Semesters of offerings are listed in the course descriptions in the catalog at: http://www.music.iastate.edu/info/advising.

Music, B.Mus. - strings

Freshman

Fall	Credits	Spring	Credits
ENGL 150[c]	3	Humanities	3
MUSIC 119D	3	MUSIC 181	1
MUSIC 127[1]	1	MUSIC 119D	3
MUSIC 224	3	MUSIC 120	3
MUSIC 225	2	MUSIC 128[1]	1
MUSIC 181	1	MUSIC 234	3
Math/Natural Science	3	MUSIC 235	1
LIB 160	1		
	17		15

Sophomore

Fall	Credits	Spring	Credits
MUSIC 219D	3	MUSIC 219D	3
MUSIC 227[1]	1	MUSIC 228[1]	1
MUSIC 334	3	MUSIC 321D	1
MUSIC 335	1	MUSIC 344	3
MUSIC 383	3	MUSIC 345	1
MUSIC 181	1	MUSIC 384	3
ENGL 250	3	MUSIC 181	1
		Social Science	3
		(Continuation Examination)	
	15		16

Junior

Fall	Credits	Spring	Credits
MUSIC 321D	1	MUSIC 419D	3
MUSIC 319D	3	MUSIC 321D	1
MUSIC 361	2	Music History/Theory - 400 Level[*]	3
MUSIC 415D	2	MUSIC 181	1
Music History/Theory - 400 Level[*]	3	World Language/Elective	4
MUSIC 181	1	Math/Natural Science Choice	3
World Language/Elective	4		
	16		15

Senior

Fall	Credits	Spring	Credits
MUSIC 321D	1	MUSIC 181	1
MUSIC 419	3	MUSIC 321D	1
MUSIC 181	1	MUSIC 415D	2
PHYS 198	3	MUSIC 419D	3
Social Science	3	Music History/Theory - 400 Level[*]	3
General Education Elective	3	Humanities	3
Elective	2	General Education Elective	2
		MUSIC 420	0
	16		15

[1] A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses. Students not required to take four semesters of class piano will take additional music elective credits.

[c] ENGL 150 requires concurrent enrollment in LIB 160.

The BM degree requires a minimum of 124.5 credits, **including a minimum of 45 credits at the 300/400 level.** The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (http://www.las.iastate.edu/academics/generaleducation/index.shtml) All ISU students must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives (which is satisfied with MUSIC 383). A list of approved courses can be found at:: (http://www.registrar.iastate.edu/courses/div-ip-guide.html (http://www.registrar.iastate.edu/courses/div-ip-guide.html)) The courses taken to meet these requirements may also be used to meet other requirements.

Flexibility in scheduling. Many general education courses can easily be taken in different semesters than indicated. Music courses are best kept in the order/semesters indicated. (Most music courses are offered on semester each year.)

* Some advanced theory and history courses (string major requires 1 history, 2 theory) are not offered every semester. Semesters of offerings are listed in the course descriptions in the catalog at: http://www.music.iastate.edu/info/advising.

Music, B.Mus. - wind or percussion instrument

Freshman

Fall	Credits	Spring	Credits
ENGL 150[c]	3	Arts and Humanites	3
MUSIC 119	3	Music Ensemble	1
MUSIC 127[1]	1	MUSIC 119	3
MUSIC 224	3	MUSIC 120	3
MUSIC 225	2	MUSIC 128[1]	1
Music Ensemble	1	MUSIC 234	3
Social Science	3	MUSIC 235	1
LIB 160[c]	1		
	17		15

Sophomore

Fall	Credits	Spring	Credits
MUSIC 219	3	MUSIC 219	3
MUSIC 227[1]	1	MUSIC 228[1]	1
MUSIC 334	3	MUSIC 344	3
MUSIC 335	1	MUSIC 345	1
MUSIC 383	3	MUSIC 384	3
Music Ensemble	1	Music Ensemble	1
ENGL 250	3	General Education Elective (Continuation Examination)	3
	15		15

Junior

Fall	Credits	Spring	Credits
MUSIC 319	3	MUSIC 319	3
MUSIC 361	2	MUSIC 321	1
MUSIC 415[2]	2	MUSIC 415[2]	2
Music History/Theory - 400 Level*	3	Music History/Theory - 400 Level*	3
Music Ensemble	1	Music Ensemble	1
World Language/Elective	4	World Language/Elective	4
Music 300+ level	3	Math/Natural Science	3
	18		17

Senior

Fall	Credits	Spring	Credits
MUSIC 321	1	MUSIC 321	1
MUSIC 419	3	MUSIC 419	3
Music Ensemble	1	Music History/Theory - 400 Level*	3
Elective	2	Arts & Humanities	3
PHYS 198	3	Math/Natural Science	3
Social Science	3	MUSIC 420	0
General Education Elective	2		
	15		13

[1] A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses. Students with a concentration in piano or organ do not take Class Study in Piano. Students not required to take four semesters of class piano will take additional elective credits.

[c] ENGL 150 requires concurrent enrollment in LIB 160.

The BM degree requires a minimum of 124.5 credits, **including a minimum of 45 credits at the 300/400 level.** The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (http://www.las.iastate.edu/academics/generaleducation/index.shtml) All ISU students must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives (which is satisfied with MUSIC 383). A list of approved courses can be found at:: (http://www.registrar.iastate.edu/courses/div-ip-guide.html (http://www.registrar.iastate.edu/courses/div-ip-guide.html)) The courses taken to meet these requirements may also be used to meet other requirements.

Flexibility in scheduling. Many general education courses can easily be taken in different semesters than indicated. Music courses are best kept in the order/semesters indicated. (Most music courses are offered on semester each year.)

* Some advanced theory and history courses (wind or percussion major requires 1 history, 2 theory) are not offered every semester. Semesters of offerings are listed in the course descriptions in the catalog at: http://www.music.iastate.edu/info/advising .

B.Mus. - voice

Music, B.Mus. - vocal: K-12 certification

Freshman

Fall	Credits	Spring	Credits
MUSIC 119	2	MUSIC 119	2
MUSIC 127[1]	1	MUSIC 120	3
MUSIC 224	3	MUSIC 128[1]	1

MUSIC 225	2 MUSIC 234	3
Choral Ensemble	1 MUSIC 235	1
MUSIC 358A[2]	0 Choral Ensemble	1
ENGL 150[c]	3 MUSIC 358A[2]	0
HIST 221	3 SP CM 212[c]	3
Math course	3 MUSIC 266[c]	2
LIB 160[c]	1 MUSIC 280K	0.5
	19	16.5

Sophomore

Fall	Credits	Spring	Credits
MUSIC 219	2	MUSIC 219	2
MUSIC 227[1]	1	MUSIC 228[1]	1
MUSIC 334	3	MUSIC 248	2
MUSIC 335	1	MUSIC 344	3
MUSIC 361 (even falls) or PSYCH 230 (off falls)[++]	2-3	MUSIC 345	1
MUSIC 383	3	Choral Ensemble	1
Choral Ensemble	1	MUSIC 360[(even springs)++]	2
MUSIC 358A[2]	0	MUSIC 362A (odd springs) or MUSIC 367 (even springs)[++]	2
ENGL 250	3	MUSIC 384	3
C I 204	3	PSYCH 230 (odd springs) or C I 333 (even springs)	3
PHYS 198	3	MUSIC 358A[2]	0
		Continuation Exam	
	22-23		20

Junior

Fall	Credits	Spring	Credits
MUSIC 319	2	MUSIC 319	2
Choral Ensemble	1	MUSIC 327	2
MUSIC 366[c]	2	Choral Ensemble	1
MUSIC 480K[c]	1	Adv. History/Theory[*]	3
Adv. History/Theory[*]	3	MUSIC 360	2
MUSIC 358A[2]	0	MUSIC 362A (odd springs) or MUSIC 367 (even spring)[++]	2
MUSIC 361 (even falls) or C I 333 (odd falls)[++]	2-3	MUSIC 358A[+]	0
SP ED 401[c]	3	MUSIC 480K	1
World Language		World Language	
		General Education - Science	3
	14-15		16

Senior

Fall	Credits	Spring	Credits
MUSIC 419	2	MUSIC 417R	8
MUSIC 466[c]	2	MUSIC 417S	8
Choral Ensemble	1		
MUSIC 301	3		
MUSIC 465	2		
MUSIC 358A[2]	0		
Humanities Requirement	3		
C I 426	3		
MUSIC 480K[c]	1		
C I 406	3		
MUSIC 420	0		
	20		16

[1] A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses. Students with a concentration in piano or organ do not take Class Study in Piano.

[2] Lab Ensemble is required every semester offered: Fall and odd springs.

[c] These courses which appear in the same semester must be taken concurrently.

[++] Alternate year courses: The usual semester of offering is indicated by the calendar year (odd or even) of the semester. Consult the current catalog and the department web site for up-to-date information about semesters courses are offered. Psych 230 and C I 333 are offered every semester; when they are taken is determined by the schedules o the alternate year music courses.

The LAS World Language requirements must be met. The U.S. diversity and international perspectives requirements are automatically met with courses required for this degree option (C I 406 and MUSIC 383).

[*] **Advanced theory and history** courses (music education major requires 1 history, 1 theory) are not offered every semester. Semesters of offerings are listed in the course descriptions in the catalog at: http://www.music.iastate.edu/info/advising.

Flexibility in scheduling. Many general education courses can easily be taken in different semesters than indicated. Music courses are best kept in the order/semesters indicated (Most music courses are offered on semester each year).

Music, B.Mus. - voice

Freshman

Fall	Credits	Spring	Credits
ENGL 150[c]	3	Humanities	3
MUSIC 119A	2	Social Science	3

MUSIC 127[1]	1	MUSIC 119A	2
MUSIC 224	3	MUSIC 120	3
MUSIC 225	2	MUSIC 128[1]	1
Music Ensemble	1	MUSIC 234	3
Math/Natural Science	3	MUSIC 235	1
LIB 160	1	Music Ensemble	1
	16		17

Sophomore

Fall	Credits	Spring	Credits
MUSIC 219A	2	MUSIC 219A	2
MUSIC 227[1]	1	MUSIC 228[1]	1
MUSIC 334	3	MUSIC 344	3
MUSIC 335	1	MUSIC 345	1
MUSIC 383	3	MUSIC 384	3
Music Ensemble	1	Music Ensemble	1
PHYS 198	3	Humanities	3
ENGL 250	3	General Education Elective (Continuation Examination)	3
	17		17

Junior

Fall	Credits	Spring	Credits
MUSIC 319A	3	MUSIC 319A	3
MUSIC 324 or 415A[2]	2	MUSIC 325 or 360[2]	2
MUSIC 361	2	MUSIC 327	2
Music History/Theory - 400 Level	3	Music History/Theory - 400 Level*	3
Music Ensemble	1	Music Ensemble	1
World Language/Elective	4	World Language/Elective	4
		Math/Natural Science	3
	15		18

Senior

Fall	Credits	Spring	Credits
MUSIC 419A	3	MUSIC 419A	3
MUSIC 119B	1-3	MUSIC 119B	1-3
MUSIC 415A or 324[2]	2	Music History/Theory - 400 Level*	3
Music Ensemble	1	MUSIC 360 or 325[2]	2
Second World Language	4	Music Ensemble	1
Social Science	3	Second World Language	4
General Education Elective	2	MUSIC 420	0
	16-18		14-16

[1] A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses.

[2] MUSIC 324 alternate Fall (even numbered years) / MUSIC 325 alternate Spring (odd number years -- same academic year; MUSIC 360 alternate Spring (even numbered years) when 325 is not taught.

[c] ENGL 150 requires concurrent enrollment in LIB 160.

The BM degree requires a minimum of 124.5 credits, **including a minimum of 45 credits at the 300/400 level.** The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (http://www.las.iastate.edu/academics/generaleducation/index.shtml) All ISU students must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives (which is satisfied with MUSIC 383). A list of approved courses can be found at:: (http://www.registrar.iastate.edu/courses/div-ip-guide.html (http://www.registrar.iastate.edu/courses/div-ip-guide.html)) The courses taken to meet these requirements may also be used to meet other requirements.

Flexibility in scheduling. Many general education courses can easily be taken in different semesters than indicated. Music courses are best kept in the order/semesters indicated. (Most music courses are offered on semester each year.)

* Some advanced theory and history courses (voice major requires 1 history, 2 theory) are not offered every semester. Semesters of offerings are listed in the course descriptions in the catalog at: http://www.music.iastate.edu/info/advising.

Music, B.Mus.-composition

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	Math/Natural Science	3
MUSIC 119	2	One credit:	1
One credit:	1	MUSIC 290C	
MUSIC 290C		MUSIC 119	2
MUSIC 127	1	MUSIC 120	3
MUSIC 224	3	MUSIC 128	1
MUSIC 225	2	MUSIC 234	3
Music Ensemble	1	MUSIC 235	1
Social Science	3	Music Ensemble	1
LIB 160	1		
	17		15

Sophomore

Fall	Credits	Spring	Credits
MUSIC 219	2	MUSIC 219	2
MUSIC 227	1	MUSIC 228	1

MUSIC 383	3	MUSIC 344	3
MUSIC 334	3	MUSIC 345	1
MUSIC 335	1	MUSIC 384	3
Music Ensemble	1	Music Ensemble	1
One credit:	1	One credit:	1
MUSIC 290C		MUSIC 290C	
ENGL 250	3	MUSIC 246	2
		General Education Elective	3
		Continuation Examination	R
	15		17

Junior

Fall	Credits	Spring	Credits
MUSIC 319	1	MUSIC 319	1
MUSIC 361	2	MUSIC 362A or MUSIC 362B	2
Music History/Theory*	3	Music History/Theory*	3
Music Ensemble	1	Music Ensemble	1
Two credits:	2	Three credits:	3
MUSIC 490C		MUSIC 490C	
World Language Elective	4	Math/Natural Science	3
PHYS 198	3	World Language Elective	4
	16		17

Senior

Fall	Credits	Spring	Credits
MUSIC 419	1	MUSIC 419	1
Music History/Theory*	3	Music History/Theory*	3
Music Ensemble	1	Music ensemble	1
Three credits:	3	Four credits:	4
MUSIC 490C		MUSIC 490C	
Humanities	3	MUSIC 362A or 362B	2
Social Science	3	Humanities	3
General Education Elective	2	MUSIC 420 Junior/Senior Recital	R
	16		14

[1] A placement examination in keyboard skills determines the student's placement in the Class Study in Piano courses. Students with a concentration in piano or organ do not take Class Study in Piano. Students placing out of class piano may need to take additional elective credits to earn the required 124.5 cr. for the BM degree.

[2] ENGL 150 requires concurrent enrollment in LIB 160.

[3] Alternate year course, taught in odd number years, spring semester.

The BM degree requires a minimum of 124.5 credits, **including a minimum of 45 credits at the 300/400 level.** The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (http://www.las.iastate.edu/academics/generaleducation/index.shtml) All ISU students must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives (which is satisfied with MUSIC 383). A list of approved courses can be found at:: (http://www.registrar.iastate.edu/courses/div-ip-guide.html (http://www.registrar.iastate.edu/courses/div-ip-guide.html)) The courses taken to meet these requirements may also be used to meet other requirements.

Some advanced theory and history courses are not offered every semester. Semesters of offerings are listed int he course descriptions in the catalog. The BM in composition requires one advanced history course (3 cr.) and 9 credits of advanced theory from the following courses: 346, 440, 446, 490B, 590I. Advanced theory courses must include 346 or 446.

* The BM degree requires a minimum of 124.5 credits, **including a minimum of 45 credits at the 300/400 level.** The LAS World Language requirements must be met. Courses which may be used for the General Education Requirements can be found at: (http://www.las.iastate.edu/academics/generaleducation/index.shtml) All ISU students must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives (which is satisfied with MUSIC 383). A list of approved courses can be found at:: (http://www.registrar.iastate.edu/courses/div-ip-guide.html (http://www.registrar.iastate.edu/courses/div-ip-guide.html)) The courses taken to meet these requirements may also be used to meet other requirements.

Courses primarily for undergraduates:

MUSIC 101: Fundamentals of Music
(1-2) Cr. 2. F.S.
Prereq: Ability to read elementary musical notation
Notation, recognition, execution and analysis of scales, intervals, triads, and rhythm; key signatures; time signatures; transposition. Open to non-majors only.

MUSIC 102: Introduction to Music Listening
(3-0) Cr. 3. F.S.SS.
Expansion of the music listening experiences for the general student through greater awareness of differences in techniques of listening, performance media, and materials of the art. The course focuses on the elements of music: rhythm, melody, harmony, form, and style, and how these elements are used in musics of different cultures and time periods. Ability to read or perform music not required.
Meets International Perspectives Requirement.

MUSIC 105: Basic Musicianship
(1-4) Cr. 3. F.S.
Prereq: Performing arts major status or permission of instructor.
Beginning keyboard techniques, sight-reading, and ear training. Basic materials of music: notation, scales, intervals, key signatures, time signatures, rhythm, and harmony.

MUSIC 111: Wind Ensemble
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Emphasis on significant extended compositions for wind and percussion instruments. Performances include formal concerts on campus and the annual tour.

MUSIC 112: Concert Band
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Open to all students who have performed on a wind or percussion instrument in high school band or orchestra
Repertoire includes the broad spectrum of band music. Two concerts are presented each semester.

MUSIC 113: Jazz Ensemble
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Designed to explore various styles and trends in contemporary jazz.

MUSIC 114: Marching and Pep Bands
(0-5) Cr. 1. Repeatable.
Performances at athletic events.

MUSIC 114A: Marching and Pep Bands: Marching Band
(0-5) Cr. 1. Repeatable. F.
Membership determined by audition and band application. Auditions held for woodwind, brass, percussion, flag, and twirler positions. Presentation of pre-game and half time shows at each home football game; additional performances are also scheduled on and off campus. Audition information is listed on the band website (www.music.iastate.edu/org/marching). Students may not be concurrently enrolled in MUSIC 114A and 114C.

MUSIC 114B: Marching and Pep Bands: Pep Band
(0-5) Cr. 1. Repeatable. S.
Prereq: Students selected by audition from members of MUSIC 114A.
Performances at basketball games.

MUSIC 114C: Marching and Pep Bands: Pep Band for Wrestling and Soccer
(0-5) Cr. 1. Repeatable. F.
Prereq: Students selected by audition.
Performances at wrestling and women's soccer games. Students may not be concurrently enrolled in MUSIC 114A and 114C.

MUSIC 115: Symphonic Band
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Stresses high quality wind literature. Performances include formal concerts on campus.

MUSIC 118: Applied Music: Non-majors
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
Applied music for the general student.

MUSIC 118A: Applied Music: Non-majors: Voice
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118B: Applied Music: Non-majors: Piano
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118C: Applied Music: Non-majors: Organ
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118D: Applied Music: Non-majors: Strings
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118E: Applied Music: Non-majors: Carillon
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118F: Applied Music: Non-majors: Woodwinds
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118G: Applied Music: Non-majors: Brass
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118I: Applied Music: Non-majors: Percussion
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 118K: Applied Music: Non-majors: Harpsichord
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 119: Applied Music for Majors
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
Applied music for music majors.

MUSIC 119A: Applied Music for Majors: Voice
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119B: Applied Music for Majors: Piano
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119C: Applied Music for Majors: Organ
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119D: Applied Music for Majors: Strings
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119E: Applied Music for Majors: Carillon
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119F: Applied Music for Majors: Woodwinds
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119G: Applied Music for Majors: Brass
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119I: Applied Music for Majors: Percussion
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 119K: Applied Music for Majors: Harpsichord
(0.5-2) Cr. 1-3. Repeatable. F.S.SS.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 120: Introduction to Music Literature and Styles
(3-0) Cr. 3. S.
Prereq: MUSIC 224; music major status or permission of instructor
Directed studies via aural analysis for music majors with emphasis on the materials of music, form and aesthetic issues. Introduction to style and literature of the major performance media in context of historical chronology. Fundamentals of score reading and performance terminology. Only one of Music 120 and 302 can count toward graduation.

MUSIC 127: Class Study in Piano I
(0-2) Cr. 1. F.S.
Prereq: Music major status or permission of instructor
Beginning keyboard technique, transposition, harmonization, ensemble and solo repertory, and sight-reading skills.

MUSIC 128: Class Study in Piano II
(0-2) Cr. 1. F.S.
Prereq: MUSIC 127 or permission of instructor
Continuation of beginning keyboard technique, transposition, harmonization, ensemble and solo repertory, and sight-reading skills.

MUSIC 141: Lyrica Women's Choir
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all female students by audition
Large chorus; emphasis on fundamental vocal and choral skills, wide variety of literature. Campus concerts each semester.

MUSIC 151: Oratorio Chorus
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Advanced skills required, high quality literature. Campus concerts each semester, some concerts in conjunction with orchestras. Men's and women's choirs separately and in combination.

MUSIC 151A: Oratorio Chorus: Cantamus Women's Choir
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Advanced skills required, high quality literature. Campus concerts each semester, some concerts in conjunction with orchestras. Men's and women's choirs separately and in combination.

MUSIC 151B: Oratorio Chorus: Statesmen Men's Choir
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Advanced skills required, high quality literature. Campus concerts each semester, some concerts in conjunction with orchestras. Men's and women's choirs separately and in combination.

MUSIC 161: Iowa State Singers
(0-5) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Concert choir specializing in performance of advanced music literature, Renaissance through contemporary. Campus concerts, annual spring tour.

MUSIC 181: Symphony Orchestra
(0-4) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Reading, preparation, and performance of standard repertoire. Five or six concerts annually plus occasional off-campus appearances.

MUSIC 219: Applied Music: Majors
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
Applied music for music majors.

MUSIC 219A: Applied Music: Majors: Voice
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219B: Applied Music: Majors: Piano
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219C: Applied Music: Majors: Organ
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219D: Applied Music: Majors: Strings
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219E: Applied Music: Majors: Carillon
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219F: Applied Music: Majors: Woodwinds
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219G: Applied Music: Majors: Brass
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219I: Applied Music: Majors: Percussion
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 219K: Applied Music: Majors: Harpsichord
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 224: Music Theory I
(3-0) Cr. 3. F.
Prereq: Music major status or permission of instructor; concurrent enrollment in MUSIC 225 recommended
Brief review of music fundamentals including keys, modes, rhythm and meter. Two-voice species counterpoint as an introduction to voice-leading principles in diatonic harmony. Application of these materials in analysis and four-part writing. Introduction to Finale notation software and other technology used in the study of music.

MUSIC 225: Aural Theory I
(0-4) Cr. 2. F.
Prereq: Music major status or permission of instructor; credit or enrollment in MUSIC 224
Aural discrimination of intervals, rhythms and patterns, as demonstrated by proficiency in ear training, sight singing, and related musicianship skills.

MUSIC 227: Class Study in Piano III
(0-2) Cr. 1. F.S.
Prereq: MUSIC 128 or permission of instructor
Intermediate keyboard technique, transposition, harmonization, improvisation, repertory, and sight-reading skills. Introduction to score reading, hymn playing, and accompanying at the piano.

MUSIC 228: Class Study in Piano IV
(0-2) Cr. 1. F.S.
Prereq: MUSIC 227 or permission of instructor
Continuation of intermediate keyboard technique, transposition, harmonization, improvisation, repertory, score reading, hymn playing, and accompanying at the piano.

MUSIC 234: Music Theory II
(3-0) Cr. 3. S.
Prereq: MUSIC 224; concurrent enrollment in MUSIC 235 recommended
Harmonic and melodic materials of tonal music with an emphasis on diatonic harmony. Application of these materials in analysis and writing. Techniques of melodic construction, formal design, and harmonization.

MUSIC 235: Aural Theory II
(0-3) Cr. 1. S.
Prereq: MUSIC 225; credit or enrollment in MUSIC 234
Development of sight singing, ear training, and related musicianship skills with emphasis on diatonic harmonic and melodic materials as well as rhythm.

MUSIC 246: Introduction to Creative Digital Music
(2-0) Cr. 2. F.S.
Prereq: MUSIC 101, MUSIC 105, or MUSIC 224, or permission of instructor
Introduction to audio and MIDI software used in creating digital music. Includes fundamentals of audio waveform editing, processing, and mixing, MIDI data structures, practical projects in musical composition using a digital audio workstation.

MUSIC 248: Technology in Music Instruction
(2-0) Cr. 2. S.
Prereq: MUSIC 224 and MUSIC 225
Introduction to computer software applications used in musical arrangements and presentations, practical introduction to audio and MIDI technologies in lab-based music instruction, basic recording/sound reinforcement and music website management. Intended for Music Education Majors.

MUSIC 265: Music in Elementary Education
(2-0) Cr. 2. F.S.
Prereq: HD FS 102 or PSYCH 230
Experiencing and understanding the fundamentals of music through singing, playing classroom instruments, body movement, reading notation, listening, and creative activities. Developing lesson plan strategies and sequence, exploring multicultural musics, integrating music with other subjects in the elementary classroom, and evaluating aspects of musical learning.

MUSIC 266: Introduction to Music Education
(1-2) Cr. 2. S.
Prereq: Concurrent enrollment in MUSIC 280K
Required for first-year majors in music education. Historical, philosophical, and social foundations of music education; music curricula overview including goals of the music program, and contemporary and international curriculum development; psychology of teaching music including discipline techniques. Preparation for required observations in area schools.

MUSIC 280K: Pre-Student Teaching Experience I: Music
(Cross-listed with C I). Cr. 0.5. Repeatable. S.
Pre-student teaching experience in music in school settings. Permission of Music coordinator required prior to enrollment. Clinical Experience Level 1. Offered on a satisfactory-fail basis only.

MUSIC 290: Special Problems
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study.

MUSIC 290A: Special Problems: Education
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in music education.

MUSIC 290B: Special Problems: Theory
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent stud in music theory.

MUSIC 290C: Special Problems: Composition
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in music composition.

MUSIC 290D: Special Problems: History
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in music history.

MUSIC 290E: Special Problems: Literature
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in music literature.

MUSIC 290F: Special Problems: Applied Music
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in applied music.

MUSIC 290G: Special Problems: Conducting
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in conducting.

MUSIC 290H: Special Problems, Honors
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent honors project in music.

MUSIC 290J: Special Problems: Business
Cr. arr. Repeatable. F.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head
Independent study in music business.

MUSIC 301: Opera Studio
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Study of selected opera scenes, chamber operas, and works from contemporary and classical music theater. Basic stagecraft, role interpretation, production.

MUSIC 301A: Opera Studio: Opera/Operetta
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Study of selected opera scenes and chamber operas. Basic stagecraft, role interpretation, production.

MUSIC 301B: Opera Studio: Music Theater
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor
Study of selected works from contemporary and classical music theater. Basic stagecraft, role interpretation, production.

MUSIC 302: Masterpieces of Music and Art in Western Culture.
(3-0) Cr. 3. S.
Prereq: MUSIC 102
Exploration of several great works of classical music in light of the artistic culture in which they were composed; and trends in musical styles as well as individual composers' personalities over history through listening and discussion. Some concert attendance is required outside of class. An ability to read music is not required, but is recommended. Non-majors only. Only one of Music 120 and 302 can count toward graduation.

MUSIC 304: History of American Rock 'n' Roll
(3-0) Cr. 3. S.
Prereq: MUSIC 101, MUSIC 102, MUSIC 221, or MUSIC 222
Rock 'n' Roll from the mid 1950s through the 1990s, focusing on the development of rock styles from its roots in blues, folk, country, and pop. Expansion of listening experience through study of song forms, musical instruments of rock, and the socio-political significance of song lyrics. Examinations, research paper or in class presentation required. Ability to read or perform music not required.
Meets U.S. Diversity Requirement

MUSIC 318: Applied Music: Non-majors
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
Applied music for students other than music majors.

MUSIC 318A: Applied Music: Non-majors: Voice
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318B: Applied Music: Non-majors: Piano
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318C: Applied Music: Non-majors: Organ
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318D: Applied Music: Non-majors: Strings
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318E: Applied Music: Non-majors: Carillon
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318F: Applied Music: Non-majors: Woodwinds
(0.5-0) Cr. 1-2. Repeatable. F.S.SS.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318G: Applied Music: Non-majors: Brass
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318I: Applied Music: Non-majors: Percussion
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 318K: Applied Music: Non-majors: Harpsichord
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
(.5-0) for 1 cr. (1-0) for 2 cr. Applied music for the general student. Open only to non-majors. Will not satisfy applied music requirements for music majors.

MUSIC 319: Applied Music: Majors
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
Applied music for music majors.

MUSIC 319A: Applied Music: Majors: Voice
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319B: Applied Music: Majors: Piano
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319C: Applied Music: Majors: Organ
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319D: Applied Music: Majors: Strings
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319E: Applied Music: Majors: Carillon
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319F: Applied Music: Majors: Woodwinds
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319G: Applied Music: Majors: Brass
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319I: Applied Music: Majors: Percussion
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 319K: Applied Music: Majors: Harpsichord
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 321: Advanced Ensemble
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in chamber music ensembles that demand high proficiency.

MUSIC 321A: Advanced Ensemble: Voice
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321B: Advanced Ensemble: Piano
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321C: Advanced Ensemble: Organ
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321D: Advanced Ensemble: Strings
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321F: Advanced Ensemble: Woodwinds
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321G: Advanced Ensemble: Brass
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321I: Advanced Ensemble: Percussion
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 321J: Advanced Ensemble: Mixed instruments/voice
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Advanced proficiency and performing ability, permission of instructor
Performance in ensembles that demand high proficiency. Open to a limited number of undergraduate and graduate students.

MUSIC 324: English and Italian Diction for Singing
(2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: Credit or enrollment in MUSIC 118A or MUSIC 119A
The international phonetic alphabet and its application to correct pronunciation of English and Italian in singing.

MUSIC 325: French and German Diction for Singing
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Credit or enrollment in MUSIC 118A or MUSIC 119A
The international phonetic alphabet and its application to correct pronunciation of French and German in singing.

MUSIC 327: Functional Piano
(0-3) Cr. 2.
Emphasis on sight reading, three and four-part score reading, improvisation, accompanying, and advanced harmonization.

MUSIC 327A: Functional Piano: Keyboard majors.
(0-3) Cr. 2.
Prereq: MUSIC 228 or permission of instructor
Emphasis on sight reading, three and four-part score reading, improvisation, accompanying, and advanced harmonization.

MUSIC 327B: Functional Piano: Voice Majors
(0-3) Cr. 2. S.
Prereq: MUSIC 228 or permission of instructor
Emphasis on sight reading, three and four-part score reading, improvisation, accompanying, and advanced harmonization.

MUSIC 334: Music Theory III
(3-0) Cr. 3. F.
Prereq: MUSIC 234; concurrent enrollment in 335 recommended
Harmonic and melodic materials of tonal music with an emphasis on chromatic harmony. Application of these materials in analysis and writing. Techniques of melodic construction, formal design, and harmonization.

MUSIC 335: Aural Theory III
(0-2) Cr. 1. F.
Prereq: MUSIC 235; credit or enrollment in 334
Development of sight singing, ear training, and related musical skills with emphasis on melodic, harmonic and rhythmic materials from the eighteenth and nineteenth centuries.

MUSIC 344: Music Theory IV
(3-0) Cr. 3. S.
Prereq: MUSIC 334; concurrent enrollment in MUSIC 345 recommended
Writing and analysis based on musical styles since 1900.

MUSIC 345: Aural Theory IV
(0-2) Cr. 1. S.
Prereq: MUSIC 335; credit or enrollment in MUSIC 344
Development of sight singing, ear training, and related musical skills with emphasis on melodic, harmonic and rhythmic materials from the nineteenth and twentieth centuries.

MUSIC 346: Computer Music Programming Design
(3-0) Cr. 3. S.
Prereq: MUSIC 246 or permission of instructor
Programming and interface design for creative musical applications. Includes computer generation of music data, advanced MIDI data processing, practical projects in musical composition and performance using a visual programming language.

MUSIC 350: Instrumental Techniques: Strings
(0-2) Cr. 1. F.
Prereq: Instrumental music education majors: concurrent enrollment in MUSIC 358B. Limited to music majors
Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students.

MUSIC 351: Instrumental Techniques: Clarinet, Flute, Saxophone
(1-2) Cr. 2. S.
Prereq: Instrumental music education majors: concurrent enrollment in MUSIC 358B. Limited to music majors
Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students.

MUSIC 352: Instrumental Techniques: Oboe, Bassoon
(0-2) Cr. 1. F.
Prereq: MUSIC 351 or permission of instructor. Instrumental music education majors: concurrent enrollment in MUSIC 358B. Limited to music majors
Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students.

MUSIC 353: Instrumental Techniques: Trumpet, Horn
(0-2) Cr. 1. F.
Prereq: Instrumental music education majors: concurrent enrollment in MUSIC 358B. Limited to music majors
Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students.

MUSIC 354: Instrumental Techniques: Trombone, Baritone, Tuba
(0-2) Cr. 1. S.
Prereq: MUSIC 353 or permission of instructor. Instrumental music education majors: concurrent enrollment in MUSIC 358B. Limited to music majors
Techniques and skills required for teaching of instruments. Examination of materials for school use. Intended for instrumental music education students.

MUSIC 355: Instrumental Techniques: Percussion
(0-2) Cr. 1. S.
Prereq: Instrumental music education majors: concurrent enrollment in MUSIC 358B. Limited to music majors
Techniques and skills required to teach percussion instruments in the schools. Techniques for performing and teaching snare drum, keyboard percussion instruments, timpani, band and orchestral hand instruments, drum set, and Latin percussion. Intended for instrumental music education students.

MUSIC 358: Lab Ensemble
Cr. R. Repeatable.
Review and selection of appropriate literature for ensembles of differing levels and abilities; conducting and rehearsal experience. Intended for music education students.

MUSIC 358A: Lab Ensemble: Choral
Cr. R. Repeatable. F.Alt. S., offered odd-numbered years.
Sight singing, conducting, and accompanying experience in conjunction with 362A. Required of all vocal music education majors every semester offered.

MUSIC 358B: Lab Ensemble: Instrumental
Cr. R. Repeatable. F.S.
Performance on secondary instruments. Includes experiences with singing and vocal techniques. Required of all instrumental music education majors in those semesters when enrolled in 350, 351, 352, 353, 354, 355, or 362B. Offered on a satisfactory-fail basis only.

MUSIC 360: Voice Pedagogy
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: MUSIC 319A or vocal proficiency examination
Physical, acoustical, and musical properties of the vocal instrument, including a survey of important texts and articles on singing and voice production.

MUSIC 361: Conducting I
(1-2) Cr. 2. F.
Prereq: MUSIC 234, MUSIC 235, Music major status or permission of instructor
Introduction to conducting; score reading and analysis. Conveying musical ideas through appropriate gestures. Leadership role of the conductor.

MUSIC 362: Conducting II
(1-2) Cr. 2.

MUSIC 362A: Conducting II: Choral Conducting Techniques
(1-2) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Music major status or permission of instructor; MUSIC 361; concurrent enrollment in MUSIC 358A and MUSIC 141, MUSIC 151, or MUSIC 161.
Advanced baton technique, score preparation and interpretation of choral repertoire.

MUSIC 362B: Conducting II: Instrumental Conducting Techniques
(1-2) Cr. 2. S.
Prereq: Music major status or permission of instructor; MUSIC 361; concurrent enrollment in MUSIC 358B
Advanced baton technique. Score preparation. Specific problems of large instrumental ensembles.

MUSIC 366: Methods of Music Education
(2-0) Cr. 2. F.
Prereq: Concurrent enrollment (1 cr.) in MUSIC 480K and SP ED 401; MUSIC 266 and admission into teacher education.
Music education strategies and materials including development of appropriate objectives and plans for general music classes utilizing traditional and multicultural musics, evaluating musical learning; overview of Orff Schulwerk, Kodaly, and Dalcroze approaches; music in special education; required teaching in lab settings and observations in area schools.

MUSIC 367: Choral Literature
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: MUSIC 361 recommended
Overview of choral repertoire from the sixteenth century to the present, including accessible works for the young conductor.

MUSIC 368: Marching Band and Jazz Ensemble Techniques
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Credit or enrollment in MUSIC 362B recommended
Techniques and materials for teaching marching band in the high school; philosophy, computer assisted drill design, music analysis, band set up, and other related skills. Jazz style, articulation, phrasing, materials and teaching techniques for secondary school jazz ensembles.

MUSIC 374: Instrumental Methods for Vocalists
(1-0) Cr. 1. Repeatable, maximum of 15 credits. F.
Prereq: Music major status, MUSIC 280K, MUSIC 266 and admission into teacher education.
Techniques and skills required to teach instrumental music in K-12 schools. Introduction of instruments, score reading and transposition, rehearsal techniques, literature, resources and other related skills. Intended for vocal music education majors and required for Iowa teaching license.

MUSIC 375: Choral Methods for Instrumentalists
(1-0) Cr. 1. S.
Prereq: Music major status, MUSIC 280K, MUSIC 266 and admission into teacher education.
Techniques and skills required to teach vocal/choral music in K-12 schools. Vocal production and health, rehearsal techniques, repertoire, resources and other related skills. Intended for instrumental music education majors and required for Iowa teaching license.

MUSIC 383: History of Music I
(3-0) Cr. 3. F.
Prereq: MUSIC 120; music major status or permission of instructor
History of the stylistic and cultural development of music: Middle Ages through Baroque.
Meets International Perspectives Requirement.

MUSIC 384: History of Music II
(3-0) Cr. 3. S.
Prereq: MUSIC 383; music major status or permission of instructor
History of the stylistic and cultural development of music: Classical through contemporary music.
Meets International Perspectives Requirement.

MUSIC 415: Literature and Pedagogy in Applied Music
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415A: Literature and Pedagogy in Applied Music: Voice
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415B: Literature and Pedagogy in Applied Music: Piano
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415C: Literature and Pedagogy in Applied Music: Organ
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415D: Literature and Pedagogy in Applied Music: Strings
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415E: Literature and Pedagogy in Applied Music: Carillon
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415F: Literature and Pedagogy in Applied Music: Woodwinds
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415G: Literature and Pedagogy in Applied Music: Brass
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415I: Literature and Pedagogy in Applied Music: Percussion
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 415J: Literature and Pedagogy in Applied Music: Jazz Pedagogy and Performance
Cr. 1-4. Repeatable. F.S.
Prereq: Permission of instructor
Includes experience in technology relative to the particular discipline.

MUSIC 417: Student Teaching
Cr. 8-12. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

MUSIC 417R: Student Teaching: Music-Elementary
(Dual-listed with MUSIC 517R). (Cross-listed with C I). Cr. arr. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

MUSIC 417S: Student Teaching: Music-Secondary
(Dual-listed with MUSIC 517S). (Cross-listed with C I). Cr. arr. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

MUSIC 419: Applied Music: Majors
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
Applied music for music majors.

MUSIC 419A: Applied Music: Voice
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419B: Applied Music: Piano
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419C: Applied Music: Organ
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419D: Applied Music: Strings
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419E: Applied Music: Carillon
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419F: Applied Music: Woodwinds
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419G: Applied Music: Brass
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419I: Applied Music: Percussion
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 419K: Applied Music: Harpsichord
(1-2) Cr. 1-3. Repeatable. F.S.
Prereq: Audition, permission of instructor; restricted to music majors
(.5-2) for 1 cr. (1-2) for 2-3 cr. Minimum weekly practice of 5 hours per credit is expected. Weekly seminar required.

MUSIC 420: Junior/Senior Recital
Cr. R. Repeatable. F.S.SS.
Prereq: Advanced performing ability, permission of instructor, concurrent registration in Music 319 or 419.
Performance of advanced repertory in a public concert. Preparation of program notes. Offered on a satisfactory-fail basis only.

MUSIC 434: Applied Theory: Improvising and Arranging
(3-0) Cr. 3. S.
Prereq: MUSIC 344 and MUSIC 345
Practical uses for music theory. Emphasis on arranging for vocal and instrumental ensembles and creating improvisations on existing materials in a variety of styles.

MUSIC 440: Seminar in Music Theory
(3-0) Cr. 3. Repeatable. Alt. S., offered even-numbered years.
Prereq: MUSIC 344, MUSIC 345
Various topics in music theory including analysis, counterpoint, arranging, pedagogy, and psychology of music. Content will vary. Contact the Department of Music for the current year offering.

MUSIC 446: Sound Synthesis Design for Electronic Music
(3-0) Cr. 3. F.
Prereq: MUSIC 246 or permission of instructor
Digital sound synthesis structures for creative musical applications. Includes modular sound synthesis techniques, software synthesizer design, and practical projects in electronic music composition.

MUSIC 464: Instrumental Administration, Materials, and Methods
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: Credit or enrollment in MUSIC 362B recommended
Instructional materials and methods appropriate for teaching instrumental music in elementary, middle school, and high school music programs. Required observations in area schools. Intended for instrumental music education students.

MUSIC 465: Choral Materials and Methods
(2-0) Cr. 2. F.
Prereq: Concurrent enrollment in MUSIC 358A and MUSIC 141, MUSIC 151, or MUSIC 161
Instructional materials and methods appropriate for teaching choral music in the secondary school. Emphasis on pedagogy and rehearsal techniques. Required observations in area schools. Intended for vocal music education students.

MUSIC 466: Program Development and Evaluation in Music Education
(2-1) Cr. 2. F.
Prereq: Continuation Examination passed; MUSIC 362, MUSIC 366, concurrent enrollment (1 cr.) in MUSIC 480K
Developing a rationale for music education; music program development; evaluation of music curricula, programs and facilities; professional growth of the teacher; preparation for student teaching and the job market. Required observations in area schools.

MUSIC 472: History of American Music
(3-0) Cr. 3.
Prereq: Ability to read music; 9 credits from music, American literature, American history, art history
History and development of the sacred and secular music in North America from approximately 1600 to the present, exploring the diverse cultural backgrounds that have contributed to the variety of contemporary musical styles.
Meets U.S. Diversity Requirement

MUSIC 473: Music of the Baroque and Classical Eras
(3-0) Cr. 3.
Prereq: MUSIC 383, MUSIC 384
Offered F. 2011. Detailed survey of instrumental, vocal, choral, and keyboard music from 1600 to 1825.

MUSIC 475: Music of the Romantic Era
(3-0) Cr. 3.
Prereq: MUSIC 383, MUSIC 384
Offered F. 2012. Detailed survey of instrumental, vocal, choral, and keyboard music from 1825 to 1910.

MUSIC 476: Music of the Twentieth Century
(3-0) Cr. 3.
Prereq: MUSIC 383, MUSIC 384
Offered S 2013. Detailed survey of instrumental, vocal, choral, and keyboard music from 1900 to the present.

MUSIC 480: Pre-Student Teaching Experience III
(Cross-listed with C I). Cr. 0.5-2. Repeatable. F.S.
Prereq: Admission to Teacher Education
Observation and participation in a variety of school settings after admission to the teacher education program. Permission of area coordinator required prior to enrollment. (S/F grading may be used in some offerings of some sections.).

MUSIC 480K: Pre-Student Teaching Experience III: Music
(Cross-listed with C I). Cr. 1. Repeatable. F.S.
Prereq: Admission to teacher education
Participation in a K-12 school setting. Permission of Music coordinator required prior to enrollment. Clinical Experience Level 2. Offered on a satisfactory-fail basis only.

MUSIC 490: Independent Study
Cr. arr. Repeatable. F.S.S.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490A: Independent Study: Education
(Cross-listed with C I). Cr. arr. Repeatable. F.S.S.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490B: Independent Study: Theory
Cr. arr. Repeatable. F.S.S.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490C: Independent Study: Composition
Cr. arr. Repeatable. F.S.S.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490D: Independent Study: History
Cr. arr. Repeatable. F.S.S.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490E: Independent Study: Literature
Cr. arr. Repeatable. F.S.S.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490F: Independent Study: Applied Music
Cr. arr. Repeatable. F.S.S.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490G: Independent Study: Conducting
Cr. arr. Repeatable. F.S.S.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490H: Independent Study: Honors
Cr. arr. Repeatable. F.S.S.S.
Prereq: Permission of instructor; 12 credits in music, approval of department head

MUSIC 490I: Independent Study: Electronic Music
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor; 12 credits in music, approval of department head

Courses primarily for graduate students, open to qualified undergraduates:

MUSIC 517R: Student Teaching: Music-Elementary
(Dual-listed with MUSIC 417R). (Cross-listed with C I). Cr. arr. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

MUSIC 517S: Student Teaching: Music-Secondary
(Dual-listed with MUSIC 417S). (Cross-listed with C I). Cr. arr. F.S.
Prereq: Minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

MUSIC 590: Special Topics
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590A: Special Topics: Education
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590B: Special Topics: Theory
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590C: Special Topics: Composition
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590D: Special Topics: History
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590E: Special Topics: Literature
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590F: Special Topics: Applied Music
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590G: Special Topics: Conducting
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

MUSIC 590I: Special Topics: Electronic Music
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor, approval of department head

Theatre and Performing Arts

www.theatre.iastate.edu (http://www.theatre.iastate.edu)

(Administered by the Department of Music)

Performing Arts graduates will understand and demonstrate:

1. Knowledge of the cultural heritage and history of the Performing Arts
2. A theoretical and experiential background in the areas of performance, theatrical design, music, and dance
3. Knowledge of creative problem solving and artistic collaboration
4. Skills necessary to perform in or design for a variety of periods, styles, and genres in theatre and dance
5. Awareness of the diversity of expression in the Performing Arts throughout the world's cultures
6. A practical understanding of the rigors of the field.

Assessment measures include the semester exhibit of design work or audition pieces, graduating senior seminar and exit interviews, public performances or designs, course grades, exhibited convention work, and internship evaluations.

Undergraduate Study

Students interested in theatre as a major area of concentration declare a major in Performing Arts and select an emphasis in Theatrical Design or Acting/Directing. Students implement the theories and principles explored in the classroom by participating in production work. During the academic year, Iowa State University Theatre presents up to ten mainstage and second stage productions in Fisher Theater, and works in close collaboration with ISU Music and Dance.

The major in Performing Arts offers the undergraduate student a cross-disciplinary concentration in Music, Dance and Theatre. The core curriculum consists of 24 credits in the three areas. Students elect a 24-credit emphasis in either Dance, Theatrical Design or Acting/Directing. In addition to coursework, Performing Arts majors and minors participate in concert (Orchesis, Footfalls), workshop (Opera Studio, Minority Theatre Workshop) and production (Barchje, Stars Over Veishea, ISU Theatre/Music Theatre/Second Stage and Studio) experiences.

Performing Arts graduates, in addition to a solid theoretical and experiential background in the areas of performance, theatrical design, dance and music, are prepared to meet the challenges of the work force or graduate school with their strengths in collaboration, creative problem solving, meeting deadlines and processing diverse input to yield cohesive output. Two required professional internships prior to graduation are vital

to the student's appreciation and practical understanding of the rigors of the field.

The theatre area offers a wide variety of courses. Students may select from courses in acting, design (costume, scenic, lighting/sound), make-up, stage direction, playwriting, stage management, and theatre history. Independent study and special topics courses supplement formal course offerings to provide opportunities to intensify study in a particular aspect of theatre.

Auditions for ISU Theatre productions are open to all students irrespective of academic major. Similarly, participation in areas of production other than acting is open to both majors and nonmajors. Qualified students also present experimental, laboratory, and Minority Theatre Workshop productions. Student actors, directors, designers, and technical crew heads are required to maintain a grade point average of at least 2.0 to participate in productions.

Theatre scholarships are awarded on a yearly basis to students who make significant contributions to Iowa State University Theatre.

Graduate Study

The department offers graduate courses as supporting work in other fields.

Bachelor of Arts - Performing Arts Major (Perf)

The Core for the Performing Arts Major (24 cr)

(For individual Dance and Music course descriptions, see Index for individual department listing.)

MUSIC 101	Fundamentals of Music	2
MUSIC 102	Introduction to Music Listening	3
DANCE 120	Modern Dance I	1
DANCE 130	Ballet I	1
DANCE 220	Modern Dance Composition	2
DANCE 270	Dance Appreciation	3
THTRE 255	Introduction to Theatrical Production	4
THTRE 263	Script Analysis	3
THTRE 365	Theatrical Design I	3
PERF 105	Issues in the Performing Arts (six semesters)	R
PERF 310	Performing Arts Internship	R
PERF 401	Performing Arts Seminar	2

Emphasis in Theatrical Design (24 cr)

THTRE 250	Theatre Practicum	1-2
THTRE 360	Stagecraft	4
THTRE 366	Theatrical Design II	3
THTRE 455	Directing I	3
THTRE 461	Theatrical Design Studio	4
THTRE 465	History of Theatre I	3
THTRE 466	History of Theatre II	3

Emphasis in Dance (24 cr)

ART H 292	Introduction to Visual Culture Studies	3
DANCE 222	Modern Dance II	1
DANCE 224	Concert and Theatre Dance (take for 2 crs)	0.5-2
DANCE 232	Ballet II	1
DANCE 360	History and Philosophy of Dance	3
DANCE 370	Advanced Studies in Dance	1-3
KIN 355	Biomechanics	3
2 credits from the following		2
DANCE 140	Jazz I	
DANCE 150	Tap Dance I	
DANCE 160	Ballroom Dance I	
DANCE 211	Fundamentals and Methods of Social and World Dance (instead of 160, 170)	
2 credits from the following		2
DANCE 223	Modern Dance III	
DANCE 233	Ballet III	
DANCE 242	Jazz II	
3 credits from the following		3
DANCE 320	Sound and Movement	
DANCE 384	Teaching Children's Dance	
DANCE 385	Methods of Teaching Dance	
DANCE 386	Teaching Dance Technique and Composition	
All students enrolled in the Dance Emphasis must register for one dance technique course every semester of residence up to a total of 8 credits		8
One computer course		
COM S 103	Computer Applications	
COM S 107	Applied Computer Programming	
COM S 207	Fundamentals of Computer Programming	
C I 201	Learning Technologies in the PK-6 Classroom	

Emphasis in Acting/Directing (24 cr)

THTRE 151	The Actor's Voice	3
THTRE 250	Theatre Practicum (take for 2 crs)	1-2
THTRE 251	Acting I	3
THTRE 351	Acting II	3
THTRE 451	Acting III	3
THTRE 455	Directing I	3

THTRE 465	History of Theatre I	3
THTRE 466	History of Theatre II	3

Minor in Performing Arts (21 cr)

PERF 105	Issues in the Performing Arts (3 semesters)	R
MUSIC 101	Fundamentals of Music	2
MUSIC 102	Introduction to Music Listening	3
DANCE 120	Modern Dance I	1
or DANCE 130	Ballet I	
DANCE 270	Dance Appreciation	3
THTRE 255	Introduction to Theatrical Production	4
THTRE 263	Script Analysis	3
or THTRE 251	Acting I	
6 credits 300+ in DANCE, THTRE or PERF		6

Communication Proficiency requirement: Select one course from:

ENGL 302	Business Communication	3
ENGL 303	Free-Lance Writing for Popular Magazines	3
ENGL 304	Creative Writing: Fiction	3
ENGL 305	Creative Writing: Nonfiction	3
ENGL 306	Creative Writing: Poetry	3
ENGL 309	Proposal and Report Writing	3
ENGL 314	Technical Communication	3
ENGL 315	Creative Writing: Screenplays	3
ENGL 316	Creative Writing: Playwriting	3
ENGL 370	Shakespeare	3

Courses primarily for undergraduates:

PERF 105: Issues in the Performing Arts
(1-0) Cr. R. F.S.
Cross-disciplinary analysis and discussion of topics in the performing arts. Six semesters required of performing arts majors.

PERF 310: Performing Arts Internship
Cr. R. Repeatable. F.S.SS.
Required of performing arts majors. A job or internship with a professional or semi-professional performing arts organization. Offered on a satisfactory-fail basis only.

PERF 401: Performing Arts Seminar
(2-0) Cr. 2. S.
Intensive collaborative study and practice of topics in music, dance and theatre. Required of performing arts majors.

Courses primarily for undergraduates:

THTRE 106: Introduction to the Performing Arts
(3-0) Cr. 3. F.S.SS.
An audience oriented, broad-based, team-taught survey of the performing arts which emphasizes theatre and includes segments on television, radio, film, dance, and music.

THTRE 110: Theatre and Society
(3-0) Cr. 3. F.S.
An introduction to Theatre focusing on its relationship with society throughout history.

THTRE 151: The Actor's Voice
(3-0) Cr. 3. F.
Study and practice of fundamentals of vocal production: breathing, quality, articulation, projection, and expressiveness for the performing artist.

THTRE 224: Concert and Theatre Dance
(Cross-listed with DANCE). (0-3) Cr. 0.5-2. Repeatable, maximum of 6 credits. F.S.
Prereq: By audition only
Choreography, rehearsal, and performance in campus dance concerts and/or musical theatre productions. Offered on a satisfactory-fail basis only.

THTRE 250: Theatre Practicum
Cr. 1-2. Repeatable, maximum of 6 credits. F.S.
Prereq: Permission of instructor
Practice in various aspects of technical theatre production. Offered on a satisfactory-fail basis only.

THTRE 251: Acting I
(3-0) Cr. 3. F.S.
Theory and practice in fundamentals of acting.

THTRE 255: Introduction to Theatrical Production
(3-3) Cr. 4. F.S.
Standard structure and procedures, historical overview of performing arts production including the design and creation of scenery, costumes and lighting.

THTRE 263: Script Analysis
(3-0) Cr. 3. F.S.
Theory, analysis, and interpretation of play scripts for production.

THTRE 290: Special Projects
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: 3 credits in theatre; permission of instructor; approval of written proposal

THTRE 316: Creative Writing: Playwriting
(Cross-listed with ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 250, not open to freshmen
Progresses from production of scenes to fully developed one-act plays. Emphasis on action, staging, writing, analytical reading, workshop criticism, and individual conferences.

THTRE 351: Acting II
(3-0) Cr. 3. S.
Prereq: THTRE 251, DANCE 120 recommended
Theory and practice of techniques of acting with emphasis on character and scene analysis.

THTRE 354: Musical Theatre I
(2-2) Cr. 3.
Prereq: THTRE 251 or MUSIC 232 or 3 credits in Dance
Theory, history and practice of musical theatre techniques. Designed to develop the musical theatre performance skills of singers, dancers, and actors.

THTRE 355: Musical Theatre II
(2-2) Cr. 3.
Prereq: THTRE 354
Theory, history and practice of musical theatre techniques. Designed to develop the musical theatre performance skills of singers, dancers, and actors.

THTRE 357: Stage Make-up
(1-2) Cr. 2. F.
Theory and practice of make-up and hair-styling techniques for the performing arts: Theatre, Opera, Dance, Television and Film. Lab required.

THTRE 358: Oral Interpretation
(3-0) Cr. 3. F.
Principles of oral interpretation: practice in analysis, in reading aloud of literary selections, and in reader's theatre.

THTRE 360: Stagecraft
(3-2) Cr. 4. S.
Prereq: THTRE 255
Tools, materials, and techniques of planning, constructing and painting of performing arts scenography. Basic principles of lighting technology. Technical drawing for performing arts production.

THTRE 365: Theatrical Design I
(2-2) Cr. 3. F.
Prereq: THTRE 255
An exploration of the elements, principles and art of theatrical design.

THTRE 366: Theatrical Design II
(2-2) Cr. 3. S.
Prereq: THTRE 365
Intensive application of the principles introduced in 365. In-depth study and practice of the graphic skills of rendering and drafting.

THTRE 393: Studies in Theatre Design and Production Workshop
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Studies in Theatre Design and Production.

THTRE 393A: Studies in Theatre Design and Production Workshop: Costume Design
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics related to costume design.

THTRE 393B: Studies in Theatre Design and Production Workshop: Scenic Design
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics related to scenic design.

THTRE 393C: Studies in Theatre Design and Production Workshop: Lighting Design
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics in lighting design.

THTRE 393D: Studies in Theatre Design and Production Workshop: Sound Design
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics in sound design.

THTRE 393E: Studies in Theatre Design and Production Workshop: Stagecraft
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics in stagecraft.

THTRE 393F: Studies in Theatre Design and Production Workshop: Costume Draping and Patterning
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics in costume draping and patterning.

THTRE 393G: Studies in Theatre Design and Production Workshop: Advanced Makeup
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics related to advanced makeup.

THTRE 393I: Studies in Theatre Design and Production Workshop: Stage Management
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics related to stage management.

THTRE 393J: Studies in Theatre Design and Production Workshop: Technical Direction
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics related to technical direction.

THTRE 393K: Studies in Theatre Design and Production Workshop: Arts Management
Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: THTRE 365
Special topics related to Arts Management.

THTRE 451: Acting III
(3-0) Cr. 3. F.
Prereq: THTRE 351 and permission of instructor
Analysis and practice of period scenes.

THTRE 455: Directing I
(3-0) Cr. 3. F.
Prereq: THTRE 255; THTRE 263; THTRE 251 recommended
Theory, techniques, and practice of directing.

THTRE 456: Directing II
(2-2) Cr. 3. S.
Prereq: THTRE 455
Practical and theoretical experience in directing the stage play.

THTRE 461: Theatrical Design Studio
(3-2) Cr. 4. Repeatable, maximum of 12 credits. F.S.
Prereq: Permission of instructor
Focuses on the art and craft of specific areas of theatrical design. Each semester the student will focus on one or two of the following: scenic, costume, or lighting design.

THTRE 465: History of Theatre I
(3-0) Cr. 3. F.
Prereq: HIST 201 or equivalent
Theatre history from ancient times to 1800.

THTRE 466: History of Theatre II
(3-0) Cr. 3. S.
Prereq: THTRE 465
Theatre history from 1800 to present.

THTRE 469: Advanced Theatre Practicum
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: 9 credits in theatre courses; junior classification
Practicum in production with ISU Theatre, with opportunities for specialization within various areas. Required: Approval of written proposal.

THTRE 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 9 credits in theatre, approved written proposal, junior classification
Only one independent study enrollment within the department is permitted per semester. No more than 9 credits in Thtre 490 may be counted toward graduation.

THTRE 499: Theatre Internship
Cr. 1-8. Repeatable, maximum of 8 credits. F.S.SS.
Prereq: 18 credits in THTRE, other courses deemed appropriate by faculty adviser; 2nd semester junior or senior standing; minimum GPA of 2.5 and minimum GPA of 3.0 in THTRE courses
Supervised application of theatre in professional settings.

Courses primarily for graduate students, open to qualified undergraduates:

THTRE 504: Seminar
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in theatre
Topics may include the following:.

THTRE 504A: Seminar: Musical Theatre
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in theatre
Topics may include the following:.

THTRE 504B: Seminar: Acting Techniques
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in theatre
Topics may include the following:.

THTRE 504C: Seminar: Acting Styles
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in theatre
Topics may include the following:.

THTRE 504D: Seminar: Design and Technical Theatre
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in theatre
Topics may include the following:.

THTRE 504E: Seminar: Arts Management
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits in theatre
Topics may include the following:.

THTRE 590: Special Topics
Cr. 1-4. Repeatable, maximum of 12 credits.
Prereq: Approved written proposal

Philosophy

Philosophy tries to make sense of human experience and reality through critical reflection and argument. The questions it treats engage and provoke all of us, and they occupy an important place in our intellectual tradition: Are there objective standards for deciding what is right and wrong, or is morality merely a subjective matter? Is capitalism morally acceptable? Do I have a will, and is it free? How do my words and thoughts come to be about the world? Does God exist? Can machines think? How are mind and body related? Students in philosophy classes will be exposed to arguments on both sides of such questions, and they will be encouraged to develop and rationally defend their own positions.

Philosophy is not an isolated discipline. It enjoys mutually beneficial exchanges with many fields of study within the humanities and sciences. Philosophers develop tools that allow them to examine critically the assumptions and implications of the social and natural sciences, religion, and law.

The study of philosophy provides several benefits. It emphasizes rigorous understanding of problems, together with careful analysis of the strengths and weaknesses of the available solutions. It encourages clarity in the presentation of one's own ideas, as well as sensitivity in the consideration of the ideas of others. The study of philosophy therefore encourages one to develop skills and habits that are useful not only in philosophy, but in other areas as well. Philosophy students historically do well, for example, in law and medical schools.

However, one should not think that philosophy is only valuable in academic settings. Philosophical questions arise in many areas of family, business, and civic life. Philosophers strive to face these questions with the kind of intellectual honesty that leads to respect for the views of others, and continual reassessment of their own. In this way, the study of philosophy fosters values and attitudes that are helpful for responding to a lifetime of intellectual challenges.

The degree program in philosophy requires a minimum of 33 credits, plus the zero credit PHIL 492 course. The following courses compose the core program of the major from which 15 credits shall be chosen. Additionally, two courses at the 400 level or above (other than PHIL 490 and PHIL 492) are required.

Ethical theory: One course required.

PHIL 330	Ethical Theory	3
PHIL 335	Social and Political Philosophy	3
PHIL 535	Contemporary Political Philosophy	3

History: Two courses required.

PHIL 310	Ancient Philosophy	3
PHIL 314	17th Century Philosophy	3
or PHIL 315	18th Century Philosophy	

Metaphysics and Epistemology: One course required.

PHIL 364	Metaphysics: God, Minds, and Matter	3
PHIL 366	Truth, Belief and Reason	3
PHIL 380	Philosophy of Science	3

Logic:

PHIL 207 Introduction to Symbolic Logic is required.

Philosophy, B.A.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	Social Science Choice	3
LIB 160	1	Philosophy Choice	3
PHIL 201	3	Foreign Language/Elective	4
Foreign Language/Elective	4	Humanities Choice	3
Humanities Choice	3	Math Choice	3
Social Science Choice	3		
	17		16

Sophomore

Fall	Credits	Spring	Credits
PHIL 310	3	History of Philosophy - 17th/18th Century Choice	3
Philosophy Choice	3	Elective	3
Humanities Choice	3	Natural Science Choice	4
Natural Science Choice	4	Social Science Choice	3
ENGL 250	3	PHIL 207	3
	16		16

Junior

Fall	Credits	Spring	Credits
PHIL 330	3	Philosophy Choice - 300/400 Level	3
Philosphy Choice	3	Elective	3

PHIL 364 or PHIL 380	3 Elective	3
Electives	6 Elective	3
	Elective	3
	15	15

Senior

Fall	Credits	Spring	Credits
Philosphy Choice - 400 Level	3	Philosphy Choice - 400 Level	3
Philosophy Choice - 300/400 Level	3	Elective	3
Electives	6	Elective	7.5
		PHIL 492	0
	12		13.5

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, i**ncluding a minimum of 45 credits at the 300/400 level**. Three of the required 45 300+ level credits must be earned in a general education group outside the group of the major. You must also complete the LAS foreign-language requirement.

Minor in Philosophy

The department offers a minor in philosophy which may be earned by completing a total of 15 credits in philosophy. At least 9 credits must be in courses numbered 300 or above. Students may want to emphasize specific areas by taking 15 hours of courses chosen from the following:

Philosophy of Science:

PHIL 201	Introduction to Philosophy	3
PHIL 206	Introduction to Logic and Scientific Reasoning	3
or PHIL 207	Introduction to Symbolic Logic	
PHIL 314	17th Century Philosophy	3
PHIL 315	18th Century Philosophy	3
PHIL 380	Philosophy of Science	3
PHIL 485	Philosophy of Physics	3

History of Philosophy:

PHIL 201	Introduction to Philosophy	3
PHIL 310	Ancient Philosophy	3
PHIL 314	17th Century Philosophy	3
PHIL 315	18th Century Philosophy	3
PHIL 316	19th Century Continental Philosophy	3
PHIL 317	20th and 21st Century Continental Philosophy	3
PHIL 318	20th and 21st Century Anglo-American Philosophy	3

Law, Social Values and Policy:

PHIL 230	Moral Theory and Practice	3
PHIL 235	Ethical Issues in A Diverse Society	3
PHIL 331	Moral Problems in Medicine	3
PHIL 332	Philosophy of Law	3
PHIL 335	Social and Political Philosophy	3
PHIL 336	Bioethics and Biotechnology	3
PHIL 338	Feminist Philosophy	3
PHIL 343	Philosophy of Technology	3
PHIL 430	Value Theory	3
PHIL 535	Contemporary Political Philosophy	3

Philosophy - Graduate Study

The department offers work for a graduate minor in philosophy. For those taking the M.A. or M.S., the minor requirement is two courses above 300 (but not PHIL 490 each taken in conjunction with PHIL 590. For those taking the Ph.D., the requirement is four courses above 300, at least one of which is above 400 (but not PHIL 490) each taken in conjunction with PHIL 590. Interested students should ask the chair to assign a minor adviser.

The department participates in the interdepartmental program in general graduate studies.

Courses primarily for undergraduates:

PHIL 201: Introduction to Philosophy
(3-0) Cr. 3. F.S.SS.
It has been rumored that the unexamined life is not worth living. Philosophy is an attempt to begin examining life by considering such questions as: What makes us human? What is the world ultimately like? How should we relate to other people? Is there a god? How can we know anything about these questions? Understanding questions of this kind and proposed answers to them is what this course is all about.

PHIL 206: Introduction to Logic and Scientific Reasoning
(3-0) Cr. 3. F.S.SS.
Basic principles of critical reasoning and argument evaluation. A consideration of basic forms of argumentation in science and everyday life. Application to contemporary issues and controversies.

PHIL 207: Introduction to Symbolic Logic
(Cross-listed with LING). (3-0) Cr. 3. S.
Introduction to fundamental logical concepts and logical symbolism. Development of natural deduction through first order predicate logic with identity. Applications to arguments in ordinary English and to philosophical issues. Linguistics majors should take LING/PHIL 207 as early as possible.

PHIL 230: Moral Theory and Practice
(3-0) Cr. 3. F.S.SS.
Investigation of moral issues in the context of major ethical theories of value and obligation; e.g., punishment, abortion, economic justice, job discrimination, world hunger, and sexual morality. Emphasis on critical reasoning and argument analysis.

PHIL 235: Ethical Issues in A Diverse Society
(3-0) Cr. 3. S.
This course will examine a range of arguments on diversity issues. Topics will include: the social status of women, the moral status of sexuality and homosexuality, the nature and role of racism in contemporary society, the relationship between biology, gender roles and social status, and various proposals for change from a variety of political perspectives.
Meets U.S. Diversity Requirement

PHIL 310: Ancient Philosophy
(Cross-listed with CL ST). (3-0) Cr. 3. F.
Prereq: PHIL 201
Survey of ancient Greek philosophy, focusing on the pre-Socratics, Plato, and Aristotle. Questions concerning being, knowledge, language, and the good life are treated in depth.

PHIL 314: 17th Century Philosophy
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: PHIL 201
Readings from philosophers such as Hobbes, Descartes, Spinoza, Leibniz, and Locke. Changing conceptions of knowledge, self, and deities in response to Galileo's new science and post-reformation challenge to ecclesiastical authority.

PHIL 315: 18th Century Philosophy
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PHIL 201
Readings from philosophers such as Berkeley, Hume, and Kant. Development of Enlightenment thought. Issues include idealism, causation, freedom, and knowledge regarding science, ethics, and deities.

PHIL 316: 19th Century Continental Philosophy
(3-0) Cr. 3. F.
Prereq: PHIL 201
The thought of Hegel, Marx, Nietzsche, and their contemporaries. Various perspectives on the philosophy of history, the nature of reason and subjectivity, the contrast between dialectical and nondialectical philosophy, and the relationship between philosophy and society.

PHIL 317: 20th and 21st Century Continental Philosophy
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: PHIL 201
Major movements of 20th and 21st century thought, such as Phenomenology, Critical Theory, Post-structuralism, Postmodernism, and Feminism. Issues include the assumptions and limits of Western metaphysics, the nature of reason, the relationship between language and power.

PHIL 318: 20th and 21st Century Anglo-American Philosophy
(3-0) Cr. 3. S.
Prereq: 6 credits in philosophy, including PHIL 201.
Major movements in recent and contemporary philosophy such as realism, logical positivism, ordinary language philosophy, and naturalism. Russell, Wittgenstein, Quine and other leading figures. Topics include knowledge of the material world, mind, language, values, and philosophical method.

PHIL 320: Existentialism and Its Critics
(3-0) Cr. 3. F.
Prereq: PHIL 201
An investigation of Existentialism and its critics in historical and cultural context. Emphasis on existential phenomenology and French existentialism, and on criticisms. Existential Marxism and Heidegger's later philosophy.

PHIL 330: Ethical Theory
(3-0) Cr. 3. F.
Prereq: PHIL 201 or PHIL 230
Study of major theories of morality and the good life. Includes such topics as moral psychology, practical reasoning, and virtue theory.

PHIL 331: Moral Problems in Medicine
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PHIL 230 or junior classification
In-depth study of some of the central moral problems arising in medicine, e.g., abortion, euthanasia, patients' rights, health care professionals' duties and responsibilities, allocation of medical resources. Major moral theories will be examined and applied.

PHIL 332: Philosophy of Law
(Cross-listed with CJ ST). (3-0) Cr. 3. F.S.
Prereq: PHIL 201 or PHIL 230
Extent of our obligation to obey the law; what constitutes just punishment; how much of the immoral should be made illegal? Relation of these questions to major theories of law and the state. Discussion of such concepts as coercion, equality, and responsibility.

PHIL 334: Environmental Ethics
(Cross-listed with ENV S). (3-0) Cr. 3. F.
Prereq: 3 credits in philosophy or junior classification
Thorough study of some of the central moral issues arising in connection with human impact on the environment, e.g., human overpopulation, species extinction, forest and wilderness management, pollution. Several world views of the proper relationship between human beings and nature will be explored.

PHIL 335: Social and Political Philosophy
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: PHIL 201 or PHIL 230
Foundations of social and political life. The basis of political organization, the nature of social and political institutions, rights and authority, justice. Original texts.

PHIL 336: Bioethics and Biotechnology
(3-0) Cr. 3.
Prereq: PHIL 201 or PHIL 230 or PHIL 235
In-depth study of some central moral issues in the life sciences, e.g., genetic screening and testing, genetically engineered plants and animals, risk analysis, biotechnology patents, research ethics, biodiversity, the impact of biotechnology on society and the environment. Major moral theories will be discussed and applied. (Phil 336 contains almost no similarities to Phil 331.).

PHIL 338: Feminist Philosophy
(Cross-listed with W S). (3-0) Cr. 3. F.
Prereq: 3 credits in philosophy or women's studies recommended
A critical, theoretical examination of the oppression of women, especially as it relates to issues of race, class, and sexual orientation. How concepts such as sex and gender, self and other, nature and nurture, complicate our understanding of what it means to be a woman. Historical and contemporary feminist philosophers addressing topics such as violence, sexuality, pornography, political power, family structure and women's paid and unpaid labor.
Meets U.S. Diversity Requirement

PHIL 339: Liberty and Law in America
(Cross-listed with CJ ST, POL S). Cr. 3.
Prereq: Sophomore status
An exploration of competing conceptions of liberty in American political thought and debates about how liberty should be protected by the law. Contemporary debates about topics such as health care, drugs, property, speech, religion, and sex.

PHIL 340: Aesthetics
(3-0) Cr. 3. F.
Prereq: PHIL 201 or PHIL 230
Is liking all there is to appreciating works of art or natural beauty? We will examine our appreciative experiences, talk about such experiences (e.g., art criticism), and what makes them valuable. Do the different arts have common values? How are their differences important?.

PHIL 343: Philosophy of Technology
(Cross-listed with T SC). (3-0) Cr. 3. F.S.
Prereq: 6 credits of social science or T SC 341 and 3 credits of social science
Moral and other philosophical problems related to developments in technology. Topics may include conditions under which technological innovations contribute to human emancipation, relationship of technology and democracy, utility and limits of technical rationality, and problems of ensuring that benefits of technological advance are communally shared. Topics discussed with reference to such issues as contemporary developments in microelectronics, technology transfer to the Third World, etc.

PHIL 350: Philosophy of Religion
(Cross-listed with RELIG). (3-0) Cr. 3. F.
Prereq: 6 credits in philosophy
The value and truth of religious life and belief. Mystical experience; religious faith and language; arguments for God's existence; the problem of evil; miracles; and religion and morality. Historical and contemporary readings.

PHIL 364: Metaphysics: God, Minds, and Matter
(3-0) Cr. 3. S.
Prereq: 6 credits in philosophy, including Phil 201.
A survey of classical and contemporary views on some basic metaphysical issues. Issues discussed include: Does God exist? Do you have a mind and, if so, how does it relate to your body? What is the nature of cause and effect? Do objects have any essential properties? How can we account for properties objects have in common?.

PHIL 366: Truth, Belief and Reason

(3-0) Cr. 3. F.

Prereq: 6 credits in philosophy including PHIL 201, or instructor permission.

This course focuses on significant topics in theory of knowledge, including the value of true beliefs, the role of sense experience in supporting our theoretical views, and the place of reason in human nature. Historical and contemporary views will be considered.

PHIL 380: Philosophy of Science

(3-0) Cr. 3. F.

Prereq: PHIL 201 or 6 credits in a science

Introduction to the philosophy of science. A variety of basic problems common to the natural and social sciences: the nature of explanation, the structure of theories, the unity of science, and the distinction between science and nonscience.

PHIL 382: History and Philosophy of the Scientific Revolution.

(Cross-listed with HIST). (3-0) Cr. 3. S.

The emergence of empirical science as the authoritative methodology for production of knowledge about the natural world in the period between Copernicus and Kant. Scientific progress achieved during the period, including the work of Galileo, Descartes, and Newton. The re-shaping of epistemology in the Western intellectual tradition. Implications for philosophy and historiography.

PHIL 398: Cooperative Education

Cr. R. F.S.SS.

Prereq: Permission of the department cooperative education coordinator; junior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

PHIL 430: Value Theory

(3-0) Cr. 3. Repeatable, maximum of 6 credits. S.

Prereq: PHIL 230

Theoretical and normative issues in ethics, aesthetics, religious thought, or political philosophy. Topics vary each time offered.

PHIL 450: Agency and Free Will

(3-0) Cr. 3. Repeatable, maximum of 1 times. F.

Prereq: 3 credits in philosophy; PHIL 207 strongly encouraged

Personal identity, agency, free will, moral responsibility, causation, future contingents, and time will be discussed. What makes a person the same person over time? Do humans have free will? Are we not morally responsible if our actions are inevitable consequences of the past and the laws of nature? What distinguishes causes from non-causes? Are there facts about the future?.

PHIL 465: Brains, Minds, and Computers

(3-0) Cr. 3. F.

Prereq: 6 credits in philosophy

Examination of concepts such as computability, intelligence, programming, and free will; and of arguments about whether any human capacity is forever beyond realization in a machine.

PHIL 466: Topics in Epistemology

(3-0) Cr. 3. Repeatable, maximum of 6 credits. S.

Prereq: 6 credits in philosophy

Topics in epistemology. Possible topics include skepticism about the external world, the extent of a priori knowledge, rival accounts of moral knowledge, feminist perspectives on the theory of knowledge, and the value of true belief. Topics vary each time offered.

PHIL 485: Philosophy of Physics

(3-0) Cr. 3.

Prereq: 3 credits in Philosophy or 3 credits in Physics

S. Conceptual and philosophical issues relating to the interpretation of theories in classical and modern physics. May include one or more of the following topics: the relationship between mathematics and the physical world; Newtonian physics (determinism and predictability); thermodynamics and statistical physics (the nature of probability; entropy and the direction of time); relativistic physics (indeterminism; realism and nonlocality; consciousness and the role of the observer).

PHIL 490: Independent Study

Cr. 1-4. Repeatable, maximum of 9 credits.

Prereq: 6 credits in philosophy; permission of instructor, approval of chair.

Guided reading and research on special topics selected to meet needs of advanced students. No more than 9 credits of Phil 490 may be counted toward graduation.

PHIL 490H: Independent Study, Honors

Cr. 1-4. Repeatable, maximum of 9 credits.

Prereq: 6 credits in philosophy; permission of instructor, approval of chair.

Guided reading and research on special topics selected to meet needs of advanced students. No more than 9 credits of Phil 490 may be counted toward graduation.

PHIL 492: Graduating Senior Survey

Cr. R. F.S.

Prereq: Graduating senior

Final presentation for graduation and the future. Outcomes assessment activities. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

PHIL 535: Contemporary Political Philosophy
(Cross-listed with POL S). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 6 credits of philosophy or political science
Examination of theories of justice proposed by contemporary political philosophers. Analysis of the philosophical foundations of perspectives such as liberalism, libertarianism, communitarianism, socialism, feminism. Normative assessments of socio-political institutions.

PHIL 590: Special Topics in Philosophy
Cr. 2-4. Repeatable.
Prereq: Permission of instructor, 9 credits in philosophy

PHIL 590A: Special Topics in Philosophy: History of Philosophy
Cr. 2-4. Repeatable.
Prereq: Permission of instructor, 9 credits in philosophy

PHIL 590B: Special Topics in Philosophy: Epistemology and Metaphysics
Cr. 2-4. Repeatable.
Prereq: Permission of instructor, 9 credits in philosophy

PHIL 590C: Special Topics in Philosophy: Value Theory
Cr. 2-4. Repeatable.
Prereq: Permission of instructor, 9 credits in philosophy

PHIL 590D: Special Topics in Philosophy: Logic and Philosophy of Science
Cr. 2-4. Repeatable.
Prereq: Permission of instructor, 9 credits in philosophy

PHIL 593: Summer Bioethics Workshop for Teachers
(2-0) Cr. 2. SS.
Topics include moral theory, pedagogical issues in teaching bioethics, and substantive current issues in bioethics.

Physics and Astronomy

Physics and astronomy are basic natural sciences which attempt to describe and provide an understanding of both our world and our universe. Physics serves as the underpinning of many different disciplines including the other natural sciences and technological areas. Graduates are proficient in the methods of rigorous scientific analysis, relevant mathematical techniques, and modern computational and laboratory methods. They have a broad knowledge of physics, including mechanics, electricity and magnetism, thermodynamics, and modern physics. They are able to communicate clearly and effectively at general and technical levels. They are prepared to pursue a wide range of careers as a professional physicist, astronomer, or science educator. They are also prepared to pursue advanced studies and careers in areas as diverse as engineering, medicine, law, and business administration. Many opportunities exist for students who terminate their studies with a bachelor's degree, especially when combined with technology studies in other areas. Students who meet the necessary scholastic standards often continue their studies in a graduate college, exploring and contributing to new developments in the field.

The department normally expects each student majoring in physics to complete at least the following courses:

PHYS 241	Principles and Symmetries in Classical Physics I	5
PHYS 242	Principles and Symmetries in Classical Physics II	5
PHYS 321	Introduction to Modern Physics I	3
PHYS 321L	Introductory Laboratory in Modern Physics I	1
PHYS 322	Introduction to Modern Physics II	3
PHYS 322L	Introductory Laboratory in Modern Physics II	1
PHYS 304	Thermal Physics	3
PHYS 310	Electronic Instrumentation for Experimental Physics	4
PHYS 361	Classical Mechanics	3
PHYS 362	Intermediate Mechanics	3
PHYS 364	Electricity and Magnetism I	3
PHYS 365	Electricity and Magnetism II	3
PHYS 480	Quantum Mechanics I	3
MATH 207	Matrices and Linear Algebra (or)	3
or		
MATH 317	Theory of Linear Algebra	4
and 2 credits of laboratory work chosen from		2
PHYS 311	Intermediate Laboratory	
PHYS 311T	Intermediate Laboratory for Secondary Physics Teachers	
PHYS 470L	Applied Physics Laboratory	
or		
ASTRO 344L	Astronomy Laboratory	
and at least 3 credits chosen from		
ASTRO 342	Introduction to Solar System Astronomy	3
ASTRO 346	Introduction to Astrophysics	3
ASTRO 405	Astrophysical Cosmology	3
PHYS 421	Ultrafast Laser Science and Spectroscopy	3
PHYS 432	Molecular and Cell Biophysics	3
PHYS 461	Physics of Biomolecules	3
PHYS 481	Quantum Mechanics II	3
PHYS 496	Modern Optics	3
PHYS 511	Condensed Matter Physics I	3
PHYS 526	Particle and Nuclear Physics	4
PHYS 528	Mathematical Methods for the Physical Sciences	3
PHYS 531	Statistical Mechanics	3
PHYS 534	Symmetry and Group Theory in Physics	3

PHYS 541	General Relativity	3
*PHYS 221 and PHYS 222 may be substituted for PHYS 241 and PHYS 242.		

All students are required to earn at least 6 credits in laboratory work in physics in addition to the laboratory components of PHYS 241 and PHYS 242. These 6 credits must be in courses numbered 304 or higher or in approved substitutions. All students must earn at least 35 credits in physics and astronomy courses numbered 304 or higher. The basic list of expected courses is not a rigid requirement and changes in this basic list will be approved by the department curriculum committee on recommendation of the student's adviser when such changes will better serve the student's needs. In particular, students planning a physics major and also seeking certification for high school teaching may, with the approval of their adviser, follow a significantly different program designed to meet their particular needs; these students should consult the department for further information. Further information concerning programs of study, including sample degree programs, is available from the department.

Students majoring in physics who wish an emphasis in astronomy/astrophysics should consider a minor in astronomy. Those planning graduate work in physics or astronomy/astrophysics should choose the option PHYS 481 from the list above. Another useful course is:

STAT 447	Statistical Theory for Research Workers	4

The expected outcomes for students in these programs are:

1. a broad knowledge of physics, including mechanics, electricity and magnetism, thermodynamics, wave motion and modern physics
2. proficiency in laboratory methods
3. proficiency in modern scientific computational methods
4. a sound foundation in the liberal arts including proficiency in communication skills.

In addition to the performance on exams and course grades, information on evaluating of the success in meeting these goals is obtained by:

1. an annual written survey of all students majoring in the program
2. an annual written survey of all graduating seniors
3. a periodic written survey of program alumni
4. student evaluations of all courses
5. adviser evaluations
6. a bimonthly meeting of program majors with the department chair

Communication Proficiency Requirement: The department requires a grade of C or better in ENGL 250 (or ENGL 250H), and a C– or better in ENGL 302, ENGL 305, ENGL 309 or ENGL 314. Students are also encouraged to study at least one foreign language.

Physics Plus: The Physics Plus option is for students who wish to establish a clear strength in a field of application of physics. This program makes double majors more feasible and is appropriate for students who plan on employment in applied physics. It is not intended for students who plan on graduate study in physics. For more information, see the physics department web site or consult an adviser in physics.

The department offers a minor in physics which may be earned by completing 20 credits in physics courses chosen as follows:

PHYS 241	Principles and Symmetries in Classical Physics I	5
PHYS 242	Principles and Symmetries in Classical Physics II	5
PHYS 321	Introduction to Modern Physics I	3
One of the following		
PHYS 321L	Introductory Laboratory in Modern Physics I	
PHYS 322L	Introductory Laboratory in Modern Physics II	
PHYS 310	Electronic Instrumentation for Experimental Physics	
PHYS 311	Intermediate Laboratory	
PHYS 311T	Intermediate Laboratory for Secondary Physics Teachers	
Other acceptable courses		
PHYS 304	Thermal Physics	
PHYS 306	Physics of Wave Motion	
PHYS 322	Introduction to Modern Physics II	
PHYS 361	Classical Mechanics	
PHYS 362	Intermediate Mechanics	
PHYS 364	Electricity and Magnetism I	
PHYS 365	Electricity and Magnetism II	
PHYS 421	Ultrafast Laser Science and Spectroscopy	
PHYS 432	Molecular and Cell Biophysics	
PHYS 461	Physics of Biomolecules	
PHYS 480	Quantum Mechanics I	
PHYS 481	Quantum Mechanics II	
PHYS 496	Modern Optics	
*PHYS 221 and PHYS 222 may be substituted for PHYS 241 and PHYS 242		

The department offers a minor in astronomy which may be earned by completing 15 credits chosen as follows:

ASTRO courses *		12-15
3 credits from the following (if only 12 Astro credits)		3
PHYS 304	Thermal Physics	
PHYS 321	Introduction to Modern Physics I	

PHYS 361	Classical Mechanics
PHYS 362	Intermediate Mechanics
PHYS 364	Electricity and Magnetism I
PHYS 365	Electricity and Magnetism II
PHYS 480	Quantum Mechanics I
PHYS 481	Quantum Mechanics II
PHYS 496	Modern Optics
AER E 351	Astrodynamics I

* must include ASTRO 344L Astronomy Laboratory and may include one of the courses ASTRO 120 The Sky and the Solar System, ASTRO 150 Stars, Galaxies, and Cosmology or ASTRO 250 Astronomy Bizarre

12 or more credits must be at the 300 level or higher. Note that only ASTRO 344L may be used to satisfy both the requirements of a physics major and an astronomy minor.

Physics, B.S

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	PHYS 242	5
PHYS 199	0	MATH 265	4
PHYS 241	5	Social Science Choice	3
MATH 166	4	Natural Science Choice	5
Humanities Choice	3		
LIB 160	1		
	16		17

Sophomore

Fall	Credits	Spring	Credits
ENGL 250	3	PHYS 361	3
PHYS 321	3	PHYS 322	3
PHYS 321L	1	PHYS 322L	1
MATH 267	4	MATH 385	3
Humanities Choice	3	Social Science Choice	3
		Humanities Choice	3
	14		16

Junior

Fall	Credits	Spring	Credits
PHYS 362	3	PHYS 304	3
PHYS 364	3	PHYS 365	3
ENGL 302, 305, 309, or 314	3	PHYS 389	0
MATH 317 or 207	4-3	Social Science Choice	3
Foreign Language (or Elective)	4-3	Humanites Choice	3
		Foreign Language (or Elective)	4-3
	17-15		16-15

Senior

Fall	Credits	Spring	Credits
PHYS 310	4	PHYS 311[1]	2
PHYS 480	3	PHYS 481[2]	3
Elective	3	Elective	3
ASTRO 344L[1]	3	Elective	3
		Elective	3
	13		14

1 Students must earn a minimum of two laboratory credits from PHYS 311, 311T, 450I, ASTRO 344L, or 450L.

2 Recommended by not required. Highly recommended for those students planning gradate study.

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.** You must also complete the LAS foreign language requirement.

Graduate Study

The department offers studies for the degrees master of science and doctor of philosophy with majors at both levels in applied physics, astrophysics, condensed matter physics, high energy physics, nuclear physics, and physics; and minor credit courses for students majoring in other departments.

Facilities of various research groups of the department, the Ames Laboratory, and the Applied Science Center, including the Microelectronics Research Center, are available for research.

Students with bachelor's degrees in physics or astronomy from other institutions ordinarily will qualify for graduate study at Iowa State provided they have satisfactorily completed course work similar to that suggested for undergraduate majors here intending to go on to graduate school. In some cases additional instruction at the intermediate level may be required.

Graduates have a broad understanding of physical science, as well as mastery of state-of-the-art methods in their area of specialization. They are able to communicate effectively to a wide range of audiences, from the general public to research colleagues. Their skills in rigorous scientific thinking prepare them for leadership in the broader community.

They are skilled in carrying out research, communicating research results, and soliciting research support. They have considerable teaching experience. They have developed problem solving skills that prepare them for careers in either industry or academia.

All candidates for an advanced degree in physics are expected to complete:

PHYS 531	Statistical Mechanics	3
PHYS 564	Advanced Classical Mechanics	3
PHYS 571	Electricity and Magnetism I	3
PHYS 572	Electricity and Magnetism II	3
PHYS 591	Quantum Physics I	4
PHYS 592	Quantum Physics II	4

Candidates for an advanced degree in applied physics are expected to complete:

PHYS 571	Electricity and Magnetism I	3
PHYS 591	Quantum Physics I	4
PHYS 470L	Applied Physics Laboratory	2-5
PHYS 699	Research	arr †
PHYS 572	Electricity and Magnetism II	3
or PHYS 531	Statistical Mechanics	

† Arranged with instructor.

Candidates for an advanced degree in astrophysics should complete:

PHYS 531	Statistical Mechanics	3
PHYS 564	Advanced Classical Mechanics	3
PHYS 571	Electricity and Magnetism I	3
PHYS 591	Quantum Physics I	4
ASTRO 505	Astrophysical Cosmology	3
ASTRO 510	Observational Astrophysics	3

Astrophysics Ph.D. candidates must take at least three of the 580 level Astro courses, while candidates for the Research Masters must take at least two 580 level Astro courses.

Except for the applied physics major where a thesis is always required, the degree master of science is offered both with and without thesis. For all areas of study except applied physics the basic requirements for the M.S. are the same: at least 30 credits of acceptable graduate work must be completed, not less than 21 of which must be in physics or astronomy. Students must complete not less than 6 credits from outside their major area, with 3 credits being required from outside the department, and 3 credits from a 500 or 600 level course in another area of specialization. Students choosing a M.S. degree with thesis may apply up to 8 credits of 699 but no credits of 599 toward the minimum 30 credits. Students choosing a degree without thesis should apply 2 credits of 599, but may not apply any credits of 699 toward the minimum 30 credits.

Students whose major area is applied physics must complete at least 30 credits of acceptable graduate work for the M.S. degree and not less than 19 credits of these must be in the required courses listed above; the remaining 11 credits of the 30 credit minimum may be chosen freely either from within the student's major area or from without and either from the department or outside, but it should be noted that not more than 3 credits of PHYS 699 Research may be applied toward the 30 credit minimum.

In addition to course work in the major area of study, all candidates for the Ph.D. degree must complete 12 credits from outside this area. Of these 6 must be taken from other departments and 6 must be taken from the department with the additional constraint that this latter 6 must include at least one 500 or 600 level introductory course in another area of specialization. Each candidate for the Ph.D. degree is required to teach one year of elementary physics or astronomy.

Graduate students interested in a physics minor should contact the department for requirements.

Courses primarily for undergraduates:

ASTRO 102: North Star Astronomy

Cr. 1. F.S.

An entirely web-based course covering topics in observing the sky and navigation by the stars for students with little or no previous experience. The course combines material on common naked-eye phenomena, such as daily and seasonal variations in the sky, with information on how these helped navigators determine where they are on Earth. The course "lectures" are on-line, interactive units with build in exercises, hands-on (offline) activities and layers of help. Graded homework and quizzes are administered via Blackboard Learn. Students who take Astro 120 may count credit in only one of Astro 102 or 103 toward graduation.

ASTRO 103: Evening Star

Cr. 1. F.S.

An entirely web-based course covering topics in celestial mechanics ("Rocket science!") for students with little or no previous experience. It combines the geography of the solar system with discussion of methods of traveling to the other planets. The course "lectures" are on-line, interactive units with built-in exercises, hands-on (offline) activities, and layers of help. Graded homework and quizzes are administered via Blackboard Learn. Students who take Astro 120 may count credit in only one of Astro 102 or 103 toward graduation.

ASTRO 106: Earth and Space Science for Elementary Education Majors
(Cross-listed with GEOL). (2-0) Cr. 2. F.S.
Prereq: Major in elementary or early childhood education.
Fundamental concepts of Earth and Space Science, including the solar system, weather and climate, water and soils, plate tectonics, and geologic hazards. Online course format.

ASTRO 106L: Earth and Space Science for Elementary Education Majors: Laboratory
(Cross-listed with GEOL). (0-2) Cr. 1. F.S.
Prereq: Restricted to elementary and early childhood education majors; to be taken concurrently with GEOL 106/ASTRO 106
Inquiry-based lab exploring fundamental concepts of Earth and Space Science, including the solar system, weather and climate, water and soils, plate tectonics, and geologic hazards. Must be taken concurrently with GEOL/ASTRO 106.

ASTRO 120: The Sky and the Solar System
(3-0) Cr. 3. F.S.SS.
For the nonscientist. A survey of our view of the universe, and the exploration of the solar system and beyond. The sky: constellations; motions of the Sun, Moon, and planets; seasons and the calendar; eclipses. The solar system: origin and evolution; characteristics of the Sun, planets, satellites, comets, meteorites, and asteroids. The detection and characterization of other solar systems, and the search for life in the universe. Extensive use of the planetarium is included. Students who take Astro 120 may count credit in only one of Astro 102 or 103 toward graduation.

ASTRO 125L: The Sky and the Solar System Laboratory
(0-2) Cr. 1. F.S.
Prereq: Concurrent or previous enrollment in ASTRO 120
Laboratory course to accompany Astro 120. Students carry out practical exercises involving naked eye and telescopic observing to explore and reinforce ideas covered in Astro 120. Activities based on a sky-simulation computer program and other weather-independent exercises are also included.

ASTRO 150: Stars, Galaxies, and Cosmology
(3-0) Cr. 3. F.S.
For the nonscientist. A survey of astronomy with a focus on the universe beyond our solar system. Basic observational astronomy and the history of astronomy. Stellar astronomy: motions, distances, sizes, spectra; types of stars; variability; binary systems. Stellar evolution: the birth, life, and death of stars, including supernovae, neutron stars, and black holes. The structure and evolution of the Milky Way Galaxy. Other galaxies, clusters of galaxies, quasars. Theories of the origin of the universe.

ASTRO 250: Astronomy Bizarre
(3-0) Cr. 3. S.
Prereq: ASTRO 120 or ASTRO 150
For the nonscientist. A small enrollment course examining new and exciting topics in modern astronomy. Galaxy and star formation. Black holes and pulsars. Colliding galaxies. Quasars. Dark Matter. Dark energy. Quasars. Cosmology, the Big Bang and the future of the universe. Prospects and searches for extraterrestrial life.

ASTRO 290: Independent Study
Cr. 1-4. Repeatable.
Prereq: Permission of instructor

ASTRO 342: Introduction to Solar System Astronomy
(3-0) Cr. 3. F.
Prereq: PHYS 222
An introduction to the physics of the Solar System and the planetary systems discovered around other stars. General characteristics of planetary systems: dynamics, thermodynamics, internal and surface structure of planets and minor bodies, physics of their atmosphere. Discovery techniques and characterization of extrasolar planets, and planetary systems formation models. "Grand tour" of the Solar System, using data and imagery from probes and telescopes that have visited these worlds. The origin and evolution of life on Earth, and the ongoing search for life in the Solar System and elsewhere in the universe.

ASTRO 344L: Astronomy Laboratory
(1-6) Cr. 3. F.
Prereq: PHYS 222
Experiments in optical astronomy. Observational techniques, ranging from stellar photometry to CCD imaging. Data processing and analysis techniques. Astronomical software packages and online databases and resources. Available instruments include a variety of small telescopes and astronomical CCD cameras.

ASTRO 346: Introduction to Astrophysics
(3-0) Cr. 3. S.
Prereq: PHYS 222
An exploration of the universe beyond our Solar System, with emphasis on the astrophysics of stars and galaxies. Observable properties of stars, physics of stellar atmospheres and interiors. Birth, evolution and death of stars, to understand the past and future of our Sun, the Milky Way galaxy and the other galaxies in the universe. Basic concepts of cosmology, dark matter and dark energy. Use of computer models to calculate the structure and evolution of stars and protostars, and to analyze actual astronomical data obtained by professional astronomers.

ASTRO 405: Astrophysical Cosmology
(Dual-listed with ASTRO 505). (3-0) Cr. 3. S.
Prereq: ASTRO 346 or permission of instructor
Introduction to modern cosmology and large-scale structure; mathematical and observational fundamentals associated with the origin, structure, and evolution of the Universe. Scale of the Universe, Hubble's Law, the cosmic microwave background, Big Bang nucleosynthesis, the origin of elements, dark energy and the accelerating universe, and dark matter. For senior undergraduates and graduate students in all areas of physics.

ASTRO 450: Undergraduate Research
Cr. 1-6. Repeatable. F.S.SS.
Prereq: Permission of instructor
Research under supervision of astronomy faculty.

ASTRO 450L: Undergraduate Research
Cr. 1-6. Repeatable. F.S.SS.
Prereq: ASTRO 344L and permission of instructor
Laboratory or observational project under supervision of astronomy faculty.

ASTRO 490: Independent Study
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: 6 credits in astronomy, permission of instructor
No more than 9 credits of Astro 490 may be counted toward graduation.

ASTRO 490H: Independent Study: Honors
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: 6 credits in astronomy, permission of instructor
No more than 9 credits of Astro 490 may be counted toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

ASTRO 505: Astrophysical Cosmology
(Dual-listed with ASTRO 405). (3-0) Cr. 3. S.
Prereq: ASTRO 346 or permission of instructor
Introduction to modern cosmology and large-scale structure; mathematical and observational fundamentals associated with the origin, structure, and evolution of the Universe. Scale of the Universe, Hubble's Law, the cosmic microwave background, Big Bang nucleosynthesis, the origin of elements, dark energy and the accelerating universe, and dark matter. For senior undergraduates and graduate students in all areas of physics.

ASTRO 510: Observational Astrophysics
(2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ASTRO 405 or ASTRO 505 or permission of instructor
Techniques in optical and near-IR astronomy, including spectroscopy and CCD photometry. Emphasis on projects involving proficiency in the use of research telescopes and modern instrumentation. Project topics range from photometric studies of pulsating and binary star systems to deep CCD imaging of faint nebulae and galaxies.

ASTRO 580: Stellar Astrophysics
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: ASTRO 405 or ASTRO 505 or permission of the instructor
The interior structure and atmospheric properties of stars: Stellar structure equations and constitutive relations: energy generation, energy transport by radiation and convection; equation of state, nuclear energy generation and nucleosynthesis. Numerical and analytic solutions to the equations of structure and evolution. Observational connections through the theory of radiative transfer. Line and continuum processes and sources of opacity. Non-LTE and statistical equilibrium. Line profiles. Interpretation of stellar spectra: temperature, pressure, and abundance determinations. Stellar evolution from formation to final phases.

ASTRO 582: High Energy Astrophysics
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: ASTRO 405 or ASTRO 505 or permission of the instructor
Interactions of high-energy particles, non-thermal radiation processes, spectral evolution of non-thermal systems, cosmic rays, active galactic nuclei, pulsars, neutrinos, measurement techniques for relativistic charged particles, high energy photons, and neutrinos.

ASTRO 584: Galactic Astronomy
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ASTRO 405 or ASTRO 505 or permission of instructor
Overall structure of our Galaxy and the interstellar medium. Physical processes in the interstellar medium (e.g., heating and cooling mechanisms, turbulence). Observational techniques for studying the interstellar medium. Kinematics and chemical evolution of the Galaxy.

ASTRO 586: Extragalactic Astronomy
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ASTRO 405 or ASTRO 505 or permission of the instructor
Galaxy evolution, dynamics of external galaxies, evolution and classification of galaxies, groups and clusters of galaxies, extragalactic radio sources, quasars, structure formation, cosmological models and their observational consequences.

ASTRO 590: Special topics
Cr. arr. Repeatable.

ASTRO 599: Creative Component
Cr. arr.
Prereq: Permission of instructor
Individually directed study of research-level problems for students electing the nonthesis M.S. option in astronomy.

Courses for graduate students:

ASTRO 650: Advanced Seminar
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest in astronomy and astrophysics. Offered on a satisfactory-fail basis only.

ASTRO 675: Advanced Stellar Astrophysics
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: ASTRO 580 or permission of instructor
Advanced topics in stellar astrophysics. Dynamic and extended atmospheres, chromospheres, coronae, and stellar winds. MHD, stellar activity, and dynamo theory. Radiative transfer and the transition from extended atmospheres to the interstellar medium. Diffusive processes in stellar atmospheres and interiors. Techniques for quantitative analysis of planetary and stellar spectra including detailed modeling and spectrum synthesis. Evolution in interacting binaries. Nucleosynthesis II. Variable stars. Supernovae. Neutron stars and black holes.

ASTRO 699: Research
Cr. arr. Repeatable.

Courses primarily for undergraduates:

PHYS 101: Physics for the Nonscientist
(3-0) Cr. 3. F.S.
Survey of the principal areas of both classical and modern physics. Emphasis on the nature of the physical universe and the application of physical principles to life in the modern world. Not suitable to meet a general physics requirement for natural science majors.

PHYS 102L: Physical Sciences for Elementary Education
(Cross-listed with CHEM). (1-4) Cr. 3. F.S.
Prereq: MATH 195 or MATH 140
Physical science principles for future elementary teachers. Emphasis on experiments that address current elementary science education standards and that are appropriate for their future students to do, such as measurements of mass, length, time, light from atoms, charge and current, motion due to forces, energy and work, heat, waves, optics, building bridges and making musical instruments, studying states of matter and chemical reactions.

PHYS 111: General Physics
(4-2) Cr. 5. F.S.SS.
Prereq: 1 1/2 years of high school algebra, 1 year of geometry, 1 semester of trigonometry
General background in physical concepts, principles, and methods for those who do not plan advanced study in physics or engineering. Mechanics, fluids, heat and thermodynamics, vibrations, waves, sound.

PHYS 112: General Physics
(4-2) Cr. 5. F.S.SS.
Prereq: PHYS 111
General background in physical concepts, principles, and methods for those who do not plan advanced study in physics or engineering. Electricity and magnetism, ray and wave optics, topics in modern physics.

PHYS 115: Physics for the Life Sciences
(4-0) Cr. 4. F.S.
Prereq: high school: 1 1/2 yr. algebra, 1 yr. geometry, 1 semester trigonometry
Emphasis on basic physics principles applied to biological problems. Topics include mechanics, fluids, thermodynamics, heat, light, sound, electricity and magnetism. A coordinated laboratory, Physics 115 laboratory is available.

PHYS 115L: Laboratory in Physics for the Life Sciences
(0-2) Cr. 1. F.S.
Experiments related to the elementary topics of physics for the life sciences. Mechanics, fluids, thermodynamics, heat, light, sound, electricity and magnetism.

PHYS 198: Physics of Music
(2-2) Cr. 3. F.
Introductory level course on sound for nonphysics majors. Properties of pure tones and harmonics; human perception of sound; room acoustics; scales; production, and analysis of musical by voice, string, woodwind, brass, and percussion instruments. Not suitable to meet a general physics requirement for natural science majors

PHYS 199: Introductory Seminar
Cr. R. F.
(1-1) Gain experience in key skills that physicists/astronomers use routinely, but are rarely explicitly taught in formal courses. Participate in faculty-led discussions on frontier areas and careers. Offered on a satisfactory-fail basis only.

PHYS 221: Introduction to Classical Physics I
(4.5-1) Cr. 5. F.S.SS.
Prereq: Proficiency in algebra, trigonometry, vector manipulation, and topics covered in Math 165, and credit or enrollment in MATH 166.
For engineering and science majors. 3 hours of lecture each week plus 3 recitations and 1 laboratory every 2 weeks. Elementary mechanics including kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation. Heat, thermodynamics, kinetic theory of gases; waves and sound.

PHYS 221H: Introduction to Classical Physics I: Honors
(4.5-1) Cr. 5. F.S.
Prereq: Proficiency in algebra, trigonometry, vector manipulation, and topics covered in Math 165, and credit or enrollment in MATH 166.
For engineering and science majors. 3 hours of lecture each week plus 3 recitations and 1 laboratory every 2 weeks. Elementary mechanics including kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation. Heat, thermodynamics, kinetic theory of gases; waves and sound.

PHYS 222: Introduction to Classical Physics II
(4-2) Cr. 5. F.S.SS.
Prereq: PHYS 221 OR PHYS 241, MATH 166
3 hours of lecture each week plus 1 recitation and 1 laboratory each week. Electric forces and fields. Electrical currents; DC circuits. Magnetic forces and fields: LR, LC, LCR circuits; Maxwell's equations; ray optics and image formation; wave optics; topics in modern physics.

PHYS 222H: Introduction to Classical Physics II: Honors
(4-2) Cr. 5. F.S.
Prereq: PHYS 221 OR PHYS 241, MATH 166
3 hours of lecture each week plus 1 recitation and 1 laboratory each week. Electric forces and fields. Electrical currents; DC circuits. Magnetic forces and fields: LR, LC, LCR circuits; Maxwell's equations; ray optics and image formation; wave optics; topics in modern physics.

PHYS 241: Principles and Symmetries in Classical Physics I
(4.5-1) Cr. 5. F.
Prereq: Proficiency in algebra, trigonometry, vector manipulation, and topics covered in MATH 165, and credit or enrollment in MATH 166.
Covers all of mechanics; Kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation, and extremum principles. Topics in kinetic theory, thermodynamics, waves and sound.

PHYS 241H: Principles and Symmetries in Classical Physics I, Honors.
(4.5-1) Cr. 5. F.
Prereq: Proficiency in algebra, trigonometry, vector manipulation, and topics covered in MATH 165, and credit or enrollment in MATH 166.
Covers all of mechanics; Kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation, and extremum principles. Topics in kinetic theory, thermodynamics, waves and sound.

PHYS 242: Principles and Symmetries in Classical Physics II
(4-2) Cr. 5. S.
Prereq: PHYS 221 or PHYS 241, credit or enrollment in MATH 166
Electrostatics, potentials and fields, currents, fields of moving charges, the magnetic field, electromagnetic induction, DC and AC circuits, Maxwell's equations and electromagnetic waves, electric and magnetic fields in matter. Topics in optics, special relativity and modern physics.

PHYS 242H: Principles and Symmetries in Classical Physics II, Honors (Spring).
(4-2) Cr. 5. S.
Prereq: PHYS 221 or PHYS 241, credit or enrollment in MATH 166
Electrostatics, potentials and fields, currents, fields of moving charges, the magnetic field, electromagnetic induction, DC and AC circuits, Maxwell's equations and electromagnetic waves, electric and magnetic fields in matter. Topics in optics, special relativity and modern physics.

PHYS 290: Independent Study
Cr. 1-4. Repeatable.
Prereq: Permission of instructor

PHYS 298: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

PHYS 302: The Challenge of Contemporary Physics
(3-0) Cr. 3. S.
Prereq: Sophomore classification
A largely nonmathematical but intellectually challenging exploration of physics, which assumes no previous work in the field. Selected material from classical and modern physics establishes the conceptual framework for the study of major areas of contemporary physics, culminating in the discussion of topics at the frontier of present knowledge. Topics vary yearly and may include quarks, lasers, superconductivity, fission and fusion, solid state devices, gravitational waves, string theory, facilities, left handed materials, and quantum computing. Not suitable to meet a general physics requirement for natural science majors.

PHYS 304: Thermal Physics
(3-0) Cr. 3. F.
Prereq: PHYS 222, MATH 266
Concepts of temperature, entropy, and other characteristic thermodynamic functions, with application to macroscopic properties of matter. The laws of thermodynamics. Introduction to statistical mechanics, including quantum statistics. Application to black body radiation, crystalline vibrations, magnetic ions in solids, electronic heat capacity of metals. Phase transformations and chemical reactions.

PHYS 306: Physics of Wave Motion
(3-0) Cr. 3. S.
Prereq: PHYS 222, credit or enrollment in MATH 267
Oscillating systems including damped and forced oscillations; fluids, geometric optics, water waves, the wave equation, Fourier and Laplace transforms, non-uniform media, cylindrical and spherical waves, polarization, interference and diffraction, transmission lines, non-linear waves.

PHYS 310: Electronic Instrumentation for Experimental Physics
(2-4) Cr. 4. F.
Prereq: PHYS 222; MATH 166
Common electrical instruments; power supplies; transducers; passive and active devices, analog integrated circuits, including filters and amplifiers; digital integrated circuits; signal transmission and enhancement.

PHYS 311: Intermediate Laboratory
Cr. 1-2. Repeatable. S.
Prereq: PHYS 322
Experiments in classical and modern physics performed independently by each student.

PHYS 311T: Intermediate Laboratory for Secondary Physics Teachers
(0-6) Cr. 3. Repeatable. S.
Prereq: PHYS 112 or PHYS 222
Experiments in classical and modern physics performed independently by each student. For students preparing for a career in high school teaching.

PHYS 321: Introduction to Modern Physics I
(3-0) Cr. 3. F.
Prereq: PHYS 222, credit or enrollment in MATH 266
Quantum nature of matter: photons, de Broglie's postulate: wave-like properties of matter; Bohr's model of hydrogen atom; Schrodinger equations in one dimension: energy quantization; detailed solutions for potential steps, barriers and wells; one-electron atoms, spin and magnetic interactions; ground states, optical and x-ray excitations of multi-electron atoms.

PHYS 321L: Introductory Laboratory in Modern Physics I
(0-2) Cr. 1. F.
Prereq: Credit or enrollment in PHYS 321
Experiments related to the foundations of modern physics. The dual wave and particle character of electrons and photons, statistics, interferometry and x-ray spectroscopy.

PHYS 322: Introduction to Modern Physics II
(3-0) Cr. 3. S.
Prereq: PHYS 321
Quantum statistics; lasers; physics of molecules. Properties of solids, including electron band structure, superconductivity and magnetism. Nuclear physics, including nuclear sizes and masses, stability, decay modes, reactions, fission and fusion. Elementary particles, including strangeness, charm, and quarks. Fundamental forces of nature.

PHYS 322L: Introductory Laboratory in Modern Physics II
(0-2) Cr. 1. S.
Prereq: Credit or enrollment in PHYS 322
Experiments related to the foundations of modern physics. Radioactive decay, elementary particles, Hall effect, quantization, spectroscopy, statistics and instrumentation.

PHYS 361: Classical Mechanics
(3-0) Cr. 3. S.
Prereq: PHYS 222, MATH 265, credit or enrollment in MATH 266 or 267
Newtonian mechanics including forced oscillations, central forces and orbital motion, collisions, moving frames of reference, Lagrange's equations.

PHYS 362: Intermediate Mechanics
(3-0) Cr. 3. F.
Prereq: PHYS 361
Rigid body motion; small oscillations, normal modes. Special relativity including length contraction, time dilation, simultaneity, Lorentz transformation, 4-vector covariant formalism, relativistic mechanics.

PHYS 364: Electricity and Magnetism I
(3-0) Cr. 3. F.
Prereq: PHYS 222
Static electric and magnetic fields, potential theory; electromagnetism, Maxwell's equations.

PHYS 365: Electricity and Magnetism II
(3-0) Cr. 3. S.
Prereq: PHYS 364, MATH 385
Relativistic electromagnetic theory; radiation and propagation of electromagnetic waves; interaction with matter.

PHYS 389: Junior Seminar
Cr. R. S.
Recommended for all junior physics majors. Career opportunities: graduate school programs and application, job placement, alternative careers, basic skills needed for the job market competition. Offered on a satisfactory-fail basis only.

PHYS 398: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

PHYS 399: Seminar on Secondary School Physics
Cr. 1-2. Repeatable, maximum of 2 credits. F.
Prereq: Permission of instructor
Review of materials and curricula for secondary school physics presented and discussed by members of the class. Required for approval to teach physics in secondary schools.

PHYS 421: Ultrafast Laser Science and Spectroscopy
(Dual-listed with PHYS 521). (3-0) Cr. 3. F.
Prereq: PHYS 321, PHYS 365, or equivalent with permission of instructor
Introduction to ultrafast lasers, nonlinear optics, and their applications. Topics selected from: basic optics, atom-photon interactions, electrodynamics of condensed matter, laser physics, ultrafast and nonlinear optics, ultrashort pulse generation, broadband pulse generation, time-resolved spectroscopy and instrumentation.

PHYS 432: Molecular and Cell Biophysics
(Dual-listed with PHYS 532). (3-0) Cr. 3. S.
Prereq: PHYS 304 or CHEM 325.
Quantitative description of biological systems using basic physical laws, including a brief discussion of a variety of biophysical techniques. Topics include: thermodynamics, chemical equilibrium, gene expression, structure and physical properties of nucleic acids and proteins, folding of nucleic acids and proteins, chemical kinetics, catalysis, allosteric enzymes, cell membrane structure and physical properties, and machines in cell membranes.

PHYS 450: Undergraduate Research
Cr. 1-6. Repeatable. F.S.SS.
Prereq: Permission of instructor
Theoretical research under supervision of physics faculty.

PHYS 450L: Undergraduate Research
Cr. 1-6. Repeatable. F.S.SS.
Prereq: PHYS 311, permission of instructor
Laboratory project under supervision of physics faculty.

PHYS 461: Physics of Biomolecules
(Dual-listed with PHYS 561). (3-0) Cr. 3. F.
Prereq: PHYS 304 or CHEM 325, BBMB 301, or permission of instructor
Cell and Molecular Biophysics. Physical techniques used to characterize the structure, dynamics and properties of biomolecules with emphasis on single molecule techniques.

PHYS 470L: Applied Physics Laboratory
Cr. 2-5. Repeatable. F.S.SS.
Prereq: PHYS 322 and permission of instructor
Studies in modern experimental techniques via experimentation and simulation in various areas of applied physics, e.g. superconductivity, optical spectroscopy, nuclear magnetic resonance, electron spin resonance, x-ray diffraction, and computation of electronic and structural properties of matter.

PHYS 480: Quantum Mechanics I
(3-0) Cr. 3. F.
Prereq: PHYS 322, MATH 385
First semester of a full-year course. A systematic development of the formalism and applications of quantum mechanics. Solutions to the time independent Schrodinger equation for various one-dimensional potentials including the harmonic oscillator; operator methods; Heisenberg picture; angular momentum; the hydrogen atom; spin; symmetry properties.

PHYS 481: Quantum Mechanics II
(3-0) Cr. 3. S.
Prereq: PHYS 480
Continuation of 480. Addition of angular momentum; charged particles in electromagnetic fields; time-independent perturbation theory; variational principles; WKB approximation; interaction picture; time-dependent perturbation theory; adiabatic approximation; scattering; selected topics in radiation theory; quantum paradoxes.

PHYS 490: Independent Study
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: 6 credits in physics, permission of instructor
No more than 9 credits of Phys 490 may be counted toward graduation.

PHYS 490H: Independent Study, Honors
Cr. 1-4. Repeatable, maximum of 9 credits.
Prereq: 6 credits in physics, permission of instructor
No more than 9 credits of Phys 490 may be counted toward graduation.

PHYS 496: Modern Optics
(Cross-listed with E E). (3-0) Cr. 3. S.
Prereq: Credit or enrollment in PHYS 322, PHYS 365, and PHYS 480
Review of wave and electromagnetic theory; topics selected from: reflection/refraction, interference, geometrical optics, Fourier analysis, dispersion, coherence, Fraunhofer and Fresnel diffraction, holography, quantum optics, nonlinear optics.

PHYS 498: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the department cooperative education coordinator; senior classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

Courses primarily for graduate students, open to qualified undergraduates:

PHYS 501: Oral Communication of Physics Seminar
(2-0) Cr. 1. Repeatable. F.
A practical introduction to communication methods in physics and astronomy classrooms and professional settings. For graduate physics majors only. Offered on a satisfactory-fail basis only.

PHYS 502: Introductory Research Seminar
Cr. R. F.
(1-1) Discussion by research staff of their research areas, expected thesis research work, and opportunities in the field. For graduate physics majors only. Offered on a satisfactory-fail basis only.

PHYS 511: Condensed Matter Physics I
(3-0) Cr. 3. F.
Prereq: PHYS 304, credit or enrollment in PHYS 481
First semester of a full-year course. Free electron model; crystal symmetry; band theory of solids; transport properties; Fermi surface; phonons; semiconductors; crystal surfaces; magnetism; superconductivity.

PHYS 512: Condensed Matter Physics II
(3-0) Cr. 3. S.
Prereq: PHYS 511
Continuation of 511. Free electron model; crystal symmetry; band theory of solids; transport properties; Fermi surface; phonons; semiconductors; crystal surfaces; magnetism; superconductivity.

PHYS 521: Ultrafast Laser Science and Spectroscopy
(Dual-listed with PHYS 421). (3-0) Cr. 3. F.
Prereq: PHYS 321, PHYS 365, or equivalent with permission of instructor
Introduction to ultrafast lasers, nonlinear optics, and their applications. Topics selected from: basic optics, atom-photon interactions, electrodynamics of condensed matter, laser physics, ultrafast and nonlinear optics, ultrashort pulse generation, broadband pulse generation, time-resolved spectroscopy and instrumentation.

PHYS 526: Particle and Nuclear Physics
(4-0) Cr. 4. F.
Prereq: Credit or enrollment in PHYS 481
Basic properties and structures of nuclei, hadrons, and elementary particles; weak and strong interactions; the Standard Model; accelerators and detectors; nuclear models; nuclear decay and stability; nuclear astrophysics; the Higgs mechanism; the CKM matrix; running coupling constants; relativistic heavy-ion collisions; selected topics beyond the standard model such as SUSY and grand unification.

PHYS 528: Mathematical Methods for the Physical Sciences
(3-0) Cr. 3. F.
Prereq: MATH 266 or MATH 267
Fast-paced coverage of mathematical techniques needed for advanced analysis in the physical sciences, particularly for quantum mechanics and electrodynamics. Linear vector spaces and operators. Linear differential equations for time-evolution and steady-state problems, Green's functions and propagators, Sturm-Liouville problems. Functions of a complex variable, calculus of residues, series expansions, integral transforms and applications.

PHYS 531: Statistical Mechanics
(3-0) Cr. 3. S.
Prereq: PHYS 304 and credit or enrollment in PHYS 481, MATH 465, credit or enrollment in MATH 365 or MATH 426
Thermodynamic properties of systems of many particles obeying Boltzmann, Fermi-Dirac, and Bose-Einstein statistics; microcanonical, canonical, and grand canonical ensembles and their application to physical problems; density matrices; introduction to phase transitions; renormalization group theory; kinetic theory and fluctuations.

PHYS 532: Molecular and Cell Biophysics
(Dual-listed with PHYS 432). (3-0) Cr. 3. S.
Prereq: PHYS 304 or CHEM 325.
Quantitative description of biological systems using basic physical laws, including a brief discussion of a variety of biophysical techniques. Topics include: thermodynamics, chemical equilibrium, gene expression, structure and physical properties of nucleic acids and proteins, folding of nucleic acids and proteins, chemical kinetics, catalysis, allosteric enzymes, cell membrane structure and physical properties, and machines in cell membranes.

PHYS 534: Symmetry and Group Theory in Physics
(3-0) Cr. 3. S.
Prereq: Credit or enrollment in PHYS 481
Theory of groups and group representations; introduction to both point and continuous groups, and their applications in physics.

PHYS 535: Physics of Semiconductors
(Cross-listed with E E). (3-3) Cr. 4.
Prereq: E E 311 and E E 332
Basic elements of quantum theory, Fermi statistics, motion of electrons in periodic structures, crystal structure, energy bands, equilibrium carrier concentration and doping, excess carriers and recombination, carrier transport at low and high fields, space charge limited current, photo-conductivity in solids, phonons, optical properties, amorphous semiconductors, heterostructures, and surface effects. Laboratory experiments on optical properties, carrier lifetimes, mobility, defect density, doping density, photo-conductivity, diffusion length of carriers.

PHYS 536: Physics of Semiconductor Devices
(Cross-listed with E E). (3-0) Cr. 3.
Prereq: E E 535
P-n junctions, band-bending theory, tunneling phenomena, Schottky barriers, heterojunctions, bipolar transistors, field-effect transistors, negative-resistance devices and optoelectronic devices.

PHYS 541: General Relativity
(3-0) Cr. 3. F.
Prereq: PHYS 362, MATH 307 or MATH 317
Tensor analysis and differential geometry developed and used to formulate Einstein field equations. Schwarzschild and Kerr solutions. Other advanced topics may include gravitational radiation, particle production by gravitational fields, alternate gravitational theories, attempts at unified field theories, cosmology.

PHYS 551: Computational Physics
(0-4) Cr. 2. S.
Prereq: PHYS 365, credit or enrollment in PHYS 481
Use of modern computational techniques to analyze topics in classical and modern physics. Offered on a satisfactory-fail basis only.

PHYS 561: Physics of Biomolecules
(Dual-listed with PHYS 461). (3-0) Cr. 3. F.
Prereq: PHYS 304 or CHEM 325, BBMB 301, or permission of instructor
Cell and Molecular Biophysics. Physical techniques used to characterize the structure, dynamics and properties of biomolecules with emphasis on single molecule techniques.

PHYS 564: Advanced Classical Mechanics
(3-0) Cr. 3. S.
Prereq: PHYS 362, MATH 426, MATH 465
Variational principles, Lagrange's equations, Hamilton's canonical equations, canonical transformations, Hamilton-Jacobi theory, infinitesimal transformations, classical field theory, canonical perturbation theory, classical chaos.

PHYS 571: Electricity and Magnetism I
(3-0) Cr. 3. F.
Prereq: PHYS 365, MATH 426
Electrostatics, magnetostatics, boundary value problems, Maxwell's equations, wave phenomena in macroscopic media, wave guides.

PHYS 572: Electricity and Magnetism II
(3-0) Cr. 3. S.
Prereq: PHYS 571
Special theory of relativity, least action and motion of charged particles in electromagnetic fields, radiation, collisions between charged particles, multipole fields, radiation damping.

PHYS 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 590A: Nuclear Physics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 590B: Condensed Matter Physics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 590C: High Energy Physics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 590D: Physics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 590E: Applied Physics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 590F: Biophysics
Cr. arr. Repeatable.
Prereq: Permission of instructor
Topics of current interest.

PHYS 591: Quantum Physics I
(4-0) Cr. 4. F.
Prereq: PHYS 481
First semester of a full-year course. Postulates of quantum mechanics; time-dependent and time-independent Schrodinger equations for one-,two-, and three-dimensional systems; theory of angular momentum; Rayleigh-Schrodinger time-independent perturbation theory.

PHYS 592: Quantum Physics II
(4-0) Cr. 4. S.
Prereq: PHYS 591
Continuation of 591. Variational theorem and WKB method; time-dependent perturbation theory and 2nd quantization of the EM field in Coulomb gauge; method of partial waves and Born approximation for scattering by central potentials; identical particles and symmetry; Dirac and Klein-Gordon equation for free particles; path integral formalism.

PHYS 599: Creative Component
Cr. arr.
Prereq: Permission of instructor
Individually directed study of research-level problems for students electing the nonthesis M.S. degree option.

Courses for graduate students:

PHYS 611: Quantum Theory of Condensed Matter
(3-0) Cr. 3. S.
Prereq: PHYS 512 and PHYS 681 or permission of instructor.
Quasiparticles in condensed matter: phonons, magnons, photons, electrons. Quantum theory of interacting many body systems: Green's functions and diagrammatic techniques.

PHYS 624: Advanced Nuclear Physics
(3-0) Cr. 3.
Prereq: PHYS 526 and PHYS 592
Microscopic few-body and many-body theory; theory of effective Hamiltonians; relativistic nuclear physics; nuclear effects in hadron-nucleus, lepton-nucleus, and nucleus-nucleus reactions.

PHYS 625: Physics of Strong Interactions
(3-0) Cr. 3.
Prereq: PHYS 681
Quark model; Quantum Chromodynamics IQCD); perturbation methods for QCD; effective field theories for pions and nucleons; finite temperature field theories; quark-gluon plasma; phase transitions in QCD.

PHYS 637: Elementary Particle Physics I
(3-0) Cr. 3. S.
Prereq: PHYS 526 and PHYS 592
First semester of a full year course. Properties of leptons, bosons, and quarks and their interactions; quantum chromodynamics, Glashow-Weinberg-Salam model, grand unification theories, supersymmetry; modern theoretical techniques and tests of the Standard Model.

PHYS 638: Elementary Particle Physics II
(3-0) Cr. 3.
Prereq: PHYS 637
Continuation of 637. Properties of leptons, bosons, and quarks and their interactions; quantum chromodynamics, Glashow-Weinberg-Salam model, grand unification theories, supersymmetry, and superstring theory; modern theoretical techniques.

PHYS 646: Mathematical Modeling of Complex Physical Systems
(Cross-listed with MATH). (3-0) Cr. 3. S.
Modeling of the dynamics of complex systems on multiple scales: Classical and dissipative molecular dynamics, stochastic modeling and Monte-Carlo simulation; coarse grained nonlinear dynamics, interface propagation and spatial pattern formation.

PHYS 650: Advanced Seminar
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 650A: Nuclear Physics
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 650B: Condensed Matter Physics
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 650C: High Energy Physics
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 650D: Physics
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 650E: Applied Physics
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 650F: Biophysics
(1-0) Cr. 1. Repeatable. F.S.
Topics of current interest. Offered on a satisfactory-fail basis only.

PHYS 660: Advanced Topics in Physics
Cr. 1-3. Repeatable. F.S.
Courses on advanced topics and recent developments.

PHYS 660B: Condensed Matter Physics
Cr. 1-3. Repeatable. F.S.
Courses on advanced topics and recent developments.

PHYS 660C: High Energy Physics
Cr. 1-3. Repeatable. F.S.
Courses on advanced topics and recent developments.

PHYS 660D: Physics
Cr. 1-3. Repeatable. F.S.
Courses on advanced topics and recent developments.

PHYS 660E: Applied Physics
Cr. 1-3. Repeatable. F.S.
Courses on advanced topics and recent developments.

PHYS 660F: Biophysics
Cr. 1-3. Repeatable. F.S.
Courses on advanced topics and recent developments.

PHYS 681: Quantum Field Theory I
(3-0) Cr. 3. F.
Prereq: PHYS 564, PHYS 572, PHYS 592
Quantization of fields (canonical and path integral); Feynman rules; introduction to gauge theories; Quantum Electrodynamics; radiative corrections; renormalization and renormalization group.

PHYS 682: Quantum Field Theory II
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: PHYS 681
Continuation of 681. Systematics of renormalization; renormalization group methods; symmetries; spontaneous symmetry breaking; non-abelian gauge theories; the Standard Model and beyond; special topics.

PHYS 699: Research
Cr. arr. Repeatable.
Prereq: Instructor permission required.
Graduate research.

Political Science

The study of political science is designed to enable students to understand the nature of politics, public values, and the institutions and processes of politics in their various forms.

Students completing a major in political science will understand and be able to interrelate the leading theories, literature, and approaches in the subfields of American government, political theory and methods, international relations, and comparative politics. Graduates can analyze and formulate effective argumentation in written and oral forms, including the ability to appreciate and accommodate diverse political ideas, and the ability to collect and critique information and ideas of others in support of original arguments. Graduates appreciate the knowledge and civic responsibilities required for effective participation in political life.

The political science major is often chosen by students preparing for a career in law. Students with this goal should consult with the department in selecting courses. See also Preprofessional Study.

Several internship options are available to the political science major, offering students the opportunity to experience practical application of the knowledge learned in academic courses.

Requirements for the Major:

For the purpose of defining undergraduate requirements in the Department of Political Science, the Department employs four subfields within the discipline, with the following courses in each:

I. Theory and Methods

POL S 235	Introduction to Ethics and Politics	3
POL S 313	Special Topics in Theory and Methods	2
POL S 333	Democracy and Diversity in America	3
POL S 339	Liberty and Law in America	3
POL S 430	Foundations of Western Political Thought	3
POL S 431	Modern Political Thought	3
POL S 470	Political Game Theory	3
POL S 480	Ethics and Public Policy	3
POL S 490B	Independent Study: Theory and Method	arr †
Total Credits		23 †

† Arranged with instructor.

II. American Government and Politics

POL S 215	Introduction to American Government	3
POL S 305	Political Behavior	3
POL S 306	Public Opinion and Voting Behavior	3
POL S 310	State and Local Government	3
POL S 312	Special Topics in American Government and Politics	2
POL S 318	Campaign and Elections	3
POL S 319	Law and Politics	3
POL S 320	American Judicial Process	3
POL S 334	Politics and Society	3
POL S 335	Science, Technology, and Public Policy	3
POL S 344	Public Policy	3

POL S 360	American Institutions: Congress	3
POL S 361	American Institutions: The Presidency	3
POL S 363	American Institutions: Media	3
POL S 364	Political Parties and Interest Groups	3
POL S 370	Religion and Politics	3
POL S 371	Public Organizations and Leadership	3
POL S 385	Women in Politics	3
POL S 383	Environmental Politics and Policies	3
POL S 413	Intergovernmental Relations	3
POL S 417	Campaign Rhetoric	3
POL S 420	Constitutional Law	3
POL S 421	Constitutional Freedoms	3
POL S 475	Management in the Public Sector	3
POL S 487	Electronic Democracy	3
POL S 490A	Independent Study: American Government and Politics	arr †

† Arranged with instructor.

III. Comparative Politics

POL S 241	Introduction to Comparative Government and Politics	3
POL S 314	Special Topics in Comparative Politics	2
POL S 340	Politics of Developing Areas	3
POL S 343	Latin American Government and Politics	3
POL S 345	Immigration Policy	3
POL S 346	European Politics	3
POL S 349	Politics of Russia and the Soviet Successor States	3
POL S 350	Politics of the Middle East	3
POL S 442	The Policy and Politics of Coastal Areas	3
POL S 485	Comparative Public Administration	3
POL S 490C	Independent Study: Comparative Politics	arr †

† Arranged with instructor.

IV. International Relations

POL S 251	Introduction to International Politics	3
POL S 315	Special Topics in International Relations	2
POL S 356	Theories of International Politics	3
POL S 357	International Security Policy	3
POL S 358	United States Foreign Policy	3
POL S 359	Current Issues in American Foreign Policy	3
POL S 381	International Political Economy	3
POL S 422	International Law	3
POL S 452	Comparative Foreign Policy	3
POL S 453	International Organizations	3
POL S 490D	Independent Study: International Relations	arr †

† Arranged with instructor.

To complete the major in Political Science a student must earn 33 semester credits of courses in Political Science subject to the following conditions:

1. Students must satisfactorily complete POL S 101 and POL S 301.
2. Students must complete at least 3 credits in each of the four subfields listed above. Students may apply only one half-semester mini-course (POL S 312, POL S 313, POL S 314, POL S 315) in each group.
3. Political Science courses in which a student has a grade of D+ or lower will not count for the major but can be counted as electives.
4. At least 18 credits of Political Science courses must be numbered 300 or above.
5. Students must pass one statistics course from among STAT 101, STAT 104, STAT 226, or STAT 231.
6. No more than nine credits of POL S 496, POL S 497, or POL S 499 (alone or in combination) can be used to fulfill any of these requirements. A maximum of three credits of POL S 490 can be applied to meet any of the four subfield requirements.
7. A maximum of six credits from half-semester mini-courses (POL S 312, POL S 313, POL S 314, POL S 315) can be applied to satisfy the above requirements.
8. At least 15 credits of Political Science coursework must be earned at Iowa State University.
9. Advanced Communication Skills: Majors must earn at least a C in one course from among ENGL 302, ENGL 309, or ENGL 314.

The department offers a minor in political science that may be earned by completing 15 credits beyond the 100-level of coursework in political science, nine of which must be at the 300 level or above. A student minoring in Political Science normally will be expected to take at least 9 credits in Political Science coursework at Iowa State University. Only 3 credits of POL S 490 or POL S 499, alone or in combination, and only 2 credits of POL S 312, POL S 313, POL S 314, or POL S 315 may be included in the total of 15 credits required for the minor. All minors in the College of Liberal Arts and Science require a minimum of 6 credits in courses numbered 300 and above taken at ISU with a minimum grade of C. Credits earned in POL S 496, POL S 497, or POL S 499, offered on a satisfactory/fail basis only, will not fulfill this requirement.

Political Science, B.A.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	POL S 251[1]	3
LIB 160	1	Social Science Choice	3
POL S 101	1	Natural Science Choice	3
POL S 215	3	Humanities Choice	3
Humanities choice	3	Elective	3
Natural Science Choice	3		
Social Science Choice	3		
	17		15

Sophomore

Fall	Credits	Spring	Credits
POL S 235	3	POL S 241	3
ENGL 250	3	Political Science Choice 300/400 Level	3
Foreign Language/Elective	3-4	Foreign Language/Elective	3-4
Humanities Choice	3	STAT 101, 104, 226 or 231[2]	3-4
Natural Science Choice	2-3	Elective	2-3
	14-16		14-17

Junior

Fall	Credits	Spring	Credits
POL S 301	3	One of the following:	3
Political Science Choice - 300/400 Level	2-3	ENGL 302	
U.S. Diversity Choice[3]	3	ENGL 309	
Humanities Choice	3	ENGL 314	
Elective	3	Political Science Choice 300/400 Level	2-3
		Electives	9
	14-15		14-15

Senior

Fall	Credits	Spring	Credits
Political Science Choice - 300/400 Level	3	Political Science Choice - 300/400 Level	3
Electives	12	Electives	11
	15		14

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.**

1 Meets international perspectives requirement.

2 Meets LAS College math requirement.

3 May be cross-listed to fulfill other requirements.

Graduate Study

The department offers work for a Master of Arts degree (MA) with a major in political science and minor for students in other departments. The department also offers work for a Graduate Certificate of Public Management and Policy (GCPMP) for those interested in an educational certificate program that requires less work than a full masters program. In addition, the Department of Political Science offers work for a Master of Science in Information Assurance (MSIA) and a joint Master of Arts/Juris Doctor (MA/JD) program with the Law School of Drake University. Information with detailed requirements for all graduate degrees may be obtained at the department's web page at https://www.pols.iastate.edu/academics/graduate/

Master of Arts (MA)

This is a 30-credit masters degree that gives students the opportunity to explore the field of political science in order to pursue a PhD, go to law school, improve research skills, or understand politics better. The three concentration areas are American Politics, Global Politics, and Public Policy. Although it is not a formal concentration, some students have worked heavily in the area of political theory. Top students are eligible for graduate assistantships that make graduate study much more affordable and provide opportunities for assisting faculty with teaching and research. These are awarded on a merit basis. A thesis is required for this degree. The department also has a joint Master of Arts/Juris Doctor (MA/JD) program with the Law School of Drake University. Students wishing to pursue this joint degree must submit separate applications to Drake University and Iowa State University and be accepted by both institutions.

MA graduates have a broad substantive understanding of the political process and the academic study of politics. They also have in-depth knowledge of one or more subfields in political science. Graduates are skilled at conducting research and preparing thorough research summaries. They are able to identify and address complex political questions, taking into account related ethical, legal, economic, and social issues.

The prerequisites for major graduate work in the MA program normally are completion of at least 15 credits in political science, the GRE (Graduate Record Examination), one year of a foreign language (equivalent to 8 semester hours), and a course in basic statistics (equivalent to STAT 101). If the basic statistics requirement has not been met, the student may remedy the deficiency by passing equivalent

courses, for which no graduate credit will be received. During their program of study, all students are expected to complete STAT 401, POL S 502, and a thesis. Additional information including detailed graduation requirements can be found at https://www.pols.iastate.edu/academics/graduate/#ma

Master of Science in Information Assurance (MSIA)

The Master of Science in Information Assurance (MSIA) is a multi-disciplinary program designed to provide students with diverse backgrounds and interests the opportunity to obtain professional training in the emerging field of information assurance. The core of the MSIA program is built around a series of courses taught in Electrical and Computer Engineering, Mathematics, and Computer Science that introduce students to software and hardware aspects of cryptography and computer security. The program also recognizes, however, that information assurance defined in terms of security, privacy, access, and reliability is not simply a technical problem but also involves important societal dimensions, including policy, education, ethics, and management. Recognizing that political science offers many potential intersections with information assurance (e.g., public sector management of information technology; forensics and computer crime; information technology policy and law; information technology and international relations; information warfare; etc.), students with interests in these areas are encouraged to select the Department of Political Science as their home department.

Students opting to pursue a MSIA degree through the Department of Political Science can expect to acquire skills and background knowledge relevant to a career in public policy or public sector management of information assurance technologies. The MSIA degree can also help prepare students who wish to go on to pursue a PhD in information politics and policy.

Students interested in the MSIA degree program should consider Political Science as a home department if their future career and/or educational interests lie in such areas as: institutional issues related to the Internet and information technologies; electronic government and electronic democracy; information technology, international security, and information warfare; information technology policy and law; and public administration and public sector management of information technology.

Admission requirements generally follow the same guidelines as the MA in Political Science. Degree requirements are specified by the MSIA program in cooperation with Political Science. More in-depth information on the program including detailed graduation requirements can be found at: https://www.pols.iastate.edu/academics/graduate/#msia

Master of Arts/Juris Doctorate Program (MA/JD)

The Drake Law School and the Department of Political Science at Iowa State University are co-sponsors of the Master of Arts/Juris Doctorate degree. This degree combines courses at both Iowa State University and the Drake Law School and follows most of the same requirements as a double degree. However, the student must have full admission to both schools. Detailed information for the MA/JD can be found at the ISU Political Science webpage as well as the Drake Law School website (under Joint Degree): http://www.law.drake.edu/.

The increasing attention being focused on the solution of social problems by state and federal governments has created a need for persons with advanced training in both law and political science. The Drake Law School and the ISU Department of Political Science jointly administer a MA/JD program to provide an opportunity for students at the Drake Law School to achieve, concurrently, a JD degree in law and a MA degree in political science, and for graduate students in political science at Iowa State University to achieve a degree in law.

Successful completion of this program will enable students at Drake Law School to receive both a JD and an MA degree within a three-year period, while graduate students in political science at Iowa State University will be able to transfer a substantial number of hours to the Drake Law School toward the fulfillment of the JD requirements in a similar amount of time. Additional information including detailed graduation requirements can be found at: https://www.pols.iastate.edu/academics/graduate/#majd

Minor

Students in other graduate programs may obtain a minor in political science by completing at least 9 credits of political science courses. Interested students should consult the Graduate College Handbook for additional information on graduate minors.

The Graduate Certificate of Public MANAGEMENT AND POLICY (GCPMP)

The Political Science Department offers a Graduate Certificate of Public Management and Policy (GCPMP). The GCPMP is a 15-credit certificate. Students who are interested in public management and policy, but unsure about committing to a full master's degree, can aim for the certificate knowing that those courses will also count toward a master's degree if they choose to continue on. Iowa State graduate students in other fields may want to pursue the certificate to improve their credentials on the job market if their interest overlaps with public management and policy. For example, doctoral students in higher education and education administration can earn all 9 of their "outside" credits in the GCPMP coursework, add the 6 more elective credits, and earn a GCPMP along with their PhD.

Requirements for admission are a graduate school application, an essay stating purposes for study, college transcripts, the GRE (waived for those with five or more years of public or nonprofit sector experience), three letters of recommendation, and the TOEFL for international students. More information on the program including curricular requirements can be found at: https://www.pols.iastate.edu/academics/graduate/#gcpm/.

Courses primarily for undergraduates:

POL S 101: Orientation to Political Science
(2-0) Cr. 1. F.S.
Prereq: Political Science and Open Option majors only or permission of the instructor
Introduction to the discipline and sub-fields of Political Science, including an introduction to analytical thinking, and research skills relevant to political science. Orientation to university, college, and departmental structure, policies, and procedures; student roles and responsibilities; degree planning and career awareness. Offered on a satisfactory-fail basis only.

POL S 215: Introduction to American Government
(3-0) Cr. 3. F.S.SS.
Fundamentals of American democracy; constitutionalism; federalism; rights and duties of citizens; executive, legislative, and judicial branches of government; elections, public opinion, interest groups, and political parties.

POL S 235: Introduction to Ethics and Politics
(3-0) Cr. 3. F.SS.
Introduction to moral controversies surrounding political issues such as violence, deception, corruption, civil disobedience, democracy, justice, equality, and freedom. Students will read classic and contemporary texts and consider political applications.

POL S 241: Introduction to Comparative Government and Politics
(3-0) Cr. 3. F.S.
Basic concepts and major theories; application to selected political systems, including non-western political systems.
Meets International Perspectives Requirement.

POL S 251: Introduction to International Politics
(3-0) Cr. 3. F.S.
Dynamics of interstate relations pertaining to nationalism, the nation state; peace and war; foreign policy making; the national interest; military capability and strategy; case studies of transnational issues, such as population, food, energy, and terrorism.
Meets International Perspectives Requirement.

POL S 298: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of department cooperative education coordinator; sophomore classification
Required of all cooperative education students. Students must register for this course prior to commencing each work period.

POL S 301: Introduction to Empirical Political Science Research
(3-0) Cr. 3. F.S.SS.
Prereq: 3 credits in political science; one statistics course required; sophomore classification
Techniques of quantitative and qualitative political research and analysis. Development and analysis of concepts and theories. Methods of data collection, research design, and critical thinking. Applications of statistics to political research.

POL S 305: Political Behavior
(3-0) Cr. 3. F.
Prereq: Sophomore classification
Empirical theories and descriptions of political behavior, including decision-making, opinion, and attitudes, with an emphasis on groups and political elites.

POL S 306: Public Opinion and Voting Behavior
(3-0) Cr. 3. S.
Prereq: 6 credits in political science or sophomore classification
The formation of political opinions and attitudes, political participation, and voting behavior of the general public, and their influences on American politics; polling as a means of assessing public opinions and behaviors.

POL S 310: State and Local Government
(3-0) Cr. 3. S.
Prereq: 3 credits in political science
Role of state and local governments in the American federal system. Structures of participation: political parties, elections, interest groups. Major governmental institutions: legislative, executive, and judicial. Structure and functions of local governments.

POL S 312: Special Topics in American Government and Politics
(3-0) Cr. 2. F.S.
Half-semester courses on selected topical issues in American government and politics. A topic may not be taken more than once.

POL S 313: Special Topics in Theory and Methods
(1.5-0) Cr. 2. F.S.
Half-semester course on selected topical issues in theory and methods in political science. A topic may not be taken more than once.

POL S 314: Special Topics in Comparative Politics
(1.5-0) Cr. 2. F.S.
Half-semester course on selected topical issues in comparative politics. A topic may not be taken more than once.

POL S 315: Special Topics in International Relations
(1.5-0) Cr. 2. F.S.
Half-semester course on selected topical issues in international relations. A topic may not be taken more than once.
Meets International Perspectives Requirement.

POL S 318: Campaign and Elections
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Methods and techniques of political campaigns in general elections. Supervised participation in candidate and political party campaign activities required.

POL S 319: Law and Politics
(3-0) Cr. 3. F.S.
Prereq: Sophomore standing; POL S 215 recommended
An evaluation of the American judicial system as it relates to controversial topics emphasizing the relationship between law and politics. Primary emphasis on topics such as statutory construction, judicial review, the proper role of the judiciary, vagueness and ambiguity in law, competing constitutional philosophies, executive branch concerns, and relative power of different branches. Credit for both Pol S 319 and 230 may not be applied toward graduation.

POL S 320: American Judicial Process
(Cross-listed with CJ ST). (3-0) Cr. 3. S.
Prereq: POL S 215
An overview of the American judicial process. Emphasis on specific topics such as application of constitutional rights to the states (particularly the Fourth, Fifth, Sixth, and Fourteenth Amendments), mechanics of judicial opinions, constitutional philosophies of Supreme Court Justices, decisions of first impression, and the value and scope of precedent.

POL S 333: Democracy and Diversity in America
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Sophomore classification.
Examination of competing Americans' conceptions of democracy as strategies for responding to the racial, religious, ethnic, gender, and economic diversity of the inhabitants of America. Connections to contemporary debates about topics such immigration, affirmative action, multicultural education, religion, and minority representation.
Meets U.S. Diversity Requirement

POL S 334: Politics and Society
(Cross-listed with SOC). (3-0) Cr. 3. F.
Prereq: A course in political science or sociology
The relationship between politics and society with emphasis on American society. Discussion of theories of inequality, power, social movements, elites, ruling classes, democracy, and capitalism.

POL S 335: Science, Technology, and Public Policy
(3-0) Cr. 3. S.
Examines the history and political dynamics of public science and technology policies. Examines differences in political and technological orientations. Assessment of the roles of politics, media, engineering, science, and private business in the formation public policies that put heavy reliance on or seek to advance science and technology.

POL S 339: Liberty and Law in America
(Cross-listed with CJ ST, PHIL). Cr. 3.
Prereq: Sophomore status
An exploration of competing conceptions of liberty in American political thought and debates about how liberty should be protected by the law. Contemporary debates about topics such as health care, drugs, property, speech, religion, and sex.

POL S 340: Politics of Developing Areas
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Examination of economic and political development as they relate to the political process of developing states. Impact of social and technological change on political systems of developing areas. Some case studies.

POL S 342: Chinese Politics
(3-0) Cr. 3.
Legacies of Imperial China, the origins of the Chinese Civil War, and the causes and consequences of the reform era. Issues of contemporary China, including economic transformation, the structure of the Party/state, the environment, the media and other topics.
Meets International Perspectives Requirement.

POL S 343: Latin American Government and Politics
(Cross-listed with US LS). (3-0) Cr. 3.
Political institutions, processes, and contemporary issues. Selected countries examined intensively to illustrate generalizations. Role of parties, military, church, human rights, women, environmental issues, interest groups, ideology, and globalization.

POL S 344: Public Policy
(3-0) Cr. 3. S.
How agendas come to be set in public policy, theories describing the policy-making process, forces molding policy choices and the impact of such choices.

POL S 345: Immigration Policy
(3-0) Cr. 3.
Prereq: Junior or Senior classification
Political, economic, and social factors that affect immigration policy in the United States and abroad. Systematic analysis and implications of different types of immigration policies in countries sending and receiving immigrants.
Meets International Perspectives Requirement.

POL S 346: European Politics
(3-0) Cr. 3. S.
Comparative study of political institutions of Europe and the European Union; emphasis on parties, elections, and governmental structures. Substance and process of public policies in selected problem areas.

POL S 349: Politics of Russia and the Soviet Successor States
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Nation-states of the former Soviet Union. Analysis of Soviet Communist system 1917-85 and the politics and revolutionary conflict leading to the dissolution of the Soviet Union from 1985 through 1991. Problems of post-Soviet nation-states of Russia and Central Eurasia since 1991.
Meets International Perspectives Requirement.

POL S 350: Politics of the Middle East
(3-0) Cr. 3. S.
Introduction to the Middle East as a region and to issues of political importance to the Middle East and its place in the world. Topics covered include Islam, regional conflicts and alliances, local leaders, economic issues, and gender and social relations.
Meets International Perspectives Requirement.

POL S 354: War and the Politics of Humanitarianism
(Cross-listed with ANTHR). (3-0) Cr. 3. S.
Prereq: Pol S 235, Pol S 251, or Anthr 230
Humanitarianism as a system of thought and a system of intervention in conflict and post-conflict situations: role of humanitarian organizations and actors in addressing human suffering caused by conflict or war military action as a form of humanitarian intervention.
Meets International Perspectives Requirement.

POL S 356: Theories of International Politics
(3-0) Cr. 3.
Introduction to essential theoretical concepts and approaches, both classical and contemporary on world politics including realism, empiricism, liberalism, and postpositivism; for example, war and conflict, peace and cooperation, political economy, crisis decision-making, systemic theory, dependence and interdependence.

POL S 357: International Security Policy
(3-0) Cr. 3. F.
The major theoretical approaches in security policy -- strategy and deterrence, game theory, bargaining theory, compellance, and coercive diplomacy, and crisis diplomacy. Illustration of these various approaches through historical and contemporary cases.

POL S 358: United States Foreign Policy
(3-0) Cr. 3. F.
Prereq: POL S 215 or POL S 251, or HIST 467 or HIST 470 or HIST 471
U.S. foreign policy since World War II with emphasis on changing American values in foreign policy, the role of the President, Congress, and the bureaucracy in policy making, and a survey of current foreign policy issues and problems.

POL S 359: Current Issues in American Foreign Policy
(3-0) Cr. 3. S.
Prereq: POL S 215, POL S 251, or POL S 358
Examination of contemporary U.S. foreign policy issues (e.g., U.S. policy in the Middle East; defense budgeting in the post-Cold War era; conventional and nuclear arms control policy). The course will explore alternate methods to analyze policy, survey the evolution of each issue, and discuss different policy alternatives.

POL S 360: American Institutions: Congress
(3-0) Cr. 3.
Prereq: POL S 215
Theory and practice of representation and deliberation in the legislative branch of the republic; operations of Congress in terms of its committees, leadership, legislative and oversight processes, partisan politics, electoral campaigns, service to local and special electoral campaigns, service to local and special interests, and interactions with the President.

POL S 361: American Institutions: The Presidency
(3-0) Cr. 3. F.
Prereq: POL S 215
Creation and historical development of the office of chief executive; character and behavior of past chief executives; selection and control; powers, roles, functions; executive staff; relations with Congress, press, public opinion.

POL S 362: The Judiciary
Cr. 3.
Exploration of the genesis, purpose, and power of judicial review, federal common law, judicial confirmation, merit of strict construction of the Constitution, and qualifications to serving on Courts; judicial activism and the infusion of politics into courts.

POL S 363: American Institutions: Media
(3-0) Cr. 3.
Prereq: Sophomore standing
Course surveys the influence of mass media organizations, forms, techniques, and technologies on the practices and expectations of American politics. Evaluates the role of media in the political process, exploring the extents to which media promotes or discourages political participation. Topics will examine the influence and political uses of news coverage, political advertising, political debates, talk radio, film, the Internet, and media spectacles.

POL S 364: Political Parties and Interest Groups
(3-0) Cr. 3. F.
Prereq: POL S 215; sophomore classification
Nature of political parties and interest groups, their relation to each other, and their effects on American politics. Topics include party identification, party organization and mobilization, factionalism, lobbying, campaign contributions and financing, and the effects of special interests on public law.

POL S 370: Religion and Politics
(Cross-listed with RELIG). (3-0) Cr. 3.
Prereq: Sophomore classification.
The interaction of religion and politics in the U.S. from both an historical and contemporary perspective, as well as the role of religion in politics internationally.

POL S 371: Public Organizations and Leadership
(3-0) Cr. 3. F.
Prereq: Sophomore classification
A survey of the historic and contemporary administrative realities that contribute to the unique challenges of public governance at the administrative and managerial levels of international, national, state, and local government. This introductory course explores the essential issues and competencies involved in the efficient, effective, and ethical provision of public goods and services. Critical topics addressed in the course include crisis management, intergovernmental relations, social equity, public-private partnerships, and privatization.

POL S 381: International Political Economy
(3-0) Cr. 3. S.
Introduction to the theoretical perspectives on international political economy. Exploration of specific issues such as the changing international trade regime, international finance, and Third World development under conditions of globalization.

POL S 383: Environmental Politics and Policies
(Cross-listed with ENV S). (3-0) Cr. 3. F.
Prereq: sophomore classification
Major ideologies relation to conservation and ecology. Processes, participants, and institutions involved in state, national, and global environmental policymaking. Case studies of environmental controversies and proposals for policy reform.

POL S 385: Women in Politics
(Cross-listed with W S). (3-0) Cr. 3. S.
Examination of the entry and participation of women in politics in the United States and other countries including a focus on contemporary issues and strategies for change through the political process.
Meets U.S. Diversity Requirement

POL S 395: Advanced Writing in Political Science
Cr. R. F.S.SS.
Taken in conjunction with 300- or 400-level Political Science courses. Offered on a satisfactory-fail basis only.

POL S 397: International Study and Travel
Cr. arr. Repeatable. SS.
Prereq: Permission of instructor.
Supervised study in an aspect of discipline while traveling or located in a foreign country.
Meets International Perspectives Requirement.

POL S 398: Cooperative Education
Cr. R. Repeatable. F.S.SS.
Prereq: Permission of department cooperative education coordinator; junior classification
Required of all cooperative education students. Students must register for this course prior to commencing work period.

POL S 402: Legal Analysis
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: Junior classification or permission of instructor.
Introduction to the style of legal analysis traditionally used in American law schools to teach law and prepare for legal practice. Topics include case briefing, legal citation, application of legal doctrines, and adversarial argument.

POL S 413: Intergovernmental Relations
(Dual-listed with POL S 513). (3-0) Cr. 3. S.
Prereq: 6 credits in American government
Theories and practices of the American federal system. Politics and policy making among federal, state, and local governments.

POL S 417: Campaign Rhetoric
(Cross-listed with SP CM). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: SP CM 212
Backgrounds of candidates for state and national elections; selected speeches and issues; persuasive strategies and techniques of individual speakers.

POL S 420: Constitutional Law
(3-0) Cr. 3. F.
Prereq: POL S 215; junior classification
Development of the United States Constitution through judicial action; influence of public law and judicial interpretations upon American government and society.

POL S 421: Constitutional Freedoms
(3-0) Cr. 3. S.
Prereq: POL S 320 or POL S 420
Leading Supreme Court cases interpreting the Bill of Rights and the Fourteenth Amendment. Emphasis on religion, speech, privacy, due process, and equal protection.

POL S 422: International Law
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: POL S 215 or POL S 251; junior classification
Development of the principles of international law of peace and war; analysis of theories concerning its nature and fundamental conceptions; its relation to national law; problems of international legislation and codification.

POL S 430: Foundations of Western Political Thought
(Cross-listed with CL ST). (3-0) Cr. 3.
Prereq: 6 credits in political science, philosophy, or European history
Study of original texts in political thought ranging from the classical period to the renaissance. Topics such as justice, freedom, virtue, the allocation of political power, the meaning of democracy, human nature, and natural law.

POL S 431: Modern Political Thought
(Dual-listed with POL S 531). (3-0) Cr. 3.
Prereq: 6 credits in political science, philosophy, or European history
Study of original texts in political thought ranging from the Reformation to the French Revolution and its aftermath. Topics such as justice, freedom, rights, democracy, toleration, property, power, skepticism, and normative views of international politics.

POL S 442: The Policy and Politics of Coastal Areas
(Dual-listed with POL S 542). (Cross-listed with ENV S). (3-0) Cr. 3. SS.
Exploration of political implications of coastal policy. Issues include: "Carrying capacity," zoning, regulation of human development activities, trade-offs between conservation and jobs, the quality of coastal lifestyle, ways in which citizens participate in policy for coastal areas.

POL S 452: Comparative Foreign Policy
(Dual-listed with POL S 552). (3-0) Cr. 3. S.
Prereq: POL S 251
Various theoretical approaches to explain foreign policy making and behavior through the use of case studies of selected nations.
Meets International Perspectives Requirement.

POL S 453: International Organizations
(3-0) Cr. 3. S.
Prereq: POL S 251
Private and public organizations such as the United Nations, other specialized agencies, and multinational organizations, and their influence on our daily lives.

POL S 470: Political Game Theory
(3-0) Cr. 3.
Prereq: ECON 101
Application of economics to political science in the study of nonmarket decision-making. Behavior of bureaucrats, elected officials, and voters. Market failure, collective action, representative democracies, direct democracies, logrolling, voter paradoxes, and game theory.

POL S 475: Management in the Public Sector
(Dual-listed with POL S 575). (3-0) Cr. 3. F.
Prereq: POL S 371
Literature and research on organizational behavior and management theory with emphasis on applied aspects of managing contemporary public sector organizations. Topics include distinctions between public and private organizations, leadership, productivity, employee motivation, organizational structure, and organizational change.

POL S 477: Government, Business, and Society
(Dual-listed with POL S 577). (3-0) Cr. 3. F.
Prereq: Graduate classification
Diverse perspectives on the changing roles and relationships of business, government, and society so as to open the way for more effective policy decisions on corporate-government affairs. Topics may include the changing economy; transformation of workplace and community conditions; consumerism; social responsibilities of businesses; economic policies and regulations; and politics in the business-government relationship.

POL S 480: Ethics and Public Policy
(Dual-listed with POL S 580). (3-0) Cr. 3.
Prereq: 6 credits in political science
Study of decision making approaches and application to case studies. Topics such as the different roles of public officials, proper scope and use of administrative discretion, and the admissibility of religious, political, and philosophical commitments in governmental decision making.

POL S 485: Comparative Public Administration
(Dual-listed with POL S 585). (3-0) Cr. 3. F.
Comparisons of government bureaucratic structures and processes in major world regions, trends and issues of administrative and management reforms, globalization and other contemporary challenges to state administrative structures and policies, skills needed to evaluate and implement public management reforms.

POL S 487: Electronic Democracy
(Dual-listed with POL S 587). (3-0) Cr. 3.
Prereq: Sophomore standing or instructor approval
The impact of computers, the Internet, and the World Wide Web on politics and policy. The positive and negative effects on information technology (IT) on selected topics such as freedom, power and control, privacy, civic participation, the sense of "community," "virtual cities," interest group behavior, the new media, campaigns, elections, and voting will be examined.

POL S 490: Independent Study
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490A: Independent Study: American Government and Politics
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490B: Independent Study: Theory and Method
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490C: Independent Study: Comparative Politics
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490D: Independent Study: International Relations
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490E: Independent Study: Extended credit
Cr. 1-2. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Extra study for any 300-Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490G: Independent Study: Catt Center Project
Cr. arr. Repeatable, maximum of 9 credits. F.S.
Prereq: 6 credits in political science
Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 490H: Independent Study: Honors

Cr. arr. Repeatable, maximum of 9 credits. F.S.

Prereq: 6 credits in political science

Special studies in the political institutions, processes and policies of American, foreign, and international governments. Also, studies in traditional and behavioral political theory. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. No more than 9 credits of Pol S 490 may be counted toward graduation.

POL S 491: Senior Thesis

Cr. 3.

Prereq: 21 credits of POL S and permission of instructor

Written under the supervision of a Political Science faculty advisor.

POL S 496: Teaching Internship in Political Science

(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.

Prereq: 12 credits in political science and permission of instructor

Undergraduate teaching experience through assisting an instructor with an introductory course in political science. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. Offered on a satisfactory-fail basis only.

POL S 497: Research Internship in Political Science

(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.

Prereq: 12 credits in political science and permission of instructor

Undergraduate research experience through assisting on a scholarly project with an instructor in political science. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. Offered on a satisfactory-fail basis only.

POL S 498: Cooperative Education

Cr. R. Repeatable. F.S.SS.

Prereq: Permission of department cooperative education coordinator; senior classification

Required of all cooperative education students. Students must register for this course prior to commencing each work period.

POL S 499: Internship in Political Science

Cr. arr. Repeatable, maximum of 12 credits. F.S.SS.

Prereq: 6 credits in political science; junior or senior classification; and permission of internship coordinator

Work experience with a specific nongovernmental or governmental agency at the local, state, national, or international level, combined with academic work under faculty supervision. Use of credit in Pol S major and minor is limited. See Undergraduate Study for information. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

POL S 502: Political Analysis and Research

(3-0) Cr. 3. F.

Prereq: 6 credits in political science

Scope and methods of political science. Introduction to theoretical approaches and analytical reasoning in political science. Relationship of theory and data. Research design.

POL S 504: Proseminar in International Politics

(3-0) Cr. 3. S.

Prereq: 6 credits in political science or graduate standing

An overview of the major theoretical and empirical works in the study of international politics and foreign policy. Among the major theoretical approaches surveyed and applied to international politics are realism, neo-realism, liberalism, functionalism, rational choice theory, game theory, and decision-making theory. Seminal writings by leading scholars will be reviewed.

POL S 505: Proseminar in Comparative Politics

(3-0) Cr. 3. F.

Prereq: 6 credits in political science or graduate standing

Major theoretic approaches to the study of comparative politics -- varying concepts and definitions of society and policy, administrative traditions, institutional arrangements, political behavior, etc. Contrasting research method designs.

POL S 506: Proseminar in American Politics

(3-0) Cr. 3. S.

Prereq: 6 credits in political science or graduate standing

A presentation of the major theories and research on American government and politics. Substantive topics include modern democratic theory, institutional performance, and mass political behavior. A variety of research methodologies are examined, including normative theory, behavioralism, and rational choice analysis.

POL S 507: Proseminar in Public Policy

(3-0) Cr. 3. F.

Prereq: Six credits in political science or graduate standing

An overview of the major theoretical approaches and empirical methods relevant to the study of public policy. Emphasis is placed on agenda setting, policy formation, policy sustainability, and policy analysis. Seminal writings by leading scholars will be reviewed. Leading quantitative and qualitative methodological tools for analyzing policy are presented.

POL S 510: State Government and Politics
(3-0) Cr. 3. Alt. F., offered even-numbered years.Alt. S., offered odd-numbered years.
Prereq: POL S 310
Comparative analysis of state political systems. Role of interest groups, political parties, legislatures, courts, and governors in state politics. Possible determinants of public policy outputs at the state level.

POL S 513: Intergovernmental Relations
(Dual-listed with POL S 413). (3-0) Cr. 3. S.
Prereq: 6 credits of American government
Theories and practices of the American federal system. Politics and policy making among federal, state, and local governments.

POL S 515: Biorenewables Law and Policy
(Cross-listed with BRT). (3-0) Cr. 3. F.
Evaluation of the biorenewables field as it relates to the areas of law and policy. Primary emphasis on the following topics: concerns that motivated the development and expansion of the biorenewables field, a history of the interactions between biorenewable pathways. U.S. law and policy and controversies that have arisen from these interactions and their effects.

POL S 516: International Biorenewables Law & Policy
(Cross-listed with BRT). (3-0) Cr. 3. S.
Evaluation of the international biorenewables field as it relates to the areas of law and policy. Primary emphasis on the following topics: concerns that motivated the development and expansion of the field by adopting countries, a history of the interactions between biorenewable pathways. Law and policy in adopting countries and international controversies that have arisen from these interactions and their effects.

POL S 525: Mass Political Behavior
(3-0) Cr. 3.
Prereq: 6 credits in Political Science or graduate standing
An in-depth survey of the theoretical, empirical, and methodological works concerning mass political behavior in the United States. Substantive topics include political attitudes and ideologies, public opinion and voting behavior, and political psychology. Methods for studying mass behavior include survey research and experimental approaches.

POL S 531: Modern Political Thought
(Dual-listed with POL S 431). (3-0) Cr. 3.
Prereq: 6 credits in political science, philosophy, or European history
Study of original texts in political thought ranging from the Reformation to the French Revolution and its aftermath. Topics such as justice, freedom, rights, democracy, toleration, property, power, skepticism, and normative views of international politics.

POL S 533: E-goverment and Information Policy
(3-0) Cr. 3. S.
Overview of the legal and policy context of E-government development. Topics include the legal and regulatory policies on information management in governments, and public policies that use information technologies to address economic and social concerns and their impacts on citizens and governmental organizations.

POL S 534: Legal and Ethical Issues in Information Assurance
(Cross-listed with CPR E, INFAS). (3-0) Cr. 3. S.
Prereq: Graduate classification; CPR E 531 or INFAS 531
Legal and ethical issues in computer security. State and local codes and regulations. Privacy issues.

POL S 535: Contemporary Political Philosophy
(Cross-listed with PHIL). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 6 credits of philosophy or political science
Examination of theories of justice proposed by contemporary political philosophers. Analysis of the philosophical foundations of perspectives such as liberalism, libertarianism, communitarianism, socialism, feminism. Normative assessments of socio-political institutions.

POL S 542: The Policy and Politics of Coastal Areas
(Dual-listed with POL S 442). (Cross-listed with C DEV). (3-0) Cr. 3. SS.
Exploration of political implications of coastal policy. Issues include: "Carrying capacity," zoning, regulation of human development activities, tradeoffs between conservation and jobs, the quality of coastal lifestyle, and ways in which citizens participate in policy for coastal areas.

POL S 544: Comparative Public Policy
(3-0) Cr. 3. Alt. F., offered even-numbered years.Alt. S., offered odd-numbered years.
Prereq: 6 credits in political science
Examines how, why and to what effect governments deal with substantive policy problems differently. Environmental factors, ideologies, cultures, domestic policy making processes, and interest groups.

POL S 552: Comparative Foreign Policy
(Dual-listed with POL S 452). (3-0) Cr. 3. S.
Prereq: POL S 251
Various theoretical approaches to explain foreign policy making and behavior through the use of case studies of selected nations.
Meets International Perspectives Requirement.

POL S 560: American Political Institutions
(3-0) Cr. 3.
Prereq: 6 credits in American government
Examination of policy-making and governance in a separation of powers system. Interaction between the chief executive, the legislature, administrative agencies, and the public. How political and legal forces affect policy makers and are reflected in public policies and programs.

POL S 569: Foundations of Public Administration
(3-0) Cr. 3. F.
Prereq: Graduate classification
An examination of the social, political, intellectual, and environmental factors contributing to the historical development and central issues of American Public Administration. Exploration of classic and contemporary texts of public administration emphasizing constitutional and civic roles of public servants, administrative responsibility in democratic governance and justice, and essential frameworks to identify managerial skills, perspectives, and resources for effective, equitable public service.

POL S 570: Politics and Management of Nonprofit Organizations
(3-0) Cr. 3.
Prereq: Graduate classification
Discussion of contemporary issues and perspectives shaping the policy development and management of national and international nonprofit organizations. Topics include an historic overview of nonprofit and philanthropic perspectives; exploration of nonprofit organization roles in public service provision; review of the legal framework influencing nonprofit governance; and consideration of capacity building issues such as strategic planning, board development, fundraising, human resources, and volunteer management.

POL S 571: Organizational Theory in the Public Sector
(3-0) Cr. 3. F.
Prereq: Graduate classification
Major theories of administrative organization, including motivations of administrators and organizations, comparisons of organizational arrangements, factors affecting organizational arrangements, and formal and informal decision-making structures.

POL S 572: Public Finance and Budgeting
(3-0) Cr. 3. S.
Prereq: Graduate classification
Topics such as the fiscal role of government in a mixed economy; evaluation of sources of public revenue and credit; administrative, political, and institutional aspects of the budget and the budgetary process; alternative budget formats; skills required to analyze public revenue and spending. Spreadsheet use required.

POL S 573: Public Personnel Administration
(3-0) Cr. 3. S.
Prereq: Graduate classification
Course discusses the history and development of high performance personnel administration in the public and nonprofit sectors regarding strategic planning, employee rights and responsibilities, performance assessment, collective bargaining, and civil service systems. Emphasized basic competencies in the essential human resource management tools in the areas of recruitment, retention, employee development, compensation, discipline, and conflict resolution.

POL S 574: Policy and Program Evaluation
(3-0) Cr. 3. F.
Prereq: Graduate classification
Integration, application, and utilization of public administration and public policy concepts in the interpretation of results and effectiveness of public programs and the prediction of consequences for policymakers and administrators.

POL S 575: Management in the Public Sector
(Dual-listed with POL S 475). (3-0) Cr. 3. F.
Prereq: POL S 371
Literature and research on organizational behavior and management theory with emphasis on applied aspects of managing contemporary public sector organizations. Topics include distinctions between public and private organizations, leadership, productivity, employee motivation, organizational structure, and organizational change.

POL S 577: Government, Business, and Society
(Dual-listed with POL S 477). (3-0) Cr. 3. F.
Prereq: Graduate classification
Diverse perspectives on the changing roles and relationships of business, government, and society so as to open the way for more effective policy decisions on corporate-government affairs. Topics may include the changing economy; transformation of workplace and community conditions; consumerism; social responsibilities of businesses; economic policies and regulations; and politics in the business-government relationship.

POL S 580: Ethics and Public Policy
(Dual-listed with POL S 480). (3-0) Cr. 3.
Prereq: 6 credits in political science
Study of decision making approaches and application to case studies. Topics such as the different roles of public officials, proper scope and use of administrative discretion, and the admissibility of religious, political, and philosophical commitments in governmental decision making.

POL S 581: International Political Economy
(3-0) Cr. 3. F.
Prereq: 6 credits in political science
An overview of the international political economy since the end of World War II. Special emphasis on national (primarily U.S.) development assistance and agricultural/food politics and policies, and those of the international food organizations, the World Bank, and the regional development banks.

POL S 585: Comparative Public Administration
(Dual-listed with POL S 485). (3-0) Cr. 3. F.
Comparisons of government bureaucratic structures and processes in major world regions, trends and issues of administrative and management reforms, globalization and other contemporary challenges to state administrative structures and policies, skills needed to evaluate and implement public management reforms.

POL S 587: Electronic Democracy
(Dual-listed with POL S 487). (3-0) Cr. 3.
Prereq: Sophomore standing or instructor approval
The impact of computers, the Internet, and the World Wide Web on politics and policy. The positive and negative effects on information technology (IT) on selected topics such as freedom, power and control, privacy, civic participation, the sense of "community," "virtual cities," interest group behavior, the new media, campaigns, elections, and voting will be examined.

POL S 590: Special Topics
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590A: Special Topics: American Political Institutions
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590B: Special Topics: Public Law
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590C: Special Topics: Political Theory and Methodology
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590D: Special Topics: Comparative Government
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590E: Special Topics: International Relations
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590F: Special Topics: Policy Process
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590G: Special Topics: Public Administration and Public Policy
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590I: Special Topics: Internship
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 590T: Special Topics: Teaching Preparation
Cr. 2-5. Repeatable. F.S.
Prereq: 15 credits in political science, written permission of instructor

POL S 598: Graduate Student Internship
Cr. 3-6. Repeatable, maximum of 6 credits. F.S.
Prereq: 15 credits in political science, permission of the instructor
Supervised internship with administrative agencies, legislative organizations, judicial branch offices, and nonprofit groups.

POL S 599: Creative Component
Cr. arr.

Courses for graduate students:

POL S 610: Graduate Seminars
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610A: Graduate Seminars: American Political Institutions
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610B: Graduate Seminars: Public Law
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610C: Graduate Seminars: Political Theory and Methodology
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610D: Graduate Seminars: Comparative Government
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610E: Graduate Seminars: International Relations
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610F: Graduate Seminars: Policy Process
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 610G: Graduate Seminars: Public Administration and Public Policy
(3-0) Cr. 3. Repeatable. F.S.
Prereq: 15 credits in political science

POL S 699: Thesis
Cr. arr. Repeatable.

Psychology

For college-level requirements in undergraduate curricula leading to the degrees of bachelor of arts and bachelor of science, see Liberal Arts and Sciences, Curriculum.

An undergraduate major in psychology provides a liberal arts and science education, which also can serve as preparation for graduate study in psychology, law, or the health professions. The undergraduate major in psychology enables graduates to understand and apply the scientific principles, facts, and basic methods of psychology to their personal and professional activities. Students with a bachelor's degree (B.A./B.S.) in psychology may qualify for a variety of positions including those in social sciences, mental health, corrections, rehabilitation, developmental disability centers, and business (management, insurance, opinion polls). Professional work as a psychologist in academic, business, clinical, government, and school settings requires graduate degrees. Depending on professional goals, a minor in another discipline may be desirable.

Following the recommendations of the American Psychological Association, the undergraduate curriculum in psychology is designed to allow each student to:
1. Develop a detailed knowledge of psychology
2. Develop an understanding of scientific inquiry and demonstrate critical thinking
3. Understand the role of ethics and diversity in human behavior
4. Be able to communicate effectively in the discourse of psychology
5. Develop skills supporting employment or graduate/professional education

COMMUNICATION PROFICIENCY REQUIREMENT

The LAS College requires a grade of C or better in ENGL 250.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
or ENGL 250H	Written, Oral, Visual, and Electronic Composition: Honors	

The Department requires a C- or better in one of the following:

PSYCH 302	Research Methods in Psychology	3
ENGL 302	Business Communication	3
ENGL 309	Proposal and Report Writing	3
ENGL 314	Technical Communication	3

The major must include the following psychology courses each with a minimum grade of C- and an overall average of C or better:

PSYCH 101	Introduction to Psychology *	3
PSYCH 102	Laboratory in Introductory Psychology *	1
PSYCH 111	Orientation to Psychology * or Psych 112 Learning Community	0.5
PSYCH 301	Research Design and Methodology *	3
PSYCH 440	Psychological Measurement I *	3

The major also must include at least one course from four of the following six areas:

Area A		
PSYCH 230	Developmental Psychology	
PSYCH 335	Abnormal Psychology of Children and Adolescents	
Area B		
PSYCH 280	Social Psychology	
PSYCH 380	Social Cognition	
Area C		
PSYCH 310	Brain and Behavior	
PSYCH 315	Drugs and Behavior	
Area D		
PSYCH 312	Sensation and Perception	
PSYCH 313	Learning and Memory	
PSYCH 316	Cognitive Psychology	
PSYCH 318	Thinking and Decision Making	
Area E		
PSYCH 360	Personality Psychology	
PSYCH 460	Abnormal Psychology	
Area F		
PSYCH 250	Psychology of the Workplace	
PSYCH 350	Human Factors in Technology	
Three additional 3-credit courses in psychology		9

Three additional 3-credit courses in psychology must be taken. Area courses may be used to meet this requirement, but variable credit courses (PSYCH 291, PSYCH 470, PSYCH 490, PSYCH 491, and PSYCH 492) may not.

In accordance with college requirements, a C or better average is required in the courses used to satisfy the major.

Departmental requirements for the B.A. and B.S. include the following supporting courses:

6 credits in Philosophy including	6

PHIL 201	Introduction to Philosophy (not 207)	3
Two of the following		
BIOL 101	Introductory Biology (or higher)	
BIOL 155	Human Biology (or 255 or 256)	
BIOL 313	Principles of Genetics	
CHEM 160	Chemistry in Modern Society (or higher)	
PHYS 101	Physics for the Nonscientist (or higher)	
STAT 101	Principles of Statistics (or higher) *	4
MATH 104	Introduction to Probability (or 150 or higher) **	3

* minimum grade of C-

** excluding MATH 105 Introduction to Mathematical Ideas

Students electing a B.S. degree also must complete PSYCH 302 Research Methods in Psychology with a minimum grade of C- and a minimum of 10 additional supporting credits in supporting courses from the list of courses in the LAS Gen Ed Natural Sciences and Mathematical Disciplines Area (or approved departmental list) as follows: three credits in mathematics, six credits in natural sciences, and one additional credit in a laboratory course.

Students electing a B.A. degree also must complete an ISU approved minor.

The department offers a minor in psychology. The minor requires completing 18 credits in psychology, including PSYCH 101 Introduction to Psychology and PSYCH 301 Research Design and Methodology, each with a minimum grade of C-. At least 9 of the 18 credits must be in 300 level courses (or above), but no more than three credits total may be from PSYCH 291 Introductory Research Experience, PSYCH 490 Independent Study, PSYCH 491 Research Practicum, and PSYCH 492 Fieldwork Practicum. In addition to an overall C average or better in courses used to satisfy the minor, a C- or better is required in each course. Contact the psychology advising office for more information.

Psychology, B.A.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	Psychology Choice*	3
PSYCH 111	0.5	Social Science Choice*	3
PSYCH 101[3]	3	Required Natural Science*	3
PSYCH 102[3]	1	Arts & Humanities Choice*	3
Required Math*	3	Electives	3
Social Science Choice*	3		
LIB 160	1		
	14.5		15

Sophomore

Fall	Credits	Spring	Credits
ENGL 250[2]	3	Psychology Choice*	3
Psychology Choice*	3	Psychology Choice*	3
Arts & Humanities Choice*	3	STAT 101[3]	4
PHIL 201	3	Required Natural Science*	3
Required Natural Science*	3	Minor	3
	15		16

Junior

Fall	Credits	Spring	Credits
PSYCH 301[3]	3	PSYCH 302 or one of ENGL 302, ENGL 309, ENGL 314[1]	3
Psychology Choice*	3	Minor	3
Philosophy Choice*	3	Foreign Language/Elective	3-4
Foreign Language/Elective	3-4	Elective	6
Minor	3		
	15-16		15-16

Senior

Fall	Credits	Spring	Credits
PSYCH 440[3]	3	Psychology Choice	3
Psychology Choice*	3	Minor	3
Minor	3	Electives	10
Electives	6		
	15		16

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.** You must also complete the LAS foreign language requirement.

1 Meets English Proficiency Requirement: C- minimum.

2 LAS College requires C or better in ENGL 250

3 Psych Requirement: C- minimum

* Choose from list of selected courses available from an adviser.

Psychology, B.S

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	Psychology Choice*	3
PSYCH 111	0.5	Social Sciences Choice*	3
PSYCH 101[3]	3	Required Natural Science*	3

PSYCH 102[3]	1	Arts & Humanities Choice[*]	3
Required Math[*]	3	Electives	3
Social Sciences Choice[*]	3		
LIB 160	1		
	14.5		15

Sophomore

Fall	Credits	Spring	Credits
ENGL 250[2]	3	Psychology Choice[*]	3
Psychology Choice[*]	3	Psychology Choice[*]	3
Arts & Humanities Choice[*]	3	STAT 101[3]	4
PHIL 201	3	Required Natural Science[*]	3
Required Natural Science[*]	3	Electives	3
Required Natural Science Laboratory[*]	1-2		
	16-17		16

Junior

Fall	Credits	Spring	Credits
PSYCH 301[3]	3	PSYCH 302[1]	3
Psychology Choice[*]	3	Required Math[*]	3
Foreign Language/Elective	3-4	Required Natural Science[*]	3
Philosophy Choice[*]	3	Foreign Language/Elective	3-4
Electives	3	Electives[*]	3
	15-16		15-16

Senior

Fall	Credits	Spring	Credits
PSYCH 440[3]	3	Psychology Choice[*]	3
Psychology Choice[*]	3	Electives	13
Electives	8		
	14		16

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.** You must also complete the LAS foreign language requirement.

1 Meets English Proficiency Requirement: C- minimum.

2 LAS College requires C or better in ENGL 250

3 Psych Requirement: C- minimum

* Choose from list of selected courses available from an adviser.

Graduate Study

The department offers work for the degree of doctor of philosophy in psychology. A master of science may be earned as part of that degree.

The department offers a doctoral specialization in counseling psychology (APA accredited) and doctoral areas of concentration in cognitive psychology and social psychology.

A basic goal of graduate study in the Department of Psychology is to provide all students with a broad base of knowledge in psychological science, as well as exposure to the content and methodological skills necessary for effective performance in teaching, research and professional practice. Accordingly, graduates have an extensive knowledge of psychological principles and the conceptual and quantitative skills to conduct psychological research and to communicate the results to the scientific community, students in the classroom, and the general public. Graduates in counseling psychology are skilled in delivering services to diverse clientele in a variety of settings.

The department also participates in the interdepartmental programs in human computer interaction (http://www.vrac.iastate.edu/hci/), neuroscience (http://www.neuroscience.iastate.edu/) and in the interdepartmental minor in gerontology (http://www.gerontology.iastate.edu/programs/).

A formal class and a supervised practicum in the teaching of psychology is recommended for all doctoral students whose future plans may include teaching at the college level. A 12-month internship in a training site or agency approved by the faculty is required of all doctoral students in counseling psychology.

Courses primarily for undergraduates:

PSYCH 101: Introduction to Psychology
(3-0) Cr. 3. F.S.SS.
Fundamental psychological concepts derived from the application of the scientific method to the study of behavior and mental processes. Applications of psychology.

PSYCH 102: Laboratory in Introductory Psychology
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in PSYCH 101
Laboratory to accompany 101.

PSYCH 111: Orientation to Psychology
Cr. 0.5. F.S.
Program requirements and degree/career options. Required of psychology majors. Offered on a satisfactory-fail basis only.

PSYCH 112: Psychology Learning Community Seminar
(1-0) Cr. 1. Repeatable, maximum of 2 credits. F.S.
Prereq: Participation in Freshman Learning Community
Topics include orientation to academic program requirements, career awareness, strategies for successful transition to college, connections with other disciplines, and applying psychology via service learning opportunities. Offered on a satisfactory-fail basis only.

PSYCH 131: Academic Learning Skills
(0-2) Cr. 1. F.S.
Evidence-based approach to learning and applying academic skills such as time management, note-taking, reading, test preparation, goal setting and motivation, and well-being. Hybrid course structured in a team-based learning format. Offered on a satisfactory-fail basis only.

PSYCH 230: Developmental Psychology
(3-0) Cr. 3. F.S.SS.
Life-span development of physical traits, cognition, intelligence, language, social and emotional behavior, personality, and adjustment.

PSYCH 250: Psychology of the Workplace
(3-0) Cr. 3.
Survey of theories and research methods of psychology applied to the workplace. Consideration of employee selection, training, performance evaluation, leadership, work groups, employee motivation, job attitudes and behaviors, organizational culture, organizational development, human factors, and job design from the scientist-practitioner approach.

PSYCH 280: Social Psychology
(3-0) Cr. 3. F.S.SS.
Individual human behavior in social contexts. Emphasis on social judgments and decisions, attitudes, perceptions of others, social influence, aggression, stereotypes, and helping.

PSYCH 291: Introductory Research Experience
Cr. 1-4. Repeatable, maximum of 4 credits. F.S.
Prereq: PSYCH 101, sophomore classification, and permission of intructor.
Beginning level supervised research experience in a faculty laboratory. Offered on a satisfactory-fail basis only.

PSYCH 301: Research Design and Methodology
(3-0) Cr. 3. F.S.SS.
Prereq: STAT 101; 1 course in psychology
Overview of the principal research techniques used in psychology with an emphasis on the statistical analysis of psychological data.

PSYCH 302: Research Methods in Psychology
(2-2) Cr. 3. F.S.
Prereq: PSYCH 301, ENGL 250
Discussion of and experience in designing research studies, collecting and analyzing data, and preparing research reports in psychology.

PSYCH 310: Brain and Behavior
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101
Survey of basic concepts in the neurosciences with emphasis on brain mechanisms mediating sensory processes, arousal, motivation, learning, and abnormal behavior.

PSYCH 312: Sensation and Perception
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101
Survey of the physiology and psychology of human sensory systems including vision, audition, smell, taste, the skin senses, and the vestibular senses.

PSYCH 313: Learning and Memory
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101
Survey of fundamental concepts and theories related to learning and memory derived from human and animal research.

PSYCH 314: Motivation
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101
Theory and research on motivation at biological, environmental, and psychological levels. Topics include emotion, eating, sex, music, addictions, incentives, goal performance, personality, coping, self-determination and purpose.

PSYCH 315: Drugs and Behavior
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101
Biologically based examination of the effects of drugs on behavior and social interactions, including recreational drugs and drugs used in the treatment of psychiatric and neurological disorders.

PSYCH 316: Cognitive Psychology
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101
Overview of human cognition, including sensation and perception, attention, memory, education, language, and judgment and decision making.

PSYCH 318: Thinking and Decision Making
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101; STAT 101 or MATH 104 or equivalent
Understanding human reasoning and decision making, including evaluating evidence, judging probabilities, emotional influences, and social dilemmas, with emphasis on the mechanisms that underlie decision making.

PSYCH 333: Educational Psychology
(Cross-listed with C I). (3-0) Cr. 3. F.S.
Prereq: PSYCH 230 or HD FS 102, application to the teacher education program or major in psychology
Classroom learning with emphasis on theories of learning and cognition, and instructional techniques. Major emphasis on measurement theory and the classroom assessment of learning outcomes.

PSYCH 335: Abnormal Psychology of Children and Adolescents
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101; PSYCH 230 or HDFS 102
Psychopathology of children and adolescents,including childhood depression and anxiety disorders. Consideration of multiple probable causes and corresponding therapies.

PSYCH 346: Psychology of Women
(Cross-listed with W S). (3-0) Cr. 3. S.
Prereq: 2 courses in psychology including PSYCH 101
Survey of theory and research related to major biological, interpersonal, and cultural issues affecting girls' and women's psychological development and behavior.
Meets U.S. Diversity Requirement

PSYCH 347: U.S. Latino/a Psychology
(Cross-listed with US LS). (3-0) Cr. 3. S.
Prereq: Two courses in Psychology including PSYCH 101
Historical, political, and social contexts of psychological and mental health constructs in terms of their validity and utility for use with Latino/a people in the U.S. Unique aspects of psychological functioning particular to Latino/a people in the U.S.
Meets U.S. Diversity Requirement

PSYCH 348: Psychology of Religion
(Cross-listed with RELIG). (3-0) Cr. 3.
Prereq: Nine credits in psychology
Survey of psychological theory and research investigating religious and spiritual attitudes, beliefs and practices.

PSYCH 350: Human Factors in Technology
(3-0) Cr. 3. F.
Prereq: PSYCH 101; junior classification
Understanding human behavior and cognition in the context of modern technologies. Focus on emergent interactive technologies, human computer interaction, user centered design, usability analysis, and usability testing.

PSYCH 360: Personality Psychology
(3-0) Cr. 3. F.S.SS.
Prereq: PSYCH 101
Historical and contemporary theory and research on development and expression of personality with a focus on normal functioning.

PSYCH 380: Social Cognition
(3-0) Cr. 3.
Prereq: PSYCH 101 or PSYCH 280
How people understand themselves and others, including attribution, social categories and schemas, the self, social inference, stereotypes, and prejudice.

PSYCH 381: Social Psychology of Small Group Behavior
(Cross-listed with SOC). (3-0) Cr. 3. S.
Prereq: SOC 305 or PSYCH 280
A survey of small group theory and research from an interdisciplinary, social psychological perspective.

PSYCH 383: Psychology and Law
(3-0) Cr. 3. F.S.
Prereq: PSYCH 101 or PSYCH 280
Survey of topics in the interface between psychology and the legal system including but not limited to Miranda warning, confessions, police interrogation, lie detection, juries, eyewitness identification, false memories, and the death penalty.

PSYCH 386: Media Psychology
Cr. 3. F.S.SS.
Prereq: PSYCH 101 or PSYCH 230 or PSYCH 280
Theories and research on the psychological mechanisms (e.g., attitudes, perceptions, emotions, arousal) by which media influence children and adults. Topics include media violence, educational media, advertising, music, video games, media literacy, and ratings.

PSYCH 401: History of Psychology
(3-0) Cr. 3. F.S.
Prereq: 4 courses in psychology
Philosophy and science backgrounds of psychology. Development of theories and causes of events in academic and applied psychology.

PSYCH 410: Behavioral Neurology
(Dual-listed with PSYCH 510). (3-0) Cr. 3. F.
Prereq: PSYCH 101; PSYCH 310 or equivalent.
Examination of the neuroanatomical foundation of cognition, affect, and action from a neurological perspective. Focus on basic and applied research with neurological patients.

PSYCH 411: Evolutionary Psychology
(3-0) Cr. 3. S.
Prereq: Junior classification, three courses in psychology; one course in biology
Examination of the application of the principles of evolutionary biology to the understanding of human behavior. Evolutionary perspectives on brain development, cognition, language, mating behavior, sex differences, altruism, artistic behavior, and criminal behavior are explored. Arguments by those critical of the evolutionary approach to psychology are also examined.

PSYCH 413: Psychology of Language
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: PSYCH 101
Introduction to psycholinguistics. Topics may include origin of language, speech perception, language comprehension, reading, bilingualism, brain bases of language, and computational modeling of language processes.

PSYCH 422: Counseling Theories and Techniques
(3-0) Cr. 3. F.
Prereq: 3 courses in psychology
Overview of the major counseling theories and techniques, with emphasis on the key concepts of each theory, the role of the counselor, therapeutic goals, and the main techniques derived from each theory.

PSYCH 422L: Laboratory in Counseling Theory and Techniques
(0-2) Cr. 1. F.
Prereq: Three classes in psychology and credit or enrollment in PSYCH 422.
Learn basic counseling skills such as active listening, reflecting feelings, empathy, confrontation, immediacy and self-disclosure. Supervised practice using basic counseling skills.

PSYCH 440: Psychological Measurement I
(2-2) Cr. 3. F.S.SS.
Prereq: PSYCH 301 and 9 credits in psychology, STAT 101
Principles of psychological measurement, including concepts of reliability and validity; interpretation of scores; factors influencing performance; construction and use of measures of ability, achievement, and personality.

PSYCH 450: Industrial Psychology
(3-0) Cr. 3. F.S.
Prereq: 2 courses in psychology including PSYCH 101, STAT 101
Theory, content and methods of industrial psychology related to the effective operation of organizations. Application of psychology principles to topics including different approaches used to select employees, how to conduct performance appraisals, and how to train and keep employees safe. Work attitudes and behaviors of employees as well as relevant legal issues. Statistics including regression and correlation are used.

PSYCH 460: Abnormal Psychology
(3-0) Cr. 3. F.S.SS.
Prereq: 3 courses in psychology including PSYCH 101
Description of major forms of psychopathology including anxiety, mood disorders, personality disorders, substance abuse, and schizophrenia. Coverage of research examining causes, development, and clinical issues concerning psychopathology.

PSYCH 470: Seminar in Psychology
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 credits in psychology
Current topics in psychological research and practice in the following areas.

PSYCH 470A: Seminar in Psychology: Counseling
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 credits in psychology

PSYCH 470B: Seminar in Psychology: Experimental
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 credits in psychology

PSYCH 470C: Seminar in Psychology: Individual Differences
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 credits in psychology

PSYCH 470D: Seminar in Psychology: Social
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 credits in psychology

PSYCH 484: Psychology of Close Relationships
(3-0) Cr. 3.
Prereq: 9 credits in psychology including PSYCH 280
Theories and research concerning the functions, development, and deterioration of close relationships. Influence of psychological processes on friendship, romantic, marital, and family relationships. Topics include mate selection, interdependence, trust and commitment, power and dominance in relationships, sexuality, divorce, gender roles, and family interaction.

PSYCH 485: Health Psychology
(3-0) Cr. 3. F.
Prereq: Junior classification, 6 credits in psychology
Application of psychological theory and research methods to issues in physical health. Psychological factors in illness prevention, health maintenance, treatment of illness, recovery from injury and illness, and adjustment to chronic illness.

PSYCH 487: Human Aggression
(3-0) Cr. 3. S.
Prereq: PSYCH 230 or PSYCH 280; PSYCH 301; PSYCH 313, PSYCH 316, PSYCH 318, PSYCH 360, or PSYCH 380
Theory and research on development and occurrence of human aggression; implications for prevention and treatment.

PSYCH 488: Cultural Psychology
(3-0) Cr. 3.
Prereq: PSYCH 280 and PSYCH 301; junior classification
Examination of the ways that cultural beliefs, values, and affordances shape cognitive, developmental, social and other psychological phenomena, as well as the forces that shape and change culture. Meets International Perspectives Requirement.

PSYCH 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior classification, 6 credits in psychology, and permission of instructor
Supervised reading in an area of psychology. Writing requirement. No more than 9 credits of Psych 490 may be counted toward a degree in psychology.

PSYCH 491: Research Practicum
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior classification, permission of instructor, and credit or enrollment in PSYCH 301
Supervised research in an area of psychology. Primarily for students intending to pursue graduate education. No more than 9 credits of Psych 491 may be counted toward a degree in psychology.

PSYCH 492: Fieldwork Practicum
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior classification, 12 credits in psychology, and permission of instructor
Supervised fieldwork in one of the following applied psychology settings. Offered on a satisfactory-fail basis only. No more than 9 credits of Psych 492 may be counted toward a degree in psychology.

PSYCH 492A: Fieldwork Practicum: Human Services
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior classification, 12 credits in psychology and permission of instructor
Offered on a satisfactory-fail basis only.

PSYCH 492B: Fieldwork Practicum: I/O Psychology
Cr. arr. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior classification, 12 credits in psychology including PSYCH 450 or PSYCH 250 and enrollment in PSYCH 450, and permission of instructor.
Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

PSYCH 501: Foundations of Behavioral Research
(3-0) Cr. 3. F.S.
Prereq: STAT 401 or equivalent
Ethical issues, research design, sampling design, measurement issues, power and precision analysis, interpretation of statistical results in non-experimental, quasi-experimental, and experimental research, use of statistical packages.

PSYCH 508: Research Methods in Applied Psychology
(3-0) Cr. 3.
Prereq: PSYCH 440 and PSYCH 501 or STAT 401
Methods and issues in applied psychological research. Role of theory in research, fidelity of measurement, selection of subjects, sampling, ethical issues, experimenter bias, data collection methods, power analysis, and professional standards for writing research articles. Emphasis on research methodological issues, not statistical issues.

PSYCH 510: Behavioral Neurology
(Dual-listed with PSYCH 410). (3-0) Cr. 3. F.
Prereq: PSYCH 101; PSYCH 310 or equivalent.
Examination of the neuroanatomical foundation of cognition, affect, and action from a neurological perspective. Focus on basic and applied research with neurological patients.

PSYCH 516: Advanced Cognition
(3-0) Cr. 3. F.S.
Prereq: PSYCH 316
Theoretical models and empirical research in human cognition including perception, attention, memory, concepts/categorization, imagery, and judgment and decision making.

PSYCH 517: Psychopharmacology
(3-0) Cr. 3.
Prereq: PSYCH 310, PSYCH 315, or equivalent and permission of instructor
Fundamentals of drug-behavior interactions with emphasis on psychoactive drugs and their use in experimental, therapeutic, and social settings.

PSYCH 519: Cognitive Neuropsychology
(3-0) Cr. 3.
Prereq: PSYCH 310 and PSYCH 316 or PSYCH 313; graduate classification or permission of instructor
Psychological models and related neurological substrates underlying cognition in normal and brain-damaged individuals.

PSYCH 521: Cognitive Psychology of Human Computer Interaction
(Cross-listed with HCI). (3-0) Cr. 3.
Prereq: Graduate classification or instructor approval
Biological, behavioral, perceptual, cognitive and social issues relevant to human computer interactions.

PSYCH 522: Scientific Methods in Human Computer Interaction
(Cross-listed with HCI). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PSYCH 521 and STAT 101 or equivalent
Basics of hypothesis testing, experimental design, analysis and interpretation of data, and the ethical principles of human research as they apply to research in human computer interaction.

PSYCH 533: Educational Psychology of Learning, Cognition, and Memory
(Cross-listed with C I). (3-0) Cr. 3. F.
Learning, cognition, and memory in educational/training settings.

PSYCH 538: Developmental Disabilities
(Cross-listed with HD FS). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 9 credits in human development and family studies or psychology or permission of instructor
Theories, research, and current issues regarding the intersection of development and disabilities. Investigation of interventions with individuals and families. (on-line course offering via Distance Education).

PSYCH 542: Applied Psychological Measurement
(3-0) Cr. 3. F.
Prereq: PSYCH 440
Principles of psychological measurement, including concepts of reliability and validity; interpretation of scores; factors influencing performance; test construction and use of measures of intelligence, ability, achievement, vocational interest, and personality. Ethical and multicultural issues in measurement.

PSYCH 544: Practicum in Assessment
(2-1) Cr. 2. F.S.
Prereq: PSYCH 542 and admission into the PhD program in counseling psychology
Supervised practice in integration of clinical interviewing, behavioral observation, and administration, scoring, and interpreting individual tests of cognitive function.

PSYCH 560: Advanced Personality Psychology
(3-0) Cr. 3.
Prereq: 4 courses in psychology, including PSYCH 360
Advanced analysis of contemporary theory and research on personality measurement, development, heritability, and social expression.

PSYCH 561: Psychopathology and Behavior Deviations
(3-0) Cr. 3.
Prereq: PSYCH 460
Examination of DSM and research based perspectives pertinent to the major forms of adult psychopathology including: anxiety, mood, psychotic, personality and other disorders. Coverage of research examining causes, development, and clinical issues concerning adult psychopathology.

PSYCH 562: Personality Assessment
(3-0) Cr. 3.
Prereq: PSYCH 360, PSYCH 440, PSYCH 542, and PSYCH 501 or STAT 401 and admission to the PhD program in counseling psychology
Principles, concepts, and methods of personality assessment. Though not a practicum course, exposure is given to a variety of objective, projective, and situational tests.

PSYCH 580: Advanced Social Psychology: Psychological Perspectives
(3-0) Cr. 3.
Prereq: 4 courses in psychology, including PSYCH 280
Current theories, methods, and research in social psychology with an emphasis on cognitive and interpersonal processes such as attribution, social cognition, attitude change, attraction, aggression, and social comparison.

PSYCH 590: Special Topics
Cr. arr. Repeatable.
Prereq: 12 credits in psychology, and permission of instructor
Guided reading on special topics or individual research projects in the following areas.

PSYCH 590A: Special Topics: Counseling
Cr. arr. Repeatable.
Prereq: 12 credits in psychology, and permission of instructor

PSYCH 590Q: Special Topics: Cognitive
Cr. arr. Repeatable.
Prereq: 12 credits in psychology, and permission of instructor

PSYCH 590R: Special Topics: Social
Cr. arr. Repeatable.
Prereq: 12 credits in psychology, and permission of instructor

PSYCH 590Z: Special Topics: General
Cr. arr. Repeatable.
Prereq: 12 credits in psychology, and permission of instructor

PSYCH 592: Seminar in Psychology
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 hours in psychology or graduate classification.
Seminar in the following areas.

PSYCH 592C: Seminar in Psychology: Developmental
(1-0) Cr. 1-3. Repeatable. F.S.
Prereq: 12 hours in psychology or graduate classification.

PSYCH 592P: Seminar in Psychology: Research Methods and Psychometrics
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 hours in psychology or graduate classification.

PSYCH 592Z: Seminar in Psychology: General
(1-0) Cr. 1-3. Repeatable.
Prereq: 12 hours in psychology or graduate classification.

PSYCH 594: Quantitative Behavioral Methods
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent
Specialized quantitative methods for social and behavioral research problems in the following areas.

PSYCH 594A: Quantitative Behavioral Methods: Classical psychometric theory
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594B: Quantitative Behavioral Methods: Modern psychometric methods
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594C: Quantitative Behavioral Methods: Construct validation
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594D: Quantitative Behavioral Methods: Multi-dimensional scaling
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594E: Quantitative Behavioral Methods: Cluster Analysis
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594F: Quantitative Behavioral Methods: Meta-analysis
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594G: Quantitative Behavioral Methods: Longitudinal analysis
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent

PSYCH 594I: Quantitative Behavioral Methods: Focus Groups
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501or equivalent

PSYCH 594K: Quantitative Behavioral Methods: Mediation and Moderation
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent
Specialized quantitative methods for social and behavioral research problems.

PSYCH 594L: Quantitative Behavioral Methods: Missing Data
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent.
Specialized quantitative methods for social and behavioral research problems.

PSYCH 594M: Quantitative Behavioral Methods: Power Analysis
(1-0) Cr. 1. F.S.
Prereq: PSYCH 501 or equivalent
Specialized quantitative methods for social and behavioral research problems.

PSYCH 595: Seminar in Social Psychology
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology
Seminar in the following areas in social psychology.

PSYCH 595A: Seminar in Social Psychology: Social Cognition
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 595B: Seminar in Social Psychology: Aggression
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 595C: Seminar in Social Psychology: Culture
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 595D: Seminar in Social Psychology: Attitudes and Attitude Change
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 595E: Seminar in Social Psychology: Psychology and Law
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 595G: Seminar in Social Psychology: Close Relationships
Cr. 1-3. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 595I: Seminar in Social Psychology: General
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 596: Seminar in Counseling Psychology
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology
Seminar in the following areas in counseling psychology.

PSYCH 596A: Seminar in Counseling Psychology: Supervision
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 596B: Seminar in Counseling Psychology: Research
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 596C: Seminar in Counseling Psychology: Multicultural
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 596D: Seminar in Counseling Psychology: Professional Issues and Ethics
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 596E: Seminar in Counseling Psychology: General
Cr. arr. Repeatable. F.S.
Prereq: 12 credits in Psychology

PSYCH 597: Internship in Psychology
Cr. R.
Prereq: M.S. degree candidacy; permission of instructor
Full-time, non-clinical, supervised experience in a setting relevant to psychology. Intended for master's degree level internships.

PSYCH 598: Seminar in Cognitive Psychology
Cr. 0. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401.
Seminar in the following areas in cognitive psychology.

PSYCH 598A: Seminar in Cognitive Psychology: Attention and Perception
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598B: Seminar in Cognitive Psychology: Memory
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598C: Seminar in Cognitive Psychology: Cognitive Neuroscience
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598D: Seminar in Cognitive Psychology: Judgment and Decision Making
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598E: Seminar in Cognitive Psychology: Evolution
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598F: Seminar in Cognitive Psychology: Language
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598G: Seminar in Cognitive Psychology: Applied
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 598I: Seminar in Cognitive Psychology: General
Cr. arr. Repeatable. F.S.
Prereq: PSYCH 516, PSYCH 501 or STAT 401

PSYCH 599: Creative Component
Cr. arr.
Offered on a satisfactory-fail basis only.

Courses for graduate students:

PSYCH 601: History of Philosophy of Psychology
(3-0) Cr. 3.
Prereq: 4 courses in psychology
Origins of psychology in philosophical, medical, and related thought. Development as an independent discipline in the nineteenth and twentieth centuries as a science and as a practice including traditional and contemporary theory and philosophy.

PSYCH 605: Multi-level Modeling
(Cross-listed with HD FS). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: HD FS 503 and HD FS 505 or STAT 404 or permission of instructor
Rationale for and interpretation of random coefficient models. Strategies for the analysis of multi-level and panel data including models for random intercepts, random slopes, and growth curves.

PSYCH 621: Psychological Counseling -Theory and Process
(3-0) Cr. 3. F.
Prereq: 3 courses in psychology and permission of instructor
Overview of major counseling theories with emphases upon: key concepts of theories, the role of the counselor, and applications of theory in fostering client change.

PSYCH 621L: Psychological Counseling -Theory and Process: Techniques in Counseling
(0-6) Cr. 3. F.
Prereq: permission of instructor required
Development of basic counseling skills and techniques through observation, role-playing, case studies, and supervised counseling sessions.

PSYCH 623: Vocational Behavior
(3-0) Cr. 3.
Prereq: 3 courses in psychology or graduate classification
Theoretical views, research, and issues in career development through the life span. Methods of career counseling, including appraisal interviewing, assessment, test interpretation, and use of information sources.

PSYCH 626: Group Counseling
(2-2) Cr. 3.
Prereq: Graduate classification
Theory, research, ethical issues, and therapeutic considerations relevant to group counseling. Participation in lab exercises for development of group counseling skills and observation of ongoing groups.

PSYCH 633: Teaching of Psychology
(3-0) Cr. 3.
Prereq: Enrollment in doctoral degree program in psychology, completion of at least 1 year of graduate study, permission of instructor
Orientation to teaching of psychology at college level: academic issues and problems, instructional and evaluative techniques.

PSYCH 691: Practicum in Psychology
Cr. arr. F.S.
Prereq: Prereg: Permission of instructor
Supervised practice and experience in the following fields of specialization in applied psychology.

PSYCH 691A: Practicum in Psychology: Counseling (Beginning)
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: PSYCH 621L

PSYCH 691B: Practicum in Psychology: Counseling (Intermediate)
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Permission of instructor, PSYCH 691A

PSYCH 691C: Practicum in Psychology: Counseling (Advanced)
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Permission of instructor, PSYCH 691A, PSYCH 691B

PSYCH 691D: Practicum in Psychology: Counseling (Advanced External Practicum)
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor, PSYCH 691A, PSYCH 691B

PSYCH 691G: Practicum in Psychology: Group Counseling
Cr. 1-3. F.S.
Prereq: Prereg: Permission of instructor, PSYCH 626, PSYCH 691A

PSYCH 691S: Practicum in Psychology: Supervision
Cr. 1-3. F.S.
Prereq: Permission of instructor, PSYCH 592A, PSYCH 621L

PSYCH 691T: Practicum in Psychology: Teaching
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Permission of instructor,PSYCH 633
Offered on a satisfactory-fail basis only.

PSYCH 691Z: Practicum in Psychology: General
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Permission of instructor

PSYCH 692: Research Seminar
(1-0) Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Research seminar in the following areas.

PSYCH 692A: Research Seminar: Counseling
(1-0) Cr. 1-3. Repeatable.
Prereq: Permission of instructor

PSYCH 692Q: Research Seminar: Cognitive
(1-0) Cr. 1-3. Repeatable.
Prereq: Permission of instructor

PSYCH 692R: Research Seminar: Social
(1-0) Cr. 1-3. Repeatable.
Prereq: Permission of instructor

PSYCH 692Z: Research Seminar: General
(1-0) Cr. 1-3. Repeatable.
Prereq: Permission of instructor

PSYCH 697: Internship in Counseling Psychology
Cr. R.
Prereq: Ph.D. candidacy in the Counseling Psychology program, approved dissertation proposal, and permission of instructor
Full time supervised predoctoral internship experience in a setting relevant to counseling psychology.

PSYCH 699: Research
Cr. arr. Repeatable.
Offered on a satisfactory-fail basis only.

Public Relations

The Public Relations Major

The public relations major provides students with the concepts, skills, and expertise needed to help organizations build mutually beneficial relationships with diverse publics. The knowledge and tools students develop through the P R curriculum ensure they can enter fields such as corporate communication, government affairs and public relations firms. The capstone professional internship experience, coupled with coursework that focuses heavily on writing, research, and professional

abilities provide opportunities for students to practice and refine their skills.

To receive a bachelor of science degree in public relations, a student must earn at least 120 credits. A minimum of 72 credits must come from courses other than ADVRT, P R, or JL MC. At least 50 of these credits must come from the liberal arts and sciences. Overall, at least 45 credits must be from 300-level or above.

Public relations majors are required to take:

STAT 101	Principles of Statistics (or another approved statistics course)	4

The degree requirements allow for a minimum of 34 credits and a maximum of 48 credits to be taken in ADVRT, P R, and JL MC. These include:

JL MC 101	Mass Media and Society	3
JL MC 110	Orientation to Journalism and Communication	1
P R 220	Principles of Public Relations	3
JL MC 201	Reporting and Writing for the Mass Media (C+ or better)	3
P R 301	Research and Strategic Planning for Advertising and Public Relations	3
P R 321	Public Relations Writing (C+ or better)	3
P R 424	Public Relations Campaigns	3
JL MC 460	Law of Mass Communication	3
JL MC 462	Media Ethics, Freedom, Responsibility	3
P R 499A	Professional Media Internship: Required	3

Additional recommended courses and requirements for the public relations major are available from the Greenlee School.

Students taking one major at the school may not seek a second major or a minor in the school. All Greenlee School majors are required to take a second major or minor outside the school as an area of expertise. All Greenlee School majors are required to take 499A.

Minor in Public Relations

Students cannot select more than one minor in the Greenlee School of Journalism and Communication. Minors in the Greenlee School are not available to Greenlee majors.

For a minor in public relations, students complete 15 credits.

JL MC 101	Mass Media and Society	3
P R 220	Principles of Public Relations	3
P R 305	Publicity Methods	3
6 credits from the following:		6
P R 301	Research and Strategic Planning for Advertising and Public Relations	
JL MC 401	Mass Communication Theory	
JL MC 406	Media Management	
P R 420X Crisis Communication		
JL MC 474	Communication Technology and Social Change	
JL MC 476	World Communication Systems	
JL MC 477	Ethnicity, Gender, Class and the Media	
P R 497	Special Topics in Communication	
Total Credits		15

Public Relations, B.S.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	P R 220	3
JL MC 110	1	U.S. Diversity	3
JL MC 101	3	Social Science	3
Arts & Humaniaties	3	Natural Science	3
Natural Science	3	International Perspectives	3
Social Science	3	LIB 160	1
	16		16

Sophomore

Fall	Credits	Spring	Credits
P R/ ADVRT/ JL MC 300-level choice*	3	P R 301	3
ENGL 250	3	JL MC 201	3
STAT 101	4	Foreign Language or Elective	4
Foreign Language or Elective	4	Arts & Humanities	3
Natural Science	2	Social Science	3
	16		16

Junior

Fall	Credits	Spring	Credits	Summer	Credits
P R 321	3	P R 424	3	P R 499A	3
Arts & Humanities	3	Arts and Humanities	3		
Minor/ Second Major Choice	3	Minor/ Second Major Choice	3		
Minor/ Second Major Choice	3	Minor/ Second Major Choice 300-level	3		
Elective 300-level	3	Minor/ Second Major Choice 300-level	3		
	15		15		3

Senior

Fall	Credits	Spring	Credits
JL MC 462	3	JL MC 460	3
P R/ ADVRT/ JL MC 300-level Choice*	3	Elective or Minor/ Second Major Choice	3
Minor/ Second Major Choice 300+	3	Elective or Minor/ Second Major Choice 300+	3
Elective 300-level	3	Elective or Minor/ Second Major Choice 300+	3
	12		12

For 300 and 400-level choices, please choose from the list of selected courses available from an academic adviser. You may schedule an appointment with an adviser by either calling 515-294-4342 or visiting with Greenlee School office staff at 101 Hamilton Hall.

University Requirement: Students in all ISU majors must complete a three-credit course in U.S. Diversity, as well as a three-credit course in International Perspectives. The approved course lists are found at the following web addresses:(U.S. Diversity) http://www.registrar.iastate.edu/students/div-ip-guide/usdiversity-courses) and (International Perspectives) http://www.registrar.iastate.edu/students/div-ip-guide/IntlPerspectives-current .

College of LAS Requirement: Minimum of 120 credits, including a minimum of 45 credits at the 300-level and above. You must also complete the LAS Foreign Language requirement and any unmet ISU admission requirements.

Minor or Second Major: Students are required to fulfill a secondary area of expertise. This requirement can be met by declaring a minor or a second major outside of the Greenlee School of Journalism and Communication.

Courses primarily for undergraduates:

P R 220: Principles of Public Relations
(3-0) Cr. 3.
Introduction to public relations in business, government and non-profit organizations; functions, processes, and management; ethics, public opinion and theory.

P R 301: Research and Strategic Planning for Advertising and Public Relations
(Cross-listed with ADVRT). (3-0) Cr. 3.
Prereq: ADVRT 230 or P R 220
The use of primary and secondary research for situations, organizations and the public. Formation and development of strategic plans for public relations and advertising students.

P R 305: Publicity Methods
(3-0) Cr. 3.
Prereq: ENGL 250, Sophomore classification
Communication and publicity fundamentals and the use of media for publicity purposes. Not available to Greenlee School majors.

P R 321: Public Relations Writing
(2-2) Cr. 3.
Prereq: JL MC 110 and minimum of C+ in JL MC 201; ADVRT/P R 301 credit or concurrent enrollment.
Developing and writing public relations materials with an emphasis on media relations and news. Techniques addressed include media kits, brochures, newsletters, digital media and speeches.

P R 390: Professional Skills Development
(Cross-listed with ADVRT, JL MC). Cr. 1-3. Repeatable, maximum of 6 credits. F.S.
Prereq: Minimum of C+ in JL MC 201; other vary by topic. Instructor permission for non-majors.
Check with Greenlee School for course availability.

P R 420: Crisis Communication
(3-0) Cr. 3.
Prereq: P R 220
Public relations strategies and tactics for crisis situations to protect and recover an organization's reputation: public behavior in crisis, crisis assessment, crisis communication plan, media training for leaders and spokespersons, apology strategy, corporate social responsibility, rumor in social media and reputation management.

P R 424: Public Relations Campaigns
(3-0) Cr. 3.
Prereq: Minimum of C+ in P R 321; ADVRT/P R 301.
Developing public relations and public information campaigns for business and social institutions.

P R 490: Independent Study in Communication
Cr. arr.
Prereq: Junior classification and contract with supervising professor to register.
Independent studies are research-based. Students may study problems associated with a medium, a professional specialization, a philosophical or practical concern, a reportorial method or writing technique, or a special topic in their field. Credit is not given for working on student or professional media without an accompanying research component.

P R 497: Special Topics in Communication
(Cross-listed with ADVRT, JL MC). Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: Junior classification. See Schedule of Classes for possible pre-requisites.
Seminars or one-time classes on topics of relevance to students in communication.

P R 499: Professional Media Internship
Cr. 1-3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, junior classification, formal faculty adviser approval.
Required of all Greenlee School majors. A 400-hour (for 3 credits) internship in the student's journalism and mass communication or advertising or public relations specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

P R 499A: Professional Media Internship: Required
Cr. 3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, junior classification, formal faculty adviser approval.
Initial, required internship. A 400-hour (for 3 credits) internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

P R 499B: Professional Media Internship: Optional
Cr. 1-3. F.S.SS.
Prereq: JL MC majors: minimum of C+ in JL MC 202 or JL MC 206 or P R 321; ADVRT majors: minimum of C+ in Jl MC 201 and ADVRT 301; P R majors: minimum of C+ in P R 321. All students, junior classification, formal faculty adviser approval.
Optional internship in the student's specialization. Assessment based on employer evaluations, student reports and faculty reviews. Available only to Greenlee School majors. Offered on a satisfactory-fail basis only.

Religious Studies

Religious Studies - Undergraduate Study

Religious studies gives students the opportunity to investigate and reflect on the world's religions in an objective, critical, and appreciative manner. Though there is emphasis in religious studies on the wide variety of religious phenomena as well as on the various methods in the study of religion, the aim is to help students develop their own integrated understanding of the nature of religion and its role in individual and social life.

Graduates of the religious studies program have knowledge of the religious diversity in the United States and the world. They have the ability to interpret religion empathetically and critically and to compare and contrast historical and contemporary differences and similarities of religious systems. They understand ways in which religion influences and is influenced by the historical, social, and cultural contexts in which

religious systems function. Graduates often pursue careers in non-profit, community organizations; apply to professional schools or graduate programs; or enter seminaries to prepare for ministry.

The major in religious studies seeks to provide both breadth and depth. Breadth is provided through the exploration of the world's various religious traditions and through exposure to a variety of theoretical approaches and methodologies in the academic study of religion. Depth is achieved through specialized courses in particular religious traditions and particular issues in the study of religions, culminating in research seminars. The objective is to expose the student to various components of the discipline of Religious Studies and by doing so develop skills that are valuable in a number of careers and that provide the necessary foundation for pursuing graduate studies.

Students pursuing a major in religious studies must complete a minimum of 33 credits, including the following requirements:

Two required introductory survey courses		6
RELIG 205	Introduction to World Religions	
RELIG 210	Religion in America	
Two courses from Bible or Western Religions		6
RELIG 220	Introduction to the Bible	
RELIG 242	History of Christianity: Beginnings to the Reformation	
RELIG 243	History of Christianity: The Reformation to the Present	
RELIG 280	Introduction to Catholicism	
RELIG 321	Old Testament	
RELIG 322	New Testament	
RELIG 358	Introduction to Islam	
One course from Asian Religions		3
RELIG 352	Religious Traditions of India	
RELIG 453	Buddhism	
One course from Religion, Culture and Society		3
RELIG 324	Christianity and Science	
RELIG 334	African American Religious Experience	
RELIG 336	Women and Religion	
RELIG 342	Religion and U.S. Latino/a Literature	
RELIG 360	Religious Ethics	
RELIG 380	Catholic Social Thought	
RELIG 384	Religion and Ecology	
RELIG 439	Goddess Religions	
RELIG 475	Seminar: Issues in the Study of Religion	
One required Capstone Course		3
RELIG 485	Theory and Method in Religious Studies	
Minimum of 12 credits of elective Religious Studies courses		12
Total Credits		33

Religious Studies, B.A.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	Religion Choice - Area I, II, III, or IV	3
LIB 160	1	Foreign Language/Elective	4
RELIG 205 or RELIG 210	3	Humanities Choice	3
Foreign Language/Elective	4	Social Science Choice	3
Humanities Choice	3	Elective	3
Math Choice	3		
	17		16

Sophomore

Fall	Credits	Spring	Credits
Religion Choice, - Area I, II, III, or IV	3	Religion Choice - Area I, II, III, or IV	3
ENGL 250	3	Religion Choice - Area I, II, III, or IV	3
Humanities Choice	3	Natural Science Choice[1]	4
Natural Science Choice[1]	4	Social Science Choice	3
Social Science Choice	3	Humanities Choice	3
	16		16

Junior

Fall	Credits	Spring	Credits
Religion Choice	3	Religion Choice	3
RELIG 485	3	Religion Choice	3
Elective	3	Elective	3
Elective	4	Elective	3
Elective	3	Elective	3
	16		15

Senior

Fall	Credits	Spring	Credits
RELIG 475(or spring)	3	Elective	3
Religion Choice	3	Elective	3
Elective	3	Elective	3
Elective	4	Elective	3
	13		12

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, i**ncluding a minimum of 45 credits at the 300/400 level**. You must also complete the LAS foreign-language requirement.

[1] Laboratory science recommended.

The program offers a minor that may be earned by completing a total of 15 credits in religious studies including either RELIG 205 Introduction to World Religions or RELIG 210 Religion in America. Nine hours must be in courses at the 300 level or above (no more than 3 hours of seminar and no more than 3 hours of independent study).

Students may choose to do a senior thesis under the supervision of a religious studies faculty adviser. This option may earn 3-6 credits toward the completion of the major.

Religious Studies - Graduate Study

Religious studies may be one of the three areas used for the interdisciplinary graduate studies master's degree.

Courses primarily for undergraduates:

RELIG 205: Introduction to World Religions
(3-0) Cr. 3. F.S.SS.
An introduction to the academic study of religions, including myths, beliefs, rituals, values, social forms. Examples chosen from oral cultures and major religions of the world.
Meets International Perspectives Requirement.

RELIG 210: Religion in America
(3-0) Cr. 3. F.S.SS.
Introductory study of the major beliefs, practices, and institutions of American Judaism, Catholicism, Protestantism, and Islam with emphasis on the diversity of religion in America, and attention to issues of gender, race, and class.
Meets U.S. Diversity Requirement

RELIG 220: Introduction to the Bible
(3-0) Cr. 3. F.S.
Basic overview of the contents of the Old and New Testament in light of their ancient socio-historical background, and with attention to a variety of interpretations and relevance to modern American society.

RELIG 242: History of Christianity: Beginnings to the Reformation
(3-0) Cr. 3. F.S.SS.
A survey of the major historical developments in Christian thought and practice that shaped Christianity from the time of Jesus through the late medieval period. Attention given to significant persons and major events, including those involving relations with Judaism and Islam.
Meets International Perspectives Requirement.

RELIG 243: History of Christianity: The Reformation to the Present
(3-0) Cr. 3. F.S.SS.
A survey of the major events, issues, and persons that contributed to the Protestant Reformation, the Catholic Counter-Reformation, and the proliferation of Christian denominations. Attention to selected responses of churches to major sixteenth-early twenty-first century developments.

RELIG 280: Introduction to Catholicism
(3-0) Cr. 3. F.
An explanation of the beliefs, spirit, and practices of Roman Catholicism, including its understanding of God, sacramentality, the human person, and community, and its relationship to other forms of Christianity and other world religions.

RELIG 321: Old Testament
(3-0) Cr. 3. F.
An in-depth study of the literature and religion of ancient Israel in light of recent archaeological discoveries, research about the ancient Near East, and a variety of interpretations.

RELIG 322: New Testament
(3-0) Cr. 3. S.
A detailed survey of the sacred scriptures of Christianity in light of recent archaeological discoveries and historical research about their Greco-Roman and Jewish background.

RELIG 324: Christianity and Science
(3-0) Cr. 3. S.
Prereq: BIOL 101, or another science course taught at ISU
Examines major challenges to Christianity's understandings of creation posed by the sciences; attention given to the relations of Christianity and science, and to Christianity's responses to ecological issues.

RELIG 334: African American Religious Experience
(Cross-listed with AF AM). (3-0) Cr. 3. F.
Prereq: Prior course work in Religious Studies or African American Studies recommended
Examination of African-American experience from the perspective of black religion with attention to political, economic, social, theological and artistic expressions, including music, that serve the life of African-American communities.".
Meets U.S. Diversity Requirement

RELIG 336: Women and Religion
(Cross-listed with W S). (3-0) Cr. 3. F.
Prereq: RELIG 205, RELIG 210 or W S 201 recommended
Examines the status of women in various religions, feminist critiques of religious structures and belief systems, and contemporary women's spirituality movements.
Meets U.S. Diversity Requirement

RELIG 340: Magic, Witchcraft, and Religion
(Dual-listed with RELIG 540). (Cross-listed with ANTHR). (3-0) Cr. 3. S.
Prereq: ANTHR 201 or ANTHR 306
Survey of global religious belief and practice from an anthropological perspective. Emphasis on myth and ritual, shamanism, magic, witchcraft, beliefs in spirits, conceptions of the soul, mind and body relationships, and healing and therapeutic practices. Discussion of religious response to dramatic political and social change; effects of globalization on religious practice.
Meets International Perspectives Requirement.

RELIG 342: Religion and U.S. Latino/a Literature
(Cross-listed with US LS). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
A study of the religious behavior and attitudes expressed in the literature of Mexican Americans, Puerto Ricans, Cuban Americans and other groups of people living in the U.S. who trace their ancestry to the Spanish-speaking countries of Latin America.
Meets U.S. Diversity Requirement

RELIG 348: Psychology of Religion
(Cross-listed with PSYCH). (3-0) Cr. 3.
Prereq: Nine credits in psychology
Survey of psychological theory and research investigating religious and spiritual attitudes, beliefs and practices.

RELIG 350: Philosophy of Religion
(Cross-listed with PHIL). (3-0) Cr. 3. F.
Prereq: 6 credits in philosophy
The value and truth of religious life and belief. Mystical experience; religious faith and language; arguments for God's existence; the problem of evil; miracles; and religion and morality. Historical and contemporary readings.

RELIG 352: Religious Traditions of India
(3-0) Cr. 3.
Prereq: Credit in RELIG 205 or equivalent.
Study of texts, practices, beliefs, historical development, and mutual influence of a variety of the religious traditions of India. Emphasis on Vedic religion and the diversity of traditions of Classical Hinduism; survey of Buddhist, Jain, Sikh, and South Asian Islamic traditions. Meets International Perspectives Requirement.
Meets International Perspectives Requirement.

RELIG 358: Introduction to Islam
(3-0) Cr. 3.
An introduction to Islamic religion, culture, and society from 700 to the present.
Meets International Perspectives Requirement.

RELIG 360: Religious Ethics
(3-0) Cr. 3.
Investigates different religious ethical theories and traditions of reasoning about practical moral issues (e.g., abortion, the just distribution of wealth, environmental ethics). Explores in detail the relationship between religious beliefs and moral practice.

RELIG 367: Christianity in the Roman Empire
(Cross-listed with CL ST). (3-0) Cr. 3.
An historical introduction to the rise of Christianity in the Roman empire, with special attention to the impact of Greco-Roman culture on the thought and practice of Christians and the interaction of early Christians with their contemporaries.

RELIG 370: Religion and Politics
(Cross-listed with POL S). (3-0) Cr. 3.
The interaction of religion and politics in the U.S. from both an historical and contemporary perspective, as well as the role of religion in politics internationally.

RELIG 376: Classical Archaeology
(Cross-listed with ANTHR, CL ST). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

RELIG 376A: Classical Archeology: Bronze Age and Early Iron Age Greece
(Cross-listed with ANTHR, CL ST). (3-0) Cr. 3. S.
Bronze Age (Minoan and Mycenaean palatial cultures) and Early Iron Age Greece. (ca 3000-700 BCE). Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

RELIG 376B: Classical Archeology: Archaic through Hellenistic Greece (ca 700-30 BCE)
(Cross-listed with ANTHR, CL ST). (3-0) Cr. 3. S.
Chronological survey of the material culture of the ancient Greece-Roman world and the role of archaeological context in understanding the varied aspects of ancient Greek or Roman culture. Among other topics, economy, architecture, arts and crafts, trade and exchange, religion and burial customs will be explored.
Meets International Perspectives Requirement.

RELIG 380: Catholic Social Thought
(3-0) Cr. 3. S.
Examines biblical roots of and major developments in Catholic social thought. Contemporary issues such as human rights, economic justice, the environment, and war and peace will be treated using principles of Catholic ethics, social analysis, official church documents, and contributions of notable theologians and activists.
Meets U.S. Diversity Requirement

RELIG 384: Religion and Ecology
(Cross-listed with ENV S). (3-0) Cr. 3.
Introduction to concepts of religion and ecology as they appear in different religious traditions, from both a historical and contemporary perspective. Special attention to religious response to contemporary environmental issues.
Meets International Perspectives Requirement.

RELIG 439: Goddess Religions
(Cross-listed with W S). (3-0) Cr. 3.
Prereq: RELIG 205 recommended
Exploration of the foundational myths of Goddess spirituality, including historical and cross-cultural female images of the divine and their modern usage by American women.

RELIG 453: Buddhism
(3-0) Cr. 3. S.
The various Buddhist paths to realize enlightenment and freedom. Special attention to meditation and yoga and their relationship to altered states of consciousness and to social contexts.
Meets International Perspectives Requirement.

RELIG 475: Seminar: Issues in the Study of Religion
(3-0) Cr. 3. Repeatable, maximum of 6 times.
Prereq: 6 credits in religious studies
Topic changes each time offered. Closed to freshmen. Sophomores must have approval of instructor.

RELIG 485: Theory and Method in Religious Studies
(3-0) Cr. 3.
Prereq: 6 credits in Religious Studies or permission of instructor
Examines the variety of theories and methods employed in the study of religion. Application of these methods to various religions of the world.

RELIG 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in religious studies and permission of instructor, approval of chairman.
Guided reading and research on special topics selected to meet the needs of advanced students. No more than 9 credits of Relig 490 may be counted toward graduation.

RELIG 490H: Independent Study: Honors
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: 6 credits in religious studies and permission of instructor, approval of chairman.
Guided reading and research on special topics selected to meet the needs of advanced students. No more than 9 credits of Relig 490 may be counted toward graduation.

RELIG 491: Senior Thesis
Cr. 3.
Written under the supervision of a Religious Studies faculty advisor.

RELIG 494: Special Studies in Religious Research Languages
Cr. 2-3. Repeatable.
Prereq: 6 credits in Religious Studies and permission of instructor

Courses primarily for graduate students, open to qualified undergraduates:

RELIG 540: Magic, Witchcraft, and Religion
(Dual-listed with RELIG 340). (Cross-listed with ANTHR). (3-0) Cr. 3. S.
Prereq: ANTHR 201 or ANTHR 306
Survey of global religious belief and practice from an anthropological perspective. Emphasis on myth and ritual, shamanism, magic, witchcraft, beliefs in spirits, conceptions of the soul, mind and body relationships, and healing and therapeutic practices. Discussion of religious response to dramatic political and social change; effects of globalization on religious practice.
Meets International Perspectives Requirement.

RELIG 590: Special Topics in Religious Studies
Cr. 1-3. Repeatable.
Prereq: Permission of instructor, 9 credits in religious studies

Sociology

Undergraduate Study in Sociology

The Department of Sociology offers course work leading to either a bachelor of arts, bachelor of science, or a minor in sociology. Additionally, a bachelor of science in Agriculture & Society is offered.

Graduates of all these programs will understand and demonstrate:

1. general knowledge of sociology
2. research methods in sociology
3. critical thinking skills
4. application of sociology to pressing social issues
5. sociological and professional values
6. information technology skills
7. communication skills
8. personal and career development

Graduates understand how social institutions, communities, and organizations work and change; they can examine the causes and consequences of conformity, deviance, and inequality. They can apply sociological understanding of human behavior to practical work situations and everyday life. Graduates can read critically, think independently, and communicate effectively about social issues and social policy.

University Requirements:

International Perspective		3
US Diversity		3
Total Credits		6

Communications:

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
LIB 160	Information Literacy	1
Total Credits		7

World Languages and Culture:

3 years H.S.		
SPAN 097	Accelerated Spanish Review	0
2 semesters college		8
Total Credits		8

Departmental requirements for sociology majors include the following supporting courses:

STAT 101	Principles of Statistics	3-4
or STAT 104	Introduction to Statistics	
One of the following		3
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
Total Credits		6-7

Majors must complete both ENGL 150 Critical Thinking and Communication and ENGL 250 Written, Oral, Visual, and Electronic Composition. In addition, majors must also take an advanced course in ENGL 302 Business Communication or ENGL 309 Proposal and Report Writing or ENGL 314 Technical Communication with a grade of C or better. Programs leading to a bachelor of arts degree will emphasize additional coursework in groups I and III of the general education requirements. Programs leading to a bachelor of science degree will emphasize additional coursework in groups IIA and IIB of the general education requirements. Some of the possible areas of coursework include criminal justice, community (urban and rural) sociology, family sociology, sociology of work, research methods and statistics, social change and development, social inequality, social psychology and sociological theory.

A program of study that meets the needs and interests of the student and department requirements will be developed in consultation with the major adviser. Students must maintain a GPA of 2.0 or higher in their core courses. Programs of study will include:

SOC 115	Orientation to Sociology	1
SOC 134	Introduction to Sociology	3
SOC 302	Research Methods for the Social Sciences	3
SOC 401	Contemporary Sociological Theories	3
6 credits of 200+ Sociology courses		6
18 credits of 300+ Sociology courses		18
Total Credits		34

In addition to the program of study above, students must select complementary courses that will lead to a bachelor of arts or bachelor of science degree.

Bachelor of Arts supporting coursework

At least 9 additional arts and humanities and/or social science courses	9
Total Credits	9

Bachelor of Science supporting coursework

At least 9 additional credits in natural science, math, or statistics	9
Total Credits	9

Sociology, Bachelor of Arts (BA) and Bachelor of Science (BS)

Freshman

Fall	Credits	Spring	Credits
ENGL 150		3 Sociology 200+	3
Stat 101 or 104		3-4 Social Science Choice	3

SOC 134		3 Natural Science Choice	3
Arts and Humanities Choice		3 Arts and Humanities Choice	3
Social Science Choice		3 Arts and Humanities Choice	3
SOC 115		1 LIB 160	1
	16-17		16

Sophomore

Fall	**Credits**	**Spring**	**Credits**
Sociology 200+	3	Sociology 300+	3
Sociology 300+	3	Sociology 300+	3
Foreign Language/ International Perspecitve	4	Foreign Language/ International Perspective	4
Arts and Humanities Choice	3	Natural Science Choice	3
ENGL 250	3	Elective	3
	16		16

Junior

Fall	**Credits**	**Spring**	**Credits**
Sociology 300+	3	SOC 302	3
U.S. Diversity	3	Sociology 300+	3
Natural Science Choice	2	Complementary Course; (approved Arts and Humanities or Social Science course if seeking a BA; approved Math or Natural Science course if seeking a BS)	3
Electives 300+	6	Electives 300+	6
	14		15

Senior

Fall	**Credits**	**Spring**	**Credits**
SOC 401	3	Sociology 300+	3
ENGL 302, 309 or 314	3	Complementary Course; (approved Arts and Humanities or Social Science course if seeking a BA; approved Math or Natural Science course if seeking a BS)	3
Complementary Course; (approved Arts and Humanities or Social Science course if seeking a BA; approved Math or Natural Science course if seeking a BS)	3	Electives 300+	6-9
Electives 300+	6		
	15		12-15

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.**

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses.

Sociology Minor

The department offers a minor in sociology which may be earned by completing 15 credits in sociology with a minimum 2.0 GPA:

SOC 134	Introduction to Sociology	3
Additional 12 credits in Sociology courses		12
9 credits must be 300+		
Total Credits		15

At least 9 of the 15 credits must be at the 300 level or higher with a minimum of 6 of those credits taken at ISU. 9 credits must stand alone in the minor.

Graduate Study

The department offers work for the degrees master of science and doctor of philosophy with majors in sociology and rural sociology and minor work for students majoring in other departments. The department offers concentrations in a number of areas, e.g., community studies and development; sociology of families, inequality, food systems, agriculture and environment; methodology; social change and development; criminology; the economy, organizations and work; and social psychology. The Department of Sociology does not offer a nonthesis master's program.

Graduates have a broad understanding of sociology, address complex societal problems, and communicate effectively with scientific colleagues and the general public in both formal and informal settings. They understand sociological theory, conduct research, and are prepared to educate college students and contribute to public policy. Although the department stipulates no language requirement for either the degree master of science or the degree doctor of philosophy, specifying competence in one or more languages may be desirable in some instances.

The department also participates in the interdepartmental program in interdepartmental majors in sustainable agriculture, transportation and water resources, and interdepartmental minors in gerontology.

Course requirements are listed below. Information about examinations, theses and dissertations, P.O.S. committees and other requirements are available on the Sociology Department web site.

Ph.D. Core Degree Requirements

Although responsibility for determining the student's course work resides with the POS committee, the Sociology Department has core courses

that must be taken by all students. A graduate course taken elsewhere can be substituted for the Ph.D. core requirements with approval by the Departmental Officer of Graduate Education (DOGE) in consultation with the faculty.

A minimum of 72 semester credits (including master's degree credits) is required for graduation.

Required Courses for the Ph.D. Degree

STAT 404	Regression for Social and Behavioral Research	3
SOC 506	Classical Sociological Theory	3
SOC 511	Research Methodology for the Social Sciences	3
SOC 512	Applied Multivariate Statistics for Social and Behavioral Research	3
SOC 513	Qualitative Research Methods	3
SOC 520	Social Psychology: A Sociological Perspective	3
SOC 534	Race, Class and Gender Inequality	3
SOC 591	Orientation to Sociology	1
SOC 607	Contemporary Sociological Theory	3
SOC 699	Dissertation Research	8

No more than 12 credits of 590 (special topics) may be applied toward the Ph.D. degree requirements (72 credits).

Ph.D. Minor / Co-Major Requirements

Required Courses for the Ph.D. Minor

SOC 506	Classical Sociological Theory	3
SOC 511	Research Methodology for the Social Sciences	3
SOC 607	Contemporary Sociological Theory	3
One of the following three courses:		
SOC 512	Applied Multivariate Statistics for Social and Behavioral Research	
SOC 513	Qualitative Research Methods	
SOC 613	Structural Equation Models for Social and Behavioral Research	
And other Sociology courses (at least one of which must be at the 600 level) for a total of 24 credits in Sociology.		

Required Courses for the Ph.D. Co-Major

STAT 404	Regression for Social and Behavioral Research	3
SOC 506	Classical Sociological Theory	3
SOC 511	Research Methodology for the Social Sciences	3
One Course in Advanced Methodology:		
SOC 512	Applied Multivariate Statistics for Social and Behavioral Research	
SOC 513	Qualitative Research Methods	
SOC 613	Structural Equation Models for Social and Behavioral Research	
One Course in Advanced Sociology		
SOC 520	Social Psychology: A Sociological Perspective	
SOC 534	Race, Class and Gender Inequality	
SOC 591	Orientation to Sociology	1
SOC 607	Contemporary Sociological Theory	3
SOC 699	Dissertation Research	8

Co-Major Requirements for the Graduate Program in Sustainable Agriculture

The Graduate Program in Sustainable Agriculture (GPSA) develops student competence and expertise in the design, implementation, and evaluation of sustainable agricultural systems. The program's curriculum satisfies the formal requirements for the MS and Ph.D. degrees, as established by the ISU Graduate College, and fosters transdisciplinary and systems-level thinking.

The Department does not offer double majors in sociology.
For admission to the co-major program contact the graduate program coordinator.

M.S. Core Degree Requirements

Although responsibility for determining the student's course work resides with the POS committee, the Sociology Department has core courses that must be taken by all students. A graduate course taken elsewhere can be substituted for the core requirements with approval by the Departmental Officer of Graduate Education (DOGE) in consultation with the faculty.

Required Courses for the M.S. Degree

STAT 401	Statistical Methods for Research Workers	4
SOC 506	Classical Sociological Theory	3
SOC 511	Research Methodology for the Social Sciences	3
SOC 591	Orientation to Sociology	1
SOC 599	Research for Master's Thesis	6
A minimum of 30 semester credits is required for the M.S. degree.		

No more than 6 credits of 590 (special topics) may be applied toward the M.S. degree requirements (30 credits).

M.S. Minor / Co-Major Requirements

Required Courses for the M.S. Minor

SOC 506	Classical Sociological Theory	3
SOC 511	Research Methodology for the Social Sciences	3

One additional course in sociology, or STAT 401, for a minimum of 9 credits.

Required Courses for the M.S. Co-Major

STAT 401	Statistical Methods for Research Workers	4
SOC 506	Classical Sociological Theory	3
SOC 511	Research Methodology for the Social Sciences	3
Three additional courses in sociology for a total of 19 credits.		

The department does not offer double majors in sociology at the graduate level. Admission requirements to the co-major program are the same as for the major.

Co-Major Requirements for the Graduate Program in Sustainable Agriculture

The Graduate Program in Sustainable Agriculture (GPSA) develops student competence and expertise in the design, implementation, and evaluation of sustainable agricultural systems. The program's curriculum satisfies the formal requirements for the MS and PhD degrees, as established by the ISU Graduate College, and fosters transdisciplinary and systems-level thinking.

Courses primarily for undergraduates:

SOC 110: Orientation to Public Service and Administration in Agriculture

Cr. R. F.

Survey of public service and administration in agriculture. Exploration of career tracks and career planning. Recommended during first semester of freshman year or as soon as possible after transfer into the department.

SOC 115: Orientation to Sociology

(1-0) Cr. 1. F.S.

Orientation to sociology. A familiarization with University and LAS College requirements and procedures. Occupational tracks and career options open to sociology; introduction to career planning. Recommended during first semester of freshman year, or as soon as possible after transfer into the department. Offered on a satisfactory-fail basis only.

SOC 134: Introduction to Sociology

(3-0) Cr. 3. F.S.SS.

Social interaction and group behavior with emphasis on the scientific study of contemporary U.S. society, including issues relating to socialization, inequality, and changing rural and urban communities. Analysis of relationships among the institutions of family, religion, political participation, work, and leisure.

SOC 134H: Introduction to Sociology: Honors.

(3-0) Cr. 3. F.S.SS.

Social interaction and group behavior with emphasis on the scientific study of contemporary U.S. society, including issues relating to socialization, inequality, and changing rural and urban communities. Analysis of relationships among the institutions of family, religion, political participation, work, and leisure.

SOC 219: Sociology of Intimate Relationships

(3-0) Cr. 3. F.S.SS.

Prereq: SOC 134

Analysis of intimate relationships among couples using a sociological perspective. Attention is given to singlehood; dating and courtship; sexuality; mate selection, cohabitation, and marriage. Relationship quality, communication, conflict and dissolution of these types of relationship will also be explored.

SOC 220: Globalization and Sustainability

(Cross-listed with ANTHR, ENV S, GLOBE, M E, MAT E, T SC). (3-0) Cr. 3. F.S.

An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.

Meets International Perspectives Requirement.

SOC 230: Rural Society in Transition

(3-0) Cr. 3. F.S.

Introduction to the causes and consequences of social and economic change affecting rural people and places. Uses a sociological perspective to examine social structures, social change, and social relationships within rural society. Topics include community, population change, inequality, rural economy, structure of agriculture, social and environmental impacts of resource extraction.

SOC 235: Social Problems and American Values

(3-0) Cr. 3. F.S.

Prereq: SOC 134

Sociological concepts, theories and methods to analyze the causes and consequences of social problems. Social problems discussed may include crime, substance abuse, income inequalities, discrimination, poverty, race relations, health care, family issues, and the environment. How American culture and values shape societal conditions, public discourse and policy.

Meets U.S. Diversity Requirement

SOC 241: Youth and Crime
(Cross-listed with CJ ST). (3-0) Cr. 3. F.
An examination of delinquency that focuses on the relationship between youth as victims and as offenders, social and etiological features of delinquency, the role of the criminal justice system, delinquents' rights, and traditional and alternative ways of dealing with juvenile crime.

SOC 302: Research Methods for the Social Sciences
(3-0) Cr. 3. F.S.
Prereq: SOC 134; STAT 101; or concurrent enrollment in STAT 101
Introduction to the principal research methods used in sociology, including survey research, interviewing, content analysis, experiments, ethnographies, focus groups, historical analysis, and analysis of secondary data. Instruction on sampling and the principles of validity and reliability underlying quantitative and qualitative methods. Training in data analysis using statistical software packages.

SOC 305: Social Psychology: A Sociological Perspective
(3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
Examination of human behavior in a social environment with emphasis on development of the self, interpersonal relations, attitudes, and small groups.

SOC 310: Community
(3-0) Cr. 3. F.S.
Prereq: SOC 134
Analysis of evolving theory and research of community as an ideal type, an ecological system, a political economy, and an interactional field; examination of the impact of economic, cultural, social and political infrastructures on community power structures and change processes in a global era.

SOC 325: Transition in Agriculture
(3-0) Cr. 3. S.
The impacts of agricultural changes on farm families, rural communities, and consumers. Past, present, and future trends in family farms and their social implications.

SOC 327: Sex and Gender in Society
(Cross-listed with W S). (3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
How the biological fact of sex is transformed into a system of gender stratification. The demographics and social positions of women and men in the family, education, media, politics, and the economy. Theories of the social-psychological and sociological bases for behavior and attitudes of women and men. The relationship between gender, class, and race.
Meets U.S. Diversity Requirement

SOC 328: Sociology of Masculinities and Manhood
(Cross-listed with W S). (3-0) Cr. 3. S.
Prereq: SOC 134 or W S 201
Examination of socially constructed and idealized images of manhood, the nature of social hierarchies and relations constructed on the basis of imagery, ideologies, and norms of masculinity. Theories on gender (sociological, psychological, and biological). Particular attention given to theory and research on gender variations among men by race, class, ethnicity, sexual orientation, physical ability and age.
Meets U.S. Diversity Requirement

SOC 330: Ethnic and Race Relations
(Cross-listed with AF AM). (3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
Analysis of ethnic and race relations, particularly in America; emphasis on the sociology and psychology of race and ethnic relations.
Meets U.S. Diversity Requirement

SOC 331: Social Class and Inequality
(3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
Social stratification and processes resulting in social and economic inequalities; implications of status, class, and poverty for people of different races, ethnicities, and gender.
Meets U.S. Diversity Requirement

SOC 332: The Latino/Latina Experience in U.S. Society
(Cross-listed with US LS). (3-0) Cr. 3. F.
Prereq: SOC 134
Examination of the social, historical, economic and political experience of varied Latino ethnic groups in the U.S. - primarily focusing on Mexican, Puerto Ricans, and Cubans.
Meets U.S. Diversity Requirement

SOC 334: Politics and Society
(Cross-listed with POL S). (3-0) Cr. 3. F.
Prereq: A course in political science or sociology
The relationship between politics and society with emphasis on American society. Discussion of theories of inequality, power, social movements, elites, ruling classes, democracy, and capitalism.

SOC 340: Deviant and Criminal Behavior
(Cross-listed with CJ ST). (3-0) Cr. 3. S.SS.
Prereq: SOC 134 or CJ ST 240
Theory and research on the etiology of types of social deviance; issues relating to crime, antisocial behavior and social policies designed to control deviant behavior.

SOC 345: Population and Society
(Cross-listed with ENV S). (3-0) Cr. 3. F.
Prereq: SOC 134
Human population growth and structure; impact on food, environment, and resources; gender issues; trends of births, deaths, and migration; projecting future population; population policies and laws; comparison of the United States with other societies throughout the world.
Meets International Perspectives Requirement.

SOC 348: Global Poverty, Resources and Sustainable Development
Cr. 3.
Prereq: Soc 134
Trends in hunger, poverty, resource use and development. Assessment of theories, policies, and programs to promote sustainable livelihoods, resource management, and development at local and national levels. Examine solutions through institutional efforts and grassroots social movements.
Meets International Perspectives Requirement.

SOC 362: Applied Ethics in Agriculture
(Cross-listed with ECON). (3-0) Cr. 3.
Prereq: ECON 101 or SOC 134, junior or senior status in the College of Agriculture
Identify major ethical issues and dilemmas in the conduct of agricultural and agribusiness management and decision making. Discuss and debate proper ethical behavior in these issues and situations and the relationship between business and personal ethical behavior.

SOC 380: Sociology of Work
(3-0) Cr. 3. F.S.
Prereq: SOC 134
Inequalities (gender, race, class) related to jobs, occupations, firms, and industries. Satisfactions, rewards, alienation, discrimination, and other topics of importance to workers are examined.

SOC 381: Social Psychology of Small Group Behavior
(Cross-listed with PSYCH). (3-0) Cr. 3. S.
Prereq: SOC 305 or PSYCH 280
A survey of small group theory and research from an interdisciplinary, social psychological perspective.

SOC 382: Environmental Sociology
(Cross-listed with ENV S). (3-0) Cr. 3. F.S.
Prereq: Soc 134 or 3 credits of ENV S
Environment-society relations; social construction of nature and the environment; social and environmental impacts of resource extraction, production, and consumption; environmental inequality; environmental mobilization and movements; U.S. and international examples.

SOC 401: Contemporary Sociological Theories
(3-0) Cr. 3. F.S.SS.
Prereq: 9 credits in sociology
Both historical and modern social theories as applied to understanding and researching the social world.

SOC 411: Social Change in Developing Countries
(3-0) Cr. 3. S.
Prereq: SOC 134 plus 3 credits in social sciences
Social change and development in developing countries; international interdependence; causes and consequences of persistent problems in agriculture, city growth, employment, gender equality, basic needs; local and worldwide efforts to foster social change and international development.
Meets International Perspectives Requirement.

SOC 415: Dynamics of Social Change
(3-0) Cr. 3. F.
Prereq: SOC 134 plus 3 credits in social sciences
Examination of public responses to complex and controversial innovations, such as environmentalism, feminism, stem-cell research, same-sex marriage, large-scale hog lots, and others. Strategies for gaining adoption/rejection of controversial innovations. Applications to topics in agriculture, development, business, and marketing. Credit for only Soc 415 or 515 may be applied toward graduation.

SOC 460: Criminal and Juvenile Justice Practicum
Cr. 3-12. Repeatable, maximum of 12 credits. F.S.SS.
Prereq: Junior or senior classification; permission of criminal justice studies coordinator; major or minor in criminal justice or sociology
Study of the criminal and juvenile justice systems and social control processes. Supervised placement in a police department, prosecutor's office, court, probation and parole department, penitentiary, juvenile correctional institution, community-based rehabilitation program, or related agency. Assessed service learning component. Offered on a satisfactory-fail basis only. No more than a total of 9 credits of 460 can be counted toward graduation. No credits in Soc 460 may be used to satisfy minimum sociology requirements for sociology majors.

SOC 464: Strategies for Community Engagement
(3-0) Cr. 3. S.SS.
Prereq: 6 credits in sociology
Project-focused engagement in community issues and initiatives. A broad range of strategies will be addressed, including popular education, applied research, network analysis and mapping, policy focused work, action research, curriculum development, community organizing, and organizational development.

SOC 485: Sociology of the Family
(3-0) Cr. 3. S.
Prereq: 6 credits in sociology
The contemporary family in developing, industrial, and post-industrial societies. Effects of modernization, cultural change, and family policies on family dynamics, structures, and functions.

SOC 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in sociology and permission of instructor
Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of Soc 490 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 490 toward graduation.

SOC 490A: Independent Study: General Sociology
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in sociology and permission of instructor
Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of Soc 490 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 490 toward graduation.

SOC 490B: Independent Study: Rural Sociology
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in sociology and permission of instructor
Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of Soc 490 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 490 toward graduation.

SOC 490E: Independent Study: Senior Seminar
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in sociology and permission of instructor
Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of Soc 490 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 490 toward graduation.

SOC 490H: Independent Study: Honors
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: 6 credits in sociology and permission of instructor
Students in the College of Agriculture must be of junior or senior classification and may use no more than 6 credits of Soc 490 toward the total of 128 credits required for graduation. Students in the College of Liberal Arts and Sciences may count no more than 9 credits of 490 toward graduation.

Courses primarily for graduate students, open to qualified undergraduates:

SOC 506: Classical Sociological Theory
(3-0) Cr. 3. S.
Prereq: SOC 401 or SOC 505
The origins of the canonical works of sociology in the mid-Industrial Revolution period including Karl Marx, Max Weber, Emile Durkheim and others.

SOC 509: Agroecosystems Analysis
(Cross-listed with AGRON, SUSAG). (3-4) Cr. 4. F.
Prereq: Senior or above classification
Experiential, interdisciplinary examination of Midwestern agricultural and food systems, emphasizing field visits, with some classroom activities. Focus on understanding multiple elements, perspectives (agronomic, economic, ecological, social, etc), and scales of operation.

SOC 511: Research Methodology for the Social Sciences
(3-0) Cr. 3. S.
Prereq: SOC 302 and STAT 401
Covers the philosophy and the techniques of research methods in sociology and other social sciences, including the ethics and politics of social science, validity issues, conceptualization and operationalization, sampling strategies, appropriate research designs for different questions, survey construction, and various data collection and analysis techniques.

SOC 512: Applied Multivariate Statistics for Social and Behavioral Research
(3-0) Cr. 3. F.
Prereq: STAT 404 or with instructor's permission
Applied techniques of multivariate analysis includng cluster analysis, principal components and factor analysis, multivariate analysis of variance and covariance binomial and multinomial regression, multi-level random coefficient models, and spatial regression. Conceptual and mathematical grounding for nonstatisticians. Instruction in Mplus and SAS.

SOC 513: Qualitative Research Methods
(3-0) Cr. 3. F.
Prereq: SOC 511
Applied qualitative research methods in sociology. Design and implementation of a course-based research project including data collection, analysis, and presentation of results. Qualitative data gathering techniques using observational, historical, in-depth interviewing or content analysis approaches. Laboratory emphasis on completion of data gathering, analysis, and report writing.

SOC 520: Social Psychology: A Sociological Perspective
(3-0) Cr. 3. F.
Prereq: SOC 305 or PSYCH 280
Examination of cognitive, symbolic interaction, exchange, role-reference group, and dramaturgical approaches. Assessment of contemporary issues in social psychology.

SOC 525: Seminar in Social Psychology
(3-0) Cr. 3.
Prereq: SOC 305 or PSYCH 280

SOC 525A: Seminar in Social Psychology: Small Groups
(3-0) Cr. 3.
Prereq: SOC 305 or PSYCH 280

SOC 525B: Seminar in Social Psychology: Attitudes and Attitude Change
(3-0) Cr. 3.
Prereq: SOC 305 or PSYCH 280

SOC 525C: Seminar in Social Psychology: Symbolic interactionism
(3-0) Cr. 3.
Prereq: SOC 305 or PSYCH 280

SOC 525D: Seminar in Social Psychology: Self and Identity
(3-0) Cr. 3.
Prereq: SOC 305 or PSYCH 280

SOC 527: Seminar in Social Inequality
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in sociology
Analysis of racial and ethnic inequality in the United States and the world; focus on the implications of the changing world social and economic order for differences in racial and ethnic groups relative to wealth, status, and power; a critical examination of majority-group domination of minority groups in various societies.

SOC 527A: Seminar in Social Inequality: Sociology of Race and Ethnicity
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in sociology
Analysis of racial and ethnic inequality in the United States and the world; focus on the implications of the changing world social and economic order for differences in racial and ethnic groups relative to wealth, status, and power; a critical examination of majority-group domination of minority groups in various societies.

SOC 527B: Seminar in Social Inequality: Sociology of Gender
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in sociology
Analysis of racial and ethnic inequality in the United States and the world; focus on the implications of the changing world social and economic order for differences in racial and ethnic groups relative to wealth, status, and power; a critical examination of majority-group domination of minority groups in various societies.

SOC 533: Rural Development and Community
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: SOC 511 or equivalent
Linkages between socioeconomic development, space, and community in local and global contexts. Focus on economic, social, cultural, environmental, and spatial dimensions of communities. Presentation of conceptual models. Applications using data and methods.

SOC 534: Race, Class and Gender Inequality
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: 6 credits in sociology
Critical examination of the causes and consequences of social stratification and inequality; classical theories, contemporary frameworks, and recent empirical studies; international stratification patterns.

SOC 536: Strategies for Community Engagement in Food and Farming Systems
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in sociology
Project-focused community practice using diverse approaches and perspectives.

SOC 540: Comparative Social Change
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 6 graduate credits in sociology
Contemporary theories of social change, modernization, dependency, and development are critically examined; methodological issues identified; supporting research explored; applicability of theoretical models, concepts, and strategies to current national and international needs are evaluated.

SOC 543: Seminar in Social Change and Development
(Cross-listed with T SC). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology
Seminar in social change and development.

SOC 543A: Seminar in Social Change and Development: Strategies of Community Engagement
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology

SOC 543B: Seminar in Social Change and Development: Sociology of Adoption and Diffusion
(Cross-listed with T SC). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology

SOC 543C: Seminar in Social Change and Development: Technological Innovation, Social Change and Development
(Cross-listed with T SC). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology

SOC 544: Sociology of Food and Agricultural Systems
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 6 credits in sociology
Social organization of food and fiber production, processing, and distribution systems. Sociological comparison of conventional and alternative production systems; gender roles in agriculture and food systems; local, national and global food systems; perspectives on food and agricultural research and policy.

SOC 549: Sociology of the Environment
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology
Social causes and social consequences of environmental problems. Interrelationship between social inequality and environmental inequality. Social construction and social experience of the environment. Contemporary developments in the social theory of the environment. International and domestic implications.

SOC 550: Sociology of Economic Life
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 6 credits in sociology
Social construction of economic activity in non-industrial and industrial societies with special attention on variations of industrial societies (capitalism and socialism), economic globalization, and economic development. Interaction of economic systems with human values, ideology, organizations, work and individual welfare.

SOC 551: Seminar in Economy, Organization, and Work
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 6 credits in sociology

SOC 551B: Seminar in Economy, Organization, and Work: Complex Organizations
(3-0) Cr. 3. F.
Prereq: 6 credits in sociology

SOC 584: Current Issues in Crime and Justice
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: 6 credits in sociology
Discussion of current research and theory in crime and delinquency; topics include the purpose and role of law in social life; emerging theoretical directions in criminology; recent work on specific forms of criminality; controversies in the criminal justice system.

SOC 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: 6 credits in sociology; senior or graduate classification

SOC 590A: Special Topics: General Sociology
Cr. 1-3. Repeatable.
Prereq: 6 credits in sociology; senior or graduate classification

SOC 590B: Special Topics: Rural Sociology
Cr. 1-3. Repeatable.
Prereq: 6 credits in sociology; senior or graduate classification

SOC 591: Orientation to Sociology
(1-0) Cr. 1. F.
Prereq: Formal admission into the sociology graduate program
Introduction to the department, current graduate student policies at department and university levels, departmental administrative procedures. Required of graduate students. Offered on a satisfactory-fail basis only.

SOC 599: Research for Master's Thesis
Cr. 1-6. Repeatable.

SOC 599A: Research for Master's Thesis: General Sociology
Cr. 1-6. Repeatable.

SOC 599B: Research for Master's Thesis: Rural Sociology
Cr. 1-6. Repeatable.

Courses for graduate students:

SOC 607: Contemporary Sociological Theory
(3-0) Cr. 3. S.
Prereq: 6 graduate credits in sociology
Provides a review of modern sociological thought, issues, and controversies as they affect current research and discourse in the discipline.

SOC 610: Foundations of Sustainable Agriculture
(Cross-listed with A B E, AGRON, ANTHR, SUSAG). (3-0) Cr. 3. F.
Prereq: Graduate classification, permission of instructor
Historical, biophysical, socioeconomic, and ethical dimensions of agricultural sustainability. Strategies for evaluating existing and emerging agricultural systems in terms of the core concepts of sustainability and their theoretical contexts.

SOC 613: Structural Equation Models for Social and Behavioral Research
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: SOC 512 and STAT 404, or with instructors permission.
Specification, identification, and interpretation of structural equation models. Techniques include structural or path models, measurement or confirmatory factor models, structural models with latent variables, and multi-level structural models. Conceptual and mathematical grounding for non-statisticians. Instruction in AMOS, MPLUS, and SAS.

SOC 698: Seminars in Sociology
(3-0) Cr. 3.

SOC 698L: Seminars in Sociology: Community Studies and Development
(3-0) Cr. 3.

SOC 698M: Seminars in Sociology: Criminology
(3-0) Cr. 3.

SOC 698N: Seminars in Sociology: The Economy, Organizations, and Work
(3-0) Cr. 3.

SOC 698O: Seminars in Sociology: Food Systems, Agriculture, and the Environment
(3-0) Cr. 3.

SOC 698P: Seminars in Sociology: Methodology
(3-0) Cr. 3.

SOC 698Q: Seminars in Sociology: Social Change and Development
(3-0) Cr. 3.

SOC 698R: Seminars in Sociology: Social Inequality
(3-0) Cr. 3.

SOC 698S: Seminars in Sociology: Social Psychology
(3-0) Cr. 3.

SOC 698T: Seminars in Sociology: Sociology of Families
(3-0) Cr. 3.

SOC 698U: Seminars in Sociology: Theory
(3-0) Cr. 3.

SOC 699: Dissertation Research
Cr. 1-8. Repeatable.

SOC 699A: Dissertation Research: General Sociology
Cr. 1-8. Repeatable.

SOC 699B: Dissertation Research: Rural Sociology
Cr. 1-8. Repeatable.

Software Engineering

For the undergraduate curriculum in Software Engineering (http://www.se.iastate.edu) leading to the degree Bachelor of Science. This curriculum is accredited under the General Criteria and Software Engineering Program Criteria by the Engineering Accreditation Commission of ABET, http://www.abet.org.

The Bachelor of Science degree in software engineering is jointly administered by the College of Engineering and the College of Liberal Arts and Sciences. The Software Engineering program provides undergraduate students with the opportunity to learn software engineering fundamentals, to study applications of state-of-the art software technologies and to prepare for the practice of software engineering. The student-faculty interaction necessary to realize this opportunity occurs within an environment motivated by the principle that excellence in undergraduate education is enhanced by an integrated commitment to successful, long-term research and outreach programs.

The software engineering curriculum offers emphasis areas in software engineering principles, process and practice. Students may also take elective courses in computer engineering and computer science.

Program Educational Objectives

Within five years of graduation, the graduates should:

1. attain a **productive career** in Software Engineering or related fields;

2. attain **leadership** roles and become **effective collaborators** to advance professional and organizational goals;

3. engage in **continuous learning** and professional development.

We expect that these objectives will be manifested in our graduates through the following five key attributes: (a) *peer-recognized expertise*, (b) *engagement in professional practice*, (c) *sustained learning*, (d) *leadership* and (e) *teamwork*.

Demonstration of expertise involves applying state-of-the-art practices for solving problems in the design, development, validation, evolution and sustainment of (software) products. Demonstration of professional engagement involves contributing locally and globally to the use of ethical, competent, and creative practices in industry, academia or the public sector. Demonstration of sustained learning involves the ability to adapt to rapid technological, environmental, and organizational changes through self-study and group study and through opportunities of professional development or graduate study. Demonstration of leadership involves the ability to take initiative, and to facilitate the advancements of individuals and the community by influencing others and by having

a widespread, positive impact on critical issues and projects. Finally, demonstration of teamwork involves the ability to work with collaborators who have varied expertise, and with diverse cultural and interdisciplinary backgrounds.

As a complement to the instructional activity, the Department of Computer Science and the Department of Electrical and Computer Engineering provide opportunities for each student to have experience with broadening activities. Students have the opportunity to gain practical industry experience in the cooperative education and internship program. Students have the opportunity to participate in advanced research activities. Through international exchange programs, students learn about engineering practices in other parts of the world.

Curriculum in Software Engineering

Administered by the Department of Electrical and Computer Engineering in the College of Engineering and the Department of Computer Science in the College of Liberal Arts and Sciences.

Leading to the degree bachelor of science.

Total credits required: 125 cr. Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs. Note: Pass/Not Pass credits cannot be used to meet graduation requirements.
International Perspectives: 3 cr. [1]
U.S. Diversity: 3 cr. [1]
Communication Proficiency/Library requirement:

ENGL 150	Critical Thinking and Communication (C or better in this course)	3
ENGL 250	Written, Oral, Visual, and Electronic Composition (C or better in this course)	3
LIB 160	Information Literacy	1
Choose one of the following:		3
ENGL 309	Proposal and Report Writing (C or better in this course)	
ENGL 314	Technical Communication (C or better in this course)	
Total Credits		10

General Education Electives: 15 cr. [2]

Choose 1 course from the following:		3
ECON 101	Principles of Microeconomics	
ECON 102	Principles of Macroeconomics	
I E 305	Engineering Economic Analysis	
Arts and Humanities		6
Social Sciences		3
Additional Arts and Humanities or Social Sciences course		3
Total Credits		15

Basic Program: 27 cr.
A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA). See Requirement for Entry into Professional Program in College of Engineering Overview section.

CHEM 167	General Chemistry for Engineering Students	4
or CHEM 177	General Chemistry I	
ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
S E 101	Software Engineering Orientation [3]	R
S E 185	Problem Solving in Software Engineering [3]	3
LIB 160	Information Literacy	1
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 221	Introduction to Classical Physics I	5
Total Credits		27

Math and Physical Science: 11 cr.

COM S 227	Introduction to Object-oriented Programming	4
COM S 228	Introduction to Data Structures	3
MATH 267	Elementary Differential Equations and Laplace Transforms	4
Total Credits		11

Software Engineering Core: 34 cr.
A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Core GPA):

CPR E 281	Digital Logic	4
Choose one of the following:		3
COM S 327	Advanced Programming Techniques	
CPR E 288	Embedded Systems I: Introduction	
Choose one of the following:		3
COM S 321	Introduction to Computer Architecture and Machine-Level Programming	
CPR E 381	Computer Organization and Assembly Level Programming	
Choose one of the following:		3
COM S 352	Introduction to Operating Systems	
CPR E 308	Operating Systems: Principles and Practice	
Choose one of the following:		3
COM S 230	Discrete Computational Structures	

CPR E 310	Theoretical Foundations of Computer Engineering	
COM S 311	Design and Analysis of Algorithms	3
COM S 363	Introduction to Database Management Systems	3
COM S 309	Software Development Practices	3
S E 319	Software Construction and User Interfaces	3
S E 329	Software Project Management	3
S E 339	Software Architecture and Design	3
Note: CPR E 288, CPR E 381 and CPR E 308 are 4-credit courses. The core credit requirement (34 credits) is given in terms of 3-credit courses. If the 4-credit courses are taken instead, then the extra credits will be used as credits for Supplementary Electives.		
Total Credits		34

Other Remaining Courses: 38 cr.

S E 491	Senior Design Project I and Professionalism	3
S E 492	Senior Design Project II	2
SP CM 212	Fundamentals of Public Speaking	3
One of the following STAT courses		3
STAT 330	Probability and Statistics for Computer Science	
STAT 305	Engineering Statistics	
One of the following ENGL courses (with a C or better in this course)		3
ENGL 309	Proposal and Report Writing	
ENGL 314	Technical Communication	
Math Elective: Choose one from the following list		3
MATH 207	Matrices and Linear Algebra	
MATH 265	Calculus III	
MATH 304	Combinatorics	
MATH 314	Graph Theory	
MATH 317	Theory of Linear Algebra	
Software Engineering Elective [2]		6
Technical Elective [2]		3
Supplementary Elective [2]		9
Open Elective [2]		3
Total Credits		38

Seminar/Co-op/Internships

S E 166	Careers in Software Engineering	R
S E 494	Software Engineering Portfolio Development	R
Co-op or internship (S E 396, S E 397, S E 398) is optional		

Transfer Credit Requirements

The degree program must include a minimum of 30 credits at the 300-level or above in professional and technical courses earned at ISU in order to receive a B.S. in software engineering. These 30 credits must include S E 492 Senior Design Project II and credits in the core professional curriculum and/or in technical electives. The software engineering degree program requires a grade of C or better for any transfer credit course that is applied to the degree program.

1. These university requirements will add to the minimum credits of the program unless the university-approved courses are also approved by the department to meet other course requirements within the degree program. U.S Diversity and International Perspectives courses may not be taken Pass/Not Pass.
2. Choose from department approved lists. (http://www.se.iastate.edu/academics)
3. See Basic Program for Professional Engineering Curricula for accepted substitutions for curriculum designated courses in the Basic Program.

See also: A 4-year plan of study grid showing course template by semester.

Note: International perspectives and U.S. diversity courses are used to meet the general education electives (http://www.se.iastate.edu/academics).

Plan of Study - 4 Year Plan *

Freshman

Fall	Credits	Spring	Credits
MATH 165	4	COM S 227	4
ENGL 150	3	MATH 166	4
S E 101	0	S E 166	0
LIB 160	1	PHYS 221	5
CHEM 167 or 177	4	Economics Elective	3
S E 185	3		
	15		16

Sophomore

Fall	Credits	Spring	Credits
CPR E 281[1]	4	S E 319[1]	3
ENGL 250	3	COM S 327 or CPR E 288[1, 2]	3
MATH 267	4	Math Elective	3
COM S 228	3	General Education Elective	3
SP CM 212	3		
	17		12

Junior

Fall	Credits	Spring	Credits
COM S 363[1]	3	S E 329[1]	3
COM S 230 or CPR E 310[1]	3	COM S 352 or CPR E 308[1, 2]	3
COM S 309[1]	3	ENGL 314 or 309	3
COM S 321 or CPR E 381[1, 2]	3	COM S 311[1]	3
General Education Elective	3	S E 339[1]	3

		Open Elective	3
	15		18
Senior			
Fall	**Credits**	**Spring**	**Credits**
S E 494	0	S E 492	2
S E 491	3	Supplementary Electives	9
STAT 330 or 305	3	Software Engineering Electives	3
Technical Elective	3	General Education Elective	3
General Education Elective	3		
Software Engineering Elective	3		
	15		17

* Total credits required - 125 credits. Any transfer credit courses applied to the degree program require a grade of C or better (but will not be calculated into the ISU Cumulative GPA, Basic Program GPA or Core GPA). See also Basic Program and Special Programs.
Basic Program - A minimum GPA of 2.00 is required for this set of courses, including any transfer courses (please note that transfer course grades will not be calculated into the Basic Program GPA)
Must receive a C or better grade in required English classes.
General Educational Elective courses to be selected in consultation with SE advisers from a list of approved courses. They must include courses that satisfy university and college general education requirements. These courses include courses or categories of courses such as international perspectives and U.S. diversity, language, arts and humanities, and social sciences. Pass/Not Pass credit is not accepted.
Software Engineering Electives, Technical Electives, and Supplementary Electives must be selected from the program-approved list (http://www.se.iastate.edu/academics).

[1] Core Professional Curriculum (A minimum GPA of 2.00 is required for this set of courses, including any transfer courses but transfer course grades will not be calculated into the Core GPA)

[2] Students who take the 4-credit lab courses CPR E 288, CPR E 308, and CPR E 381 instead of the corresponding 3-credit alternatives can apply the additional credits toward Supplementary Electives. The total number of credits required in the Software Engineering Program remains the same for all students.

Courses primarily for undergraduates:

S E 101: Software Engineering Orientation
Cr. R.
Introduction to the procedures, policies, and resources of Iowa State University and the department of Computer Science and Electrical and Computer Engineering. Information on engineering and computer-based professions.

S E 166: Careers in Software Engineering
Cr. R.
Overview of the nature and scope of the software engineering profession. Relationship of coursework to careers. Departmental rules, student services operations, degree requirements, program of study planning, career options, and student organizations.

S E 185: Problem Solving in Software Engineering
(2-2) Cr. 3.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Introduction to software engineering and computer programming. Systematic thinking process for problem solving in the context of software engineering. Group problem solving. Solving software engineering problems and presenting solutions through computer programs, written documents and oral presentations. Introduction to principles of programming, software design, and extensive practice in design, writing, running, debugging, and reasoning about programs.

S E 319: Software Construction and User Interfaces
(Cross-listed with COM S). (3-0) Cr. 3. F.
Prereq: COM S 228
Basic theory of grammars, parsing. Language paradigms. State transition and table-based software design. Review of principles of object orientation, object oriented analysis using UML. Frameworks and APIs. User interface architecture, evaluation of user interface. Design of windows, menus, and commands. Introduction to formal specification and model-based software design. Introduction to domain-specific software engineering.

S E 329: Software Project Management
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: COM S 309
Process-based software development. Capability Maturity Model (CMM). Project planning, cost estimation, and scheduling. Project management tools. Factors influencing productivity and success. Productivity metrics. Analysis of options and risks. Version control and configuration management. Inspections and reviews. Managing the testing process. Software quality metrics. Modern software engineering techniques and practices.

S E 339: Software Architecture and Design
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: S E 319
Modeling and design of software at the architectural level. Architectural styles. Basics of model-driven architecture. Object-oriented design and analysis. Iterative development and unified process. Design patterns. Design by contract. Component based design. Product families. Measurement theory and appropriate use of metrics in design. Designing for qualities such as performance, safety, security, reliability, reusability, etc. Analysis and evaluation of software architectures. Introduction to architecture definition languages. Basics of software evolution, reengineering, and reverse engineering. Case studies. Introduction to distributed system software.

S E 342: Principles of Programming Languages
(Cross-listed with COM S). (3-1) Cr. 3. F.S.
Prereq: Minimum of C- in COM S 228 and MATH 165; COM S 230 or CPR E 310
Study of concepts in programming languages and major programming paradigms, especially functional programming. Special emphasis on design tradeoffs that enable students to make sound choices of programming languages for a given software development task. Programming projects.

S E 396: Summer Internship
Cr. R. Repeatable. SS.
Prereq: Permission of department and Engineering Career Services
Professional work period of at least 10 weeks during the summer. Students must register for this course prior to commencing work. Offered on a satisfactory-fail basis only.

S E 398: Cooperative Education (Co-op)
Cr. R. Repeatable. F.S.
Prereq: Permission of department and Engineering Career Services
Professional work period. One semester per academic or calendar year. Students must register for this course before commencing work. Offered on a satisfactory-fail basis only.

S E 409: Software Requirements Engineering
(3-0) Cr. 3. F.
Prereq: COM S 309; for graduate credit: graduate standing or permission of instructor
The requirements engineering process including identification of stakeholders requirements elicitation techniques such as interviews and prototyping, analysis fundamentals, requirements specification, and validation. Use of Models: State-oriented, Function-oriented, and Object-oriented. Documentation for Software Requirements. Informal, semi-formal, and formal representations. Structural, informational, and behavioral requirements. Non-functional requirements. Use of requirements repositories to manage and track requirements through the life cycle. Case studies, software projects, written reports, and oral presentations will be required.

S E 412: Formal Methods in Software Engineering
(Cross-listed with COM S, CPR E). (3-0) Cr. 3. S.
Prereq: COM S 230 or CPR E 310; COM S 311, STAT 330; for graduate credit: graduate standing or permission of instructor
A study of formal techniques for model-based specification and verification of software systems. Topics include logics, formalisms, graph theory, numerical computations, algorithms and tools for automatic analysis of systems. Graduate credit requires in-depth study of concepts.

S E 416: Software Evolution and Maintenance
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: COM S 309
Practical importance of software evolution and maintenance, systematic defect analysis and debugging techniques, tracing and understanding large software, impact analysis, program migration and transformation, refactoring, tools for software evolution and maintenance, experimental studies and quantitative measurements of software evolution. Written reports and oral presentation.

S E 417: Software Testing
(Cross-listed with COM S). (3-0) Cr. 3. S.
Prereq: COM S 309; COM S 230 or CPR E 310; ENGL 250, SP CM 212
Comprehensive study of software testing, principles, methodologies, management strategies and techniques. Test models, test design techniques (black box and white box testing techniques), test adequacy criteria,integration, regression, system testing methods, and software testing tools.

S E 419: Software Tools for Large Scale Data Analysis
(Cross-listed with CPR E). (3-3) Cr. 4.
Prereq: CPR E 308 or COM S 352, COM S 309
Software tools for managing and manipulating large volumes of data, external memory processing, large scale parallelism, and stream processing, data interchange formats. Weekly programming labs that involve the use of a parallel computing cluster.

S E 490: Independent Study
Cr. arr. Repeatable.
Prereq: Senior classification in software engineering
Investigation of an approved topic.

S E 491: Senior Design Project I and Professionalism
(2-3) Cr. 3.
Prereq: S E 329, completion of 29 credits in the S E core professional program, ENGL 314
Preparing for entry to the workplace. Selected professional topics. Use of technical writing skills in developing project plan and design report; project poster. First of two-semester team-oriented, project design and implementation experience.

S E 492: Senior Design Project II
(1-3) Cr. 2.
Prereq: S E 491
Second semester of a team design project experience. Emphasis on the successful implementation and demonstration of the design completed in S E 491 and the evaluation of project results. Technical writing of final project report; oral presentation of project achievements.

S E 494: Software Engineering Portfolio Development
Cr. R. F.S.
Prereq: Credit or enrollment in S E 491
Portfolio assessment for Software Engineers. Guidelines and Advice to improve software engineering portfolios and to better use portfolios as a tool to enhance career opportunities.

Speech Communication

Speech Communication, a major in the Department of English, helps students develop their understanding and appreciation of the human communication process and enhances their oral and written communication practice. Speech Communication students develop an awareness of the importance of oral communication and listening for success in their personal, civic, and professional lives; become familiar with behavioral research in persuasion; understand how language is used to create social change; develop competent delivery skills; assess the quality of arguments; evaluate information found in research and public discourse; and cultivate rhetorical sensitivity in order to better connect with individuals and audiences. In this way, the program contributes to the humanistic, aesthetic, and critical development of liberally educated students in order to prepare them for full and effective participation in society.

Undergraduate Study

The cross-disciplinary program in speech communication offers courses designed for all students as part of their general education and as a complement to their professional training. It also offers a major or minor in speech communication as well as an additional endorsement for secondary teachers who already have an endorsement in another content area.

Students who major or minor in speech communication will prepare themselves for a wide variety of employment opportunities in business, industry and government, as well as in non-profit and educational organizations. With their effective oral communication, listening, teamwork, problem-solving and leadership skills, speech communication students find positions in general business management: human resources, benefits, financial services, retail, sales and marketing and serve various organizations as recruiters, trainers, promotions managers, communication specialists, community outreach personnel and event planners. The program also prepares students for the study of law, theology, and for graduate level work in speech communication and related disciplines.

The program participates in the following interdisciplinary undergraduate minor programs: the interdisciplinary program in Linguistics and the interdisciplinary program in Technology and Social Change. Speech Communication also offers a core course and several optional courses in the undergraduate certificate program in Leadership Studies.

Speech Communication Major

A student electing to major in speech communication must earn at least 120 credits with 45 credits at the 300/400 level. A minimum of 33 of those credits must be earned in Speech Communication courses where the student earns a grade of C or better. Our flexible curriculum with few prerequisites can help you meet the 33 hour requirement in a timely way.

Core Requirements (18 credits)

SP CM 110	Listening	3
SP CM 212	Fundamentals of Public Speaking	3
SP CM 327	Persuasion and Social Influence	3
or SP CM 350	Rhetorical Traditions	
SP CM 412	Rhetorical Criticism	3
SP CM 416	History of American Public Address	3
SP CM 497	Capstone Seminar	3

Additional Coursework (Choose at least 5 of the following for 15 credits)

SP CM 275	Analysis of Popular Culture Texts	3
SP CM 305	Language, Thought and Action	3
SP CM 312	Business and Professional Speaking	3
SP CM 313	Communication in Classrooms and Workshops	3
SP CM 322	Argumentation, Debate, and Critical Thinking	3
SP CM 323	Gender and Communication	3
SP CM 324	Legal Communication	3

SP CM 350	Rhetorical Traditions	3
SP CM 404	Seminar	3
SP CM 417	Campaign Rhetoric	3
SP CM 216	America Speaks: Great Speakers and Speeches in US History	3
SP CM 327	Persuasion and Social Influence	3

Credits in SP CM 290 Special Projects or SP CM 499 Communication Internship cannot be applied toward the minimum required credits for the major.

The Communication Proficiency requirement may be met by (1) completion of ENGL 150 Critical Thinking and Communication; (2) completion of or credit for ENGL 250 Written, Oral, Visual, and Electronic Composition (or ENGL 250H Written, Oral, Visual, and Electronic Composition: Honors), or its equivalent, with a grade of C or better; (3) one additional writing course beyond ENGL 250 Written, Oral, Visual, and Electronic Composition with a grade of C or better from the following approved list:

ENGL 302	Business Communication	3
ENGL 303	Free-Lance Writing for Popular Magazines	3
ENGL 304	Creative Writing: Fiction	3
ENGL 305	Creative Writing: Nonfiction	3
ENGL 309	Proposal and Report Writing	3
ENGL 314	Technical Communication	3
ENGL 415	Business and Technical Editing	3
JL MC 201	Reporting and Writing for the Mass Media	3

Speech Communication Education

Students working toward a primary teaching endorsement in another discipline may add a speech communication endorsement as an additional area. Coursework prepares students to teach speech, dramatic arts, and media at the secondary school level. In addition, they prepare to direct co-curricular and extracurricular activities such as drama, speech and debate.

Each student seeking an additional endorsement in speech communication must meet a 29 hour requirement by taking the following courses:

SP CM 110	Listening	3
or COMST 102	Introduction to Interpersonal Communication	
SP CM 212	Fundamentals of Public Speaking	3
SP CM 313	Communication in Classrooms and Workshops	3
SP CM 322	Argumentation, Debate, and Critical Thinking	3
SP CM 412	Rhetorical Criticism	3
SP CM 495A	Independent Study: Directing Speech Activities	1
SP CM 495B	Independent Study: Teaching Speech	3
THTRE 358	Oral Interpretation	3
JL MC 101	Mass Media and Society	3
One of the following		3
THTRE 255	Introduction to Theatrical Production	
THTRE 360	Stagecraft	
THTRE 455	Directing I	

Speech Communication, B.A.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	Math Choice	3
SP CM 110	3	Humanities Choice	3
Humanities Choice	3	Natural Science Choice	3
Natural Science Choice	3	Social Science Choice	3
Social Science Choice	3	Elective	3
LIB 160	1		
	16		15

Sophomore

Fall	Credits	Spring	Credits
ENGL 250	3	Social Science Choice	3
Humanities Choice	3	Foreign Language/Elective	4-3
Natural Science Choice	3	Humanities Choice	3
SP CM 212	3	Speech Communication Choice	3
Foreign Language/Elective	4-3	Elective	3
	16-15		16-15

Junior

Fall	Credits	Spring	Credits
SP CM 327	3	SP CM 416	3
Speech Communication Choice - 300/400 Level	3	Speech Communication Choice - 300/400 Level	3
Elective - 300/400 Level	3	JL MC 201 or ENGL 302, 303, 304, 305, 309, 314, 315	3
2 Electives - 300/400 Level	6	2 Electives - 300/400 Level	6
	15		15

Senior

Fall	Credits	Spring	Credits
Speech Communication Choice	3	Speech Communication Choice 300/400 Level	3
SP CM 412	3	SP CM 497	3
2 Electives - 300/400 Level	6	2 Electives - 300/400 Level	6

Elective	3 Elective	3
	15	15

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.** You must also complete the LAS foreign language requirement.

Speech Communication Choices include SP CM 205 (also ENGL 205), 305, 312, 313, 322, 323, 325 (also COMST 325 - has COMST prerequisites), 305 (also ENGL 350), and 417. Note: Students must earn a C or better in all Speech communication courses used to meet the 33 credits required for the major.

Speech Communication Minor

Students from any major can complement their studies with a Speech Communication Minor (http://www.speechcomm.iastate.edu/index.php?option=com_content&view=article&id=34&Itemid=29). The requirements for a minor in speech communication may be fulfilled by credit in SP CM 212 Fundamentals of Public Speaking plus at least 15 additional hours from the lists above, of which 9 credits are in courses numbered 300 or above.

Graduate Study

The program offers courses for a graduate minor in speech communication as well as supporting work for other disciplines. The requirements for a graduate minor (http://www.speechcomm.iastate.edu) in Speech Communication include:

SP CM 412	Rhetorical Criticism	3
Plus 9 additional hours selected from the following		9
SP CM 323	Gender and Communication	
SP CM 416	History of American Public Address	
SP CM 417	Campaign Rhetoric	
SP CM 504	Seminar	
SP CM 513	Proseminar: Teaching Fundamentals of Public Speaking	
SP CM 547	The History of Rhetorical Theory I: From Plato to Bacon	
SP CM 548	The History of Rhetorical Theory II: From Bacon to the Present	
SP CM 590	Special Topics	
SP CM 592	Core Studies in Rhetoric, Composition, and Professional Communication	

The Program of Speech Communication also participates in the interdepartmental program leading to a master's degree in Interdisciplinary Graduate Studies.

Courses primarily for undergraduates:

SP CM 110: Listening
(3-0) Cr. 3. F.S.
Theory, principles, and competency development in comprehensive, therapeutic, critical, consumer, and appreciative listening. The impact of listening in relationships and partnerships.

SP CM 212: Fundamentals of Public Speaking
(3-0) Cr. 3. F.S.SS.
Theory and practice of basic speech communication principles applied to public speaking. Practice in the preparation and delivery of extemporaneous speeches.

SP CM 216: America Speaks: Great Speakers and Speeches in US History
Cr. 3.
Survey of great speeches examined within their political and cultural contexts. Analysis of the rhetorical strategies of diverse speakers with an emphasis on texts from social movements in the United States.
Meets U.S. Diversity Requirement

SP CM 275: Analysis of Popular Culture Texts
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.
Prereq: Credit in or equivalent of 250
Analysis of how information and entertainment forms persuade and manipulate audiences. Study of several forms that may include newspapers, speeches, television, film, advertising, fiction, and magazines. Special attention to verbal and visual devices.

SP CM 290: Special Projects
Cr. 1-2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: 3 credits in speech communication; permission of program director

SP CM 305: Language, Thought and Action
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: ENGL 250
The study of symbolic processes and how meaning is conveyed in words, sentences, and utterances; discussion of modern theories of meaning; and an exploration of relationships among language, thought and action.

SP CM 312: Business and Professional Speaking
(3-0) Cr. 3. F.S.
Prereq: SP CM 212
Theory, principles, and competency development in the creation of coherent, articulate business and professional oral presentations.

SP CM 313: Communication in Classrooms and Workshops
(3-0) Cr. 3.
Prereq: SP CM 212
Principles of communicating information: training in classroom and workshop-oriented communication activities; use of recording for analysis of presentations.

SP CM 322: Argumentation, Debate, and Critical Thinking
(2-2) Cr. 3.
Prereq: SP CM 212
Practice in preparing and presenting arguments and debates; emphasis on critical thinking and ethical and logical duties of the advocate; analysis, evidence, reasoning, attack, defense, research, case construction, and judging.

SP CM 323: Gender and Communication
(Cross-listed with W S). (3-0) Cr. 3.
Examines how understanding and enactment of gender identity is shaped by communication. Verbal and nonverbal communication across various contexts including personal relationships and the media. Explores discourse of social movements aiming to transform cultural definitions of gender.
Meets U.S. Diversity Requirement

SP CM 324: Legal Communication
(3-0) Cr. 3.
Prereq: SP CM 212
Speech communication in the legal system inside and outside the trial process: interviewing and counseling, negotiating and bargaining, voir dire, opening statements, examination of witnesses, closing arguments, judge's instructions, jury behavior, and appellate advocacy.

SP CM 327: Persuasion and Social Influence
(3-0) Cr. 3. F.S.SS.
Prereq: SP CM 212
Examination of persuasive theories, strategies and research in persuasion. Emphasis on application and analysis; logical, emotional, and ethical proofs.

SP CM 350: Rhetorical Traditions
(Cross-listed with CL ST, ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 250
Ideas about the relationship between rhetoric and society in contemporary and historical contexts. An exploration of classical and contemporary rhetorical theories in relation to selected topics that may include politics, gender, race, ethics, education, science, or technology.

SP CM 404: Seminar
(Dual-listed with SP CM 504). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior or above classification
Seminar on topics central to the field of speech communication.

SP CM 412: Rhetorical Criticism
(3-0) Cr. 3. S.
Prereq: SP CM 212 and 6 credits in speech communication
Development of rhetorical theory and practice from Corax to modern times. Application of principles of criticism to current public speaking practices.

SP CM 416: History of American Public Address
(3-0) Cr. 3. S.
Prereq: SP CM 212
Relationship between public discourse and social change; selected speakers and discourse as linked with political or historical events.

SP CM 417: Campaign Rhetoric
(Cross-listed with POL S). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: SP CM 212
Backgrounds of candidates for state and national elections; selected speeches and issues; persuasive strategies and techniques of individual speakers.

SP CM 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: 18 credits in speech communication, junior classification, permission of program director
Only one independent study enrollment is permitted within the department per semester.

SP CM 495A: Independent Study: Directing Speech Activities
(1-0) Cr. 1. S.
Prereq: C I 301; 9 credits in speech communication; minimum GPA of 2.5 in speech communication courses
Problems, methods, and materials related to directing speech activities in secondary schools.

SP CM 495B: Independent Study: Teaching Speech
(Cross-listed with C I). (3-0) Cr. 3. F.
Prereq: C I 301; 9 credits in speech communication; minimum GPA of 2.5 in speech communication courses
Problems, methods, and materials related to teaching speech, theatre, and media in secondary schools.

SP CM 497: Capstone Seminar
(3-0) Cr. 3.
Prereq: 15 credits in speech communication; junior or senior classification
Students synthesize relevant theory and research about contemporary communication practice.

SP CM 499: Communication Internship
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: 18 credits in speech communication courses, other courses deemed appropriate by faculty adviser; 2nd semester junior or senior standing; minimum GPA of 2.5 and minimum GPA of 3.0 in speech communication courses; and permission of the internship committee
Applications should be submitted in the term prior to the term in which the internship is desired. Supervised application of speech communication in professional settings.

Courses primarily for graduate students, open to qualified undergraduates:

SP CM 504: Seminar
(Dual-listed with SP CM 404). (3-0) Cr. 3. Repeatable, maximum of 9 credits. F.S.SS.
Prereq: Junior or above classification
Seminar on topics central to the field of speech communication.

SP CM 513: Proseminar: Teaching Fundamentals of Public Speaking
(1-0) Cr. 1. Repeatable, maximum of 3 credits. F.
Prereq: Permission of instructor
Required of all new SP CM 212 teaching assistants. Introduction to the teaching of public speaking. Support and supervision of teaching assistants of SP CM 212. Discussion of lesson planning, teaching methods, development of speaking assignments, and evaluation of student speaking.

SP CM 547: The History of Rhetorical Theory I: From Plato to Bacon
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: 6 credits in English
Rhetorical theory from the classical period of ancient Greece and Rome through the Middle Ages to the early Renaissance; attention to its relation to the nature of knowledge, communication, practice, and pedagogy.

SP CM 548: The History of Rhetorical Theory II: From Bacon to the Present
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: 6 credits in English
Rhetorical theory from the early modern period (Bacon, Descartes, and Locke) to the present; attention to its relation to the nature of knowledge, communication practice, and pedagogy.

SP CM 590: Special Topics
Cr. 1-4. Repeatable, maximum of 12 credits.
Prereq: Permission of program chair

SP CM 592: Core Studies in Rhetoric, Composition, and Professional Communication
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

SP CM 592A: Core Studies: Rhetoric
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

SP CM 592B: Core Studies: Composition
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

SP CM 592C: Core Studies: Professional Communication
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 9 credits.
Prereq: 12 credits in rhetoric, linguistics, or literature, excluding ENGL 150 and ENGL 250
Seminar on topics central to the fields of rhetoric and professional communication or composition.

Statistics

Undergraduate Study

For the undergraduate curriculum in liberal arts and sciences, major in statistics, leading to the degree bachelor of science, see Liberal Arts and Sciences, Curriculum.

The curriculum in liberal arts and sciences with a major in statistics is designed to prepare students for (1) entry level statistics positions requiring the B.S. degree in statistics in business, industry or commerce, nonprofit institutions, and in state or federal government; (2) graduate study in statistics. Entry-level positions include the following types of work: statistical design, analysis and interpretation of experiments and surveys; data processing and analysis using modern computation facilities and statistical computing systems; application of statistical principles and methods in commercial areas such as finance, insurance, industrial research, marketing, manufacturing, and quality control. Nonprofit organizations such as large health study institutions have

entry-level positions for B.S. graduates in statistics. Also, there are opportunities for work in statistics that require a major in a subject-matter field and a minor in statistics.

Students completing the undergraduate degree in statistics should have a broad understanding of the discipline of statistics. They should have a clear comprehension of the theoretical basis of statistical reasoning and should be proficient in the use of modern statistical methods and computing. Such graduates should have an ability to apply and convey statistical concepts and knowledge in oral and written form. They should be aware of ethical issues associated with polling and surveys and in summarizing the outcomes of statistical studies.

Undergraduate majors in this department usually include in their programs:

STAT 100	Orientation in Statistics	R
STAT 201	Introduction to Statistical Concepts and Methods	4
One of the following options		
Option I		
MATH 165	Calculus I	
MATH 166	Calculus II	
MATH 265	Calculus III	
Option II		
MATH 165	Calculus I	
MATH 166H	Calculus II, Honors	
MATH 265H	Calculus III, Honors	
MATH 207	Matrices and Linear Algebra	3-4
or MATH 317	Theory of Linear Algebra	
COM S 107	Applied Computer Programming	3
or COM S 207	Fundamentals of Computer Programming	
STAT 301	Intermediate Statistical Concepts and Methods	4
STAT 341	Introduction to the Theory of Probability and Statistics I	3
STAT 342	Introduction to the Theory of Probability and Statistics II	3
STAT 402	Statistical Design and the Analysis of Experiments	3
STAT 421	Survey Sampling Techniques	3
STAT 479	Computer Processing of Statistical Data	3
STAT 480	Statistical Computing Applications	3

These courses plus at least six additional credits in statistics at the 400 level or above (excluding STAT 401, 447, 495, 496) constitute the major. I E 361 Statistical Quality Assurance/STAT 361 Statistical Quality Assurance may be substituted for three credits of 400 level courses. It is advisable to have a minor in a field of application.

English and Speech proficiency requirement: The department requires a passing grade in ENGL 150 Critical Thinking and Communication, completion of ENGL 250 Written, Oral, Visual, and Electronic Composition (or ENGL 250H Written, Oral, Visual, and Electronic Composition: Honors) with a grade of C or better, and completion of one of ENGL 302 Business Communication or ENGL 314 Technical Communication with a grade of C- or better. The department requires a passing grade in COMST 102 Introduction to Interpersonal Communication or SP CM 212 Fundamentals of Public Speaking.

Students intending to do graduate work in statistics normally will take additional courses in mathematics.

Statistics, B.S.

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	MATH 166 (or MATH 166H)	4
LIB 160	1	STAT 201	4
STAT 100	0	Social Science Choice	3
MATH 165 (or MATH 165H)	4	Humanities Choice	3
Humanities Choice	3		
Natural Science Choice	4		
	15		14

Sophomore

Fall	Credits	Spring	Credits
STAT 301	4	STAT 402	3
MATH 265 (or MATH 265H)	4	COM S 207 (or COM S 107)	3
ENGL 250	3	MATH 207 (or MATH 317)	3
Natural Science Choice	4	Humanities Choice	3
		Social Science Choice	3
	15		15

Junior

Fall	Credits	Spring	Credits
STAT 341	3	STAT 342	3
STAT 479	3	STAT 421	3
SP CM 212 (or COMST 102)	3	Social Science Choice	3
Foreign Language/Elective	4	Foreign Language/Elective	4
Elective	3	Elective	3
	16		16

Senior

Fall	Credits	Spring	Credits
Statistics Choice - 400 Level	3	Statistics Choice - 400 Level	3
ENGL 302 (or ENGL 314)	3	STAT 480	3
Humanities Choice	3	Electives	9

Electives	6	
	15	15

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.**

You must also complete the LAS foreign language requirement.

Minor

The department offers a minor in statistics which may be earned by completing one introductory course in statistics (STAT 101, 104, 105, 201, 226, 231, 305, 322 or 330); STAT 301 or 326; plus 9 additional credits from STAT 341, 342, 361, and 400 level or above (excluding STAT 401, 447, 495, 496) to yield a total of at least 15 credits in statistics courses.

Graduate Study

The department offers graduate programs leading to both Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees with a major in statistics. Graduate work leading to a minor in statistics is available for students majoring in other programs, at both the M.S. and Ph.D. levels. The Ph.D. degree is also offered as a co-major with other graduate programs. The department participates in inter-disciplinary graduate programs in Bioinformatics and Computational Biology, Ecology and Evolutionary Biology, Genetics, Human Computer Interaction, Nutritional Sciences, and Wind Energy Science, Engineering, and Policy.

Graduates of the M.S. program have an understanding of basic statistical theory and methods. Elective courses in the M.S. program provide an opportunity for students to emphasize particular areas of statistical methods or application in their program. Students complete a minimum of 34 semester credits, including work on a capstone project resulting in a written creative component under the direction of an individual major professor and presented in a final oral examination.

Graduates of the Ph.D. program in statistics have studied advanced theory and methods, and have demonstrated the ability to conduct independent research resulting in an original contribution to the discipline. Candidates for the Ph.D. degree in statistics complete a minimum of 72 semester credits, including at least 18 credits given for research activity, pass an oral preliminary examination, and submit a written dissertation containing original research that is defended in a final oral examination. Dissertation research is typically conducted in close collaboration with a major professor and usually results in publishable material. The department does not offer specific program tracks or areas of emphasis, but the diversity of elective courses and research areas of faculty allow students to tailor their individual programs to reflect areas of particular interest.

Graduates of co-major Ph.D. programs in statistics and an applied scientific discipline have mastered basic statistical theory and have studied advanced methodology. Students complete a minimum of 72 semester credits for courses in statistics and the chosen scientific discipline. Students conduct research that is a combination of statistical methodology and the scientific discipline. Co-major professors work with the student to prepare for an oral preliminary examination and conduct research leading to a single dissertation project that produces an original contribution to at least one of the two disciplines that is defended in a final oral examination.

Graduates of co-major Ph.D. programs in statistics and an area of theoretical mathematics have mastered basic statistical methods and have studied advanced statistical theory. Students complete a minimum of 72 semester credits. Co-major professors assist the student in preparing a dissertation that represents original research that makes a contribution at the interface of statistical theory and a sub-discipline of mathematics. The dissertation is defended in a final oral examination.

Courses primarily for undergraduates:

STAT 100: Orientation in Statistics
(1-0) Cr. R. F.
Opportunities, challenges, and the scope of the curriculum in statistics. For students planning or considering a career in this area.

STAT 101: Principles of Statistics
(3-2) Cr. 4. F.S.SS.
Prereq: 1 1/2 years of high school algebra
Statistical concepts in modern society; descriptive statistics and graphical displays of data; the normal distribution; data collection (sampling and designing experiments); elementary probability; elements of statistical inference; estimation and hypothesis testing; linear regression and correlation; contingency tables. Credit for only one of the following courses may be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226.

STAT 104: Introduction to Statistics
(2-2) Cr. 3. F.S.SS.
Prereq: 1 1/2 years of high school algebra
Statistical concepts and their use in science; collecting, organizing and drawing conclusions from data; elementary probability; binomial and normal distributions; regression; estimation and hypothesis testing. For students in the agricultural and biological sciences. Credit for only one of the following courses may be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226.

STAT 105: Introduction to Statistics for Engineers
(3-0) Cr. 3. F.S.
Prereq: MATH 165 (or MATH 165H)
Statistical concepts with emphasis on engineering applications. Data collection; descriptive statistics; probability distributions and their properties; elements of statistical inference; regression; statistical quality control charts; use of statistical software; team project involving data collection, description and analysis. Credit for only one of the following courses may be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226. Credit for both STAT 105 and STAT 305 may not be applied for graduation.

STAT 201: Introduction to Statistical Concepts and Methods
(3-2) Cr. 4. S.
Prereq: Credit or enrollment in MATH 165
Statistical thinking and applications of statistical concepts and methods in modern society. Display and summary of categorical and numerical data. Exploring relationships between variables, association, correlation, and regression. Observational studies and experiments. Probability concepts, random variables, discrete and continuous distributions. Elements of statistical inference; estimation and hypothesis testing. Credit for only one of the following courses may be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226.

STAT 226: Introduction to Business Statistics I
(3-0) Cr. 3. F.S.SS.
Prereq: MATH 150 or MATH 165
Obtaining, presenting, and organizing statistical data; measures of location and dispersion; the Normal distribution; sampling and sampling distributions; elements of statistical inference; estimation and confidence intervals; hypothesis testing; inference for simple linear regression analysis; use of computers to visualize and analyze data. Credit for only one of the following courses may be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226.

STAT 231: Probability and Statistical Inference for Engineers
(4-0) Cr. 4. F.S.
Prereq: Credit or enrollment in MATH 265
Emphasis on engineering applications. Basic probability; random variables and probability distributions; joint and sampling distributions. Descriptive statistics; confidence intervals; hypothesis testing; simple linear regression; multiple linear regression; one way analysis of variance; use of statistical software.

STAT 301: Intermediate Statistical Concepts and Methods
(3-2) Cr. 4. F.S.
Prereq: STAT 101 or STAT 104 or STAT 105 or STAT 201
Statistical concepts and methods used in the analysis of data. Statistical models. Analysis of single sample, two sample and paired sample data. Simple and multiple linear regression including polynomial regression. Analysis of residuals. Regression diagnostics. Model building. Regression with indicator variables. Credit for only one of the following courses may be applied toward graduation: STAT 301, STAT 326, or STAT 401

STAT 305: Engineering Statistics
(3-0) Cr. 3. F.S.SS.
Prereq: MATH 165 (or MATH 165H)
Statistics for engineering problem solving. Principles of engineering data collection; descriptive statistics; elementary probability distributions; principles of experimentation; confidence intervals and significance tests; one-, two-, and multi-sample studies; regression analysis; use of statistical software; team project involving engineering experimentation and data analysis. Credit for both Stat 105 and 305 may not be applied for graduation.

STAT 322: Probabilistic Methods for Electrical Engineers
(Cross-listed with E E). (3-0) Cr. 3. F.S.
Prereq: E E 224
Introduction to probability with applications to electrical engineering. Sets and events, probability space, conditional probability, total probability and Bayes' rule. Discrete and continuous random variables, cumulative distribution function, probability mass and density functions, expectation, moments, moment generating functions, multiple random variables, functions of random variables. Elements of statistics, hypothesis testing, confidence intervals, least squares. Introduction to random processes.

STAT 326: Introduction to Business Statistics II
(2-2) Cr. 3. F.S.
Prereq: STAT 226
Multiple regression analysis; regression diagnostics; model building; applications in analysis of variance and time series; random variables; distributions; conditional probability; statistical process control methods; use of computers to visualize and analyze data. Credit for only one of the following courses may be applied toward graduation: STAT 301, STAT 326 or STAT 401.

STAT 330: Probability and Statistics for Computer Science
(3-0) Cr. 3. F.S.
Prereq: MATH 166
Topics from probability and statistics applicable to computer science. Basic probability; Random variables and their distributions; Stochastic processes including Markov chains; Queuing models; Basic statistical inference; Introduction to regression.

STAT 332: Visual Communication of Quantitative Information
(Cross-listed with ENGL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 101, STAT 104, STAT 201 or STAT 226; ENGL 250
Communicating quantitative information using visual displays; visualizing data; interactive and dynamic data displays; evaluating current examples in the media; color, perception, and representation in graphs; interpreting data displays.

STAT 341: Introduction to the Theory of Probability and Statistics I
(Cross-listed with MATH). (3-0) Cr. 3. F.S.
Prereq: MATH 265 (or MATH 265H)
Probability; distribution functions and their properties; classical discrete and continuous distribution functions; multivariate probability distributions and their properties; moment generating functions; simulation of random variables and use of the R statistical package. Credit for both STAT 341 and STAT 447 may not be applied toward graduation.

STAT 342: Introduction to the Theory of Probability and Statistics II
(Cross-listed with MATH). (3-0) Cr. 3. F.S.
Prereq: STAT 341; MATH 207 or MATH 317
Transformations of random variables; sampling distributions; confidence intervals and hypothesis testing; theory of estimation and hypothesis tests; linear model theory; use of the R statistical package for simulation and data analysis.

STAT 361: Statistical Quality Assurance
(Cross-listed with I E). (2-2) Cr. 3. F.S.
Prereq: STAT 231, STAT 301, STAT 326 or STAT 401
Statistical methods for process improvement. Simple quality assurance principles and tools. Measurement system precision and accuracy assessment. Control charts. Process capability assessment. Experimental design and analysis for process improvement. Significant external project in process improvement.

STAT 398: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of department chair
Off-campus work periods for undergraduate students in a field of statistics.

STAT 401: Statistical Methods for Research Workers
(3-2) Cr. 4. F.S.SS.
Prereq: STAT 101 or STAT 104 or STAT 105 or STAT 201 or STAT 226
Graduate students without an equivalent course should contact the department. Methods of analyzing and interpreting experimental and survey data. Statistical concepts and models; estimation; hypothesis tests with continuous and discrete data; simple and multiple linear regression and correlation; introduction to analysis of variance and blocking. Credit for only one of the following courses may be applied toward graduation: STAT 301, STAT 326, or STAT 401.

STAT 402: Statistical Design and the Analysis of Experiments
(3-0) Cr. 3. F.S.
Prereq: STAT 301 or STAT 326 or STAT 401
The role of statistics in research and the principles of experimental design. Experimental units, randomization, replication, blocking, subdividing and repeatedly measuring experimental units; factorial treatment designs and confounding; extensions of the analysis of variance to cover general crossed and nested classifications and models that include both classificatory and continuous factors. Determining sample size.

STAT 404: Regression for Social and Behavioral Research
(2-2) Cr. 3. F.S.
Prereq: STAT 301 or STAT 326 or STAT 401
Applications of generalized linear regression models to social science data. Assumptions of regression; diagnostics and transformations; analysis of variance and covariance; path analysis; logistic, multinomial and Poisson regression.

STAT 406: Statistical Methods for Spatial Data
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Six hours of statistics at the 400-level
The analysis of spatial data; geostatistical methods, mapping and spatial prediction; methods for areal data; models and methods for spatial point processes. Emphasis on application and practical use of spatial statistical analysis. Use of R and R packages for spatial data analysis.

STAT 407: Methods of Multivariate Analysis
(2-2) Cr. 3. F.
Prereq: STAT 301 or STAT 326 or STAT 401, knowledge of matrix algebra
Techniques for displaying and analyzing multivariate data including plotting high-dimensional data using interactive graphics, comparing group mean vectors using Hotelling's T2, multivariate analysis of variance, reducing variable dimension with principal components, grouping/classifying observations with cluster analysis and discriminant analysis. Imputation of missing multivariate observations.

STAT 410: Statistical Methods for Mathematics Teachers
(6-0) Cr. 6. Alt. SS., offered odd-numbered years.
Prereq: STAT 341 or equivalent
Descriptive statistics; data collection through experimentation and sampling; univariate statistical inference; contingency tables; design of experiments and ANOVA; simple linear regression; logistic regression; multiple linear regression; statistics pedagogy.

STAT 415: Advanced Statistical Methods for Research Workers
(1-0) Cr. 1. Repeatable, maximum of 3 credits. S.
Prereq: STAT 301 or STAT 326 or STAT 401
Advanced statistical methods for modeling and analyzing data. Taught as separate 1 cr. sections, each of 5 weeks. Three sections taught in one semester. Areas covered: Logistic and Poisson regression; Structural equation modeling; Smoothing and nonparametric regression; Nonparametric and distribution free methods; Bootstrapping and randomization tests; Visualization of high dimensional data; Analysis of species composition data; Missing data and measurement error.

STAT 416: Statistical Design and Analysis of Gene Expression Experiments
(3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401
Introduction to high-throughput technologies for gene expression studies (especially RNA-sequencing technology): the role of blocking, randomization, and biological and technical replication in the design of gene expression experiments; normalization methods; methods for identifying differentially expressed genes including mixed linear model analysis, generalized linear model analysis, generalized linear mixed model analysis, quasi-likelihood methods, empirical Bayes analysis, and resampling based approaches; procedures for controlling false discovery rate for multiple testing; clustering and classification problems for gene expression data; testing gene categories; emphasis on practical use of methods.

STAT 421: Survey Sampling Techniques
(2-2) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401
Concepts of sample surveys and the survey process; methods of designing sample surveys, including: simple random, stratified, and multistage sampling designs; methods of analyzing sample surveys including ratio, regression, domain estimation and nonresponse.

STAT 430: Empirical Methods for the Computational Sciences
(3-0) Cr. 3. F.
Prereq: STAT 330 or an equivalent course, MATH 166, knowledge of linear algebra.
Statistical methods for research involving computers; exploratory data analysis; selected topics from analysis of designed experiments - analysis of variance, hypothesis testing, interaction among variables; linear regression, logistic regression, Poisson regression; parameter estimation, prediction, confidence regions, dimension reduction techniques, model diagnostics and sensitivity analysis; Markov chains and processes; simulation techniques and bootstrap methods; applications to computer science, bioinformatics, computer engineering - programs, models and systems as objects of empirical study; communicating results of empirical studies. Statistical software: R.

STAT 432: Applied Probability Models
(3-0) Cr. 3. F.
Prereq: STAT 231 or STAT 341 or STAT 447
Probabilistic models in biological, engineering and the physical sciences. Markov chains; Poisson, birth-and-death, renewal, branching and queing processes; applications to bioinformatics and other quantitative problems.

STAT 444: Bayesian Data Analysis
(2-2) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401; STAT 342 or STAT 447.
Probability models and prior distributions; updating priors through the likelihood function. Computational and simulation-based methods for deriving posterior distributions and for estimating parameters. Basic statistical and hierarchical models. Model adequacy and posterior predictive checks. Markov Chain Monte Carlo methods and introduction to WinBUGS or similar software. Emphasis on applications and examples from the social, biological and physical sciences.

STAT 447: Statistical Theory for Research Workers
(4-0) Cr. 4. F.S.SS.
Prereq: MATH 151 and permission of instructor, or MATH 265
Primarily for graduate students not majoring in statistics. Emphasis on aspects of the theory underlying statistical methods. Probability, probability density and mass functions, distribution functions, moment generating functions, sampling distributions, point and interval estimation, maximum likelihood and likelihood ratio tests, linear model theory, conditional expectation and minimum mean square error estimation, introduction to posterior distributions and Bayesian analysis, use of simulation to verify and extend theory. Credit for both STAT 341 and STAT 447 may not be applied toward graduation.

STAT 451: Applied Time Series
(3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401
Meeker. Methods for analyzing data collected over time; review of multiple regression analysis. Elementary forecasting methods: moving averages and exponential smoothing. Autoregressive-moving average (Box-Jenkins) models: identification, estimation, diagnostic checking, and forecasting. Transfer function models and intervention analysis. Introduction to multivariate time series methods.

STAT 457: Applied Categorical Data Analysis
(3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401
Statistical methods for the analysis of categorical data: graphical summaries, estimation and inference for proportions, sample size determination, chi-square tests, measures of relative risk, odds and association, analysis of paired data and measures of agreement, logistic regression models, log-linear models.

STAT 479: Computer Processing of Statistical Data
(3-0) Cr. 3. F.
Prereq: STAT 301 or STAT 326 or STAT 401
Structure, content and programming aspects of the Statistical Analysis System (SAS) software package. Advanced techniques in the use of SAS for data analysis including statistical graphics, regression diagnostics, and complex analysis of variance models. The SAS graphical interfaces Enterprise Guide and Enterprise Miner will be introduced.

STAT 480: Statistical Computing Applications
(3-0) Cr. 3. S.
Prereq: STAT 301 or STAT 326 or STAT 401
Modern statistical computing. Data management; spread sheets, verifying data accuracy, transferring data between software packages. Data and graphical analysis with statistical software packages. Algorithmic programming concepts and applications. Simulation. Software reliability.

STAT 490: Independent Study
Cr. arr. Repeatable, maximum of 9 credits.
Prereq: 10 credits in statistics
No more than 9 credits in Stat 490 may be counted toward graduation.

STAT 490H: Independent Study: Honors
Cr. arr. Repeatable, maximum of 9 credits.
Prereq: 10 credits in statistics
No more than 9 credits in Stat 490 may be counted toward graduation.

STAT 495: Applied Statistics for Industry I
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 101 or STAT 104 or STAT 105 or STAT 201 or STAT 226; MATH 166 (or MATH 166H)
Graduate students without an equivalent course should consult the department. Statistical thinking applied to industrial processes. Assessing, monitoring and improving processes using statistical methods. Analytic/enumerative studies; graphical displays of data; fundamentals of six sigma; process monitoring; control charts; capability analysis.

STAT 496: Applied Statistics for Industry II
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 495
Statistical design and analysis of industrial experiments. Concepts of control, randomization and replication. Simple and multiple regression; factorial and fractional factorial experiments; application of ideas of six sigma; reliability; analysis of lifetime data.

Courses primarily for graduate students, open to qualified undergraduates:

STAT 500: Statistical Methods I
(3-2) Cr. 4. F.
Prereq: STAT 447 or current enrollment in STAT 542; knowledge of matrix algebra.
Analysis of data from designed experiments and observational studies. Randomization-based inference; inference on group means; nonparametric bootstrap; pairing/blocking and other uses of restricted randomization. Use of linear models to analyze data; least squares estimation; estimability; sampling distributions of estimators; general linear tests; inference for parameters and contrasts. Model assessment and diagnostics; remedial measures; alternative approaches based on ranks.

STAT 501: Multivariate Statistical Methods
(3-0) Cr. 3. S.
Prereq: STAT 500 or STAT 402; STAT 447 or STAT 542; STAT 579 or equivalent; knowledge of matrix algebra.
Statistical methods for analyzing and displaying multivariate data; the multivariate normal distribution; inference in multivariate populations, simultaneous analysis of multiple responses, multivariate analysis of variance; summarizing high dimensional data with principal components, factor analysis, canonical correlations, classification methods, clustering, multidimensional scaling; introduction to basic nonparametric multivariate methods. Statistical software: SAS or R.

STAT 502: Applied Modern Multivariate Statistical Learning
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 500, STAT 542, STAT 579.
A Statistics-MS-level introduction to Modern Multivariate Statistical Learning. Theory-based methods for modern data mining and machine learning, inference and prediction. Variance-bias trade-offs and choice of predictors; linear methods of prediction; basis expansions; smoothing, regularization, kernel smoothing methods; neural networks and radial basis function networks; bootstrapping, model averaging, and stacking; linear and quadratic methods of classification; support vector machines; trees and random forests; boosting; prototype methods; unsupervised learning including clustering, principal components, and multi-dimensional scaling; kernel mechanics. Substantial use of R packages implementing these methods.

STAT 503: Exploratory Methods and Data Mining
(2-2) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 301 or STAT 326 or STAT 401; STAT 341 or STAT 447 or STAT 542; STAT 480 or STAT 579
Approaches to finding the unexpected in data; exploratory data analysis; pattern recognition; dimension reduction; supervised and unsupervised classification; interactive and dynamic graphical methods; computer-intensive statistical techniques for large or high dimensional data and visual inference. Emphasis is on problem solving, topical problems, and learning how so-called black-box methods actually work.

STAT 505: Environmental Statistics
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 341 or STAT 447; STAT 401
Statistical methods and models for environmental applications. Emphasis on environmental toxicology. Analysis of data with below detection-limit values. Dose-response curve modeling, including overdispersion and estimation of safe doses. Trend analysis; analysis of autocorrelated data. Equivalence testing.

STAT 506: Statistical Methods for Spatial Data
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 447 or STAT 542
The analysis of spatial data; geostatistical methods and spatial prediction; discrete index random fields and Markkov random field models; models for spatial point processes.

STAT 510: Statistical Methods II
(3-0) Cr. 3. S.
Prereq: STAT 500, STAT 447 or credit/enrollment in STAT 543
Model selection and collinearity in linear regression. Likelihood analysis for general models and models with non-normal random components; linear model results in the context of likelihood; linear mixed models and their application; estimation, inference, and prediction. Computational issues in iterative algorithms; expectation- maximization algorithm and its use in mixed models. Case studies of applications including problem formulation, exploratory analysis, model development, estimation and inference, and model assessment.

STAT 512: Design of Experiments
(3-0) Cr. 3. F.
Prereq: STAT 511
Basic techniques of experimental design developed in the context of the general linear model; completely randomized, randomized complete block, and Latin Square designs; factorial experiments, confounding, fractional replication; split-plot and incomplete block designs.

STAT 513: Response Surface Methodology
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 402 or STAT 512, knowledge of elementary matrix theory and matrix formulation of regression
Analysis techniques for locating optimum and near-optimum operating conditions: standard experimental designs for first- and second-order response surface models; design performance criteria; use of data transformations; mixture experiments; optimization for multiple-response problems. Requires use of statistical software with matrix functions.

STAT 515: Theory and Applications of Nonlinear Models
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 447 or STAT 543; STAT 510
Construction of nonlinear statistical models; random and systematic model components, additive error nonlinear regression with constant and non-constant error variances, generalized linear models, transform both sides models. Iterative algorithms for estimation and asymptotic inference. Basic random parameter models, beta-binomial and gamma-Poisson mixtures. Requires use of instructor-supplied and student-written R functions.

STAT 516: Statistical Design and Analysis of Gene Expression Experiments
(3-0) Cr. 3. S.
Prereq: STAT 500; STAT 447 or STAT 542
Introduction to high-throughput technologies for gene expression studies (especially RNA-sequencing technology): the role of blocking, randomization, and biological and technical replication in the design of gene expression experiments; normalization methods; methods for identifying differentially expressed genes including mixed linear model analysis, generalized linear model analysis, generalized linear mixed model analysis, quasi-likelihood methods, empirical Bayes analysis, and resampling based approaches; procedures for controlling false discovery rate for multiple testing; clustering and classification problems for gene expression data; testing gene categories; emphasis on current research topics for statistical analysis of high dimensional gene expression data.

STAT 520: Statistical Methods III
(3-0) Cr. 3. F.
Prereq: STAT 510, STAT 447 or STAT 543
Nonlinear regression; generalized least squares; asymptotic inference. Generalized linear models; exponential dispersion families; maximum likelihood and inference. Designing Monte Carlo studies; bootstrap; cross-validation. Fundamentals of Bayesian analysis; data models, priors and posteriors; posterior prediction; credible intervals; Bayes Factors; types of priors; simulation of posteriors; introduction to hierarchical models and Markov Chain Monte Carlo methods.

STAT 521: Theory and Applications of Sample Surveys
(3-0) Cr. 3. S.
Prereq: STAT 401; STAT 447 or STAT 542
Practical aspects and basic theory of design and estimation in sample surveys for finite populations. Simple random, systematic, stratified, cluster multistage and unequal-probability sampling. Horvitz-Thompson estimation of totals and functions of totals: means, proportions, regression coefficients. Linearization technique for variance estimation. Model-assisted ratio and regression estimation. Two-phase sampling and sampling on two occasions. Non-response effects. Imputation.

STAT 522: Advanced Applied Survey Sampling
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 521 or both STAT 421 and STAT 447
Advanced topics in survey sampling and methodology: clustering and stratification in practice, adjustments and imputation for missing data, variance estimation in complex surveys, methods of panel and/or longitudinal surveys, procedures to increase response rates, and computing. Examples are taken from large, well-known surveys in various subject areas. Prior exposure to mathematical statistics, probability, and at least one course in survey sampling theory is assumed.

STAT 531: Quality Control and Engineering Statistics
(Cross-listed with I E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 401; STAT 342 or STAT 447
Statistical methods and theory applicable to problems of industrial process monitoring and improvement. Statistical issues in industrial measurement; Shewhart, CUSUM, and other control charts; feedback control; process characterization studies; estimation of product and process characteristics; acceptance sampling, continuous sampling and sequential sampling; economic and decision theoretic arguments in industrial statistics.

STAT 533: Reliability
(Cross-listed with I E). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 342 or STAT 432 or STAT 447
Probabilistic modeling and inference in engineering reliability; lifetime models, product limit estimator, probability plotting, maximum likelihood estimation for censored data, Bayesian methods in reliability, system reliability models, competing risk analysis, acceleration models and analysis of accelerated test data; analysis of recurrence data; planning studies to obtain reliability data.

STAT 534: Ecological Statistics
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 447 or STAT 542
Statistical methods for non-standard problems, illustrated using questions and data from ecological field studies. Estimation of abundance and survival from mark-recapture studies, deterministic and stochastic matrix models of population trends, integral projection models, and hierarchical modeling, especially of population dynamics. Additional topics vary based on student interest.

STAT 536: Statistical Genetics
(Cross-listed with GDCB). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 401, STAT 447; GEN 320 or BIOL 313
Statistical models and methods for genetics covering models of population processes: selection, mutation, migration, population structure, and linkage disequilibrium, and inference techniques: genetic mapping, linkage analysis, and quantitative trait analysis. Applications include genetic map construction, gene mapping, genome-wide association studies (GWAS), inference about population structure, phylogenetic tree construction, and forensic and paternity identification.

STAT 542: Theory of Probability and Statistics I

(4-0) Cr. 4. F.

Prereq: MATH 414.

Sample spaces, basic probability results, conditional probability. Random variables, univariate distributions, moment generating functions. Joint distributions, conditional distributions and independence, correlation and covariance. Probability laws and transformations. Introduction to the multivariate normal distribution. Sampling distributions, normal theory, sums and order statistics. Convergence concepts, the law of large numbers, the central limit theorem and delta method. Basics of stochastic simulation.

STAT 543: Theory of Probability and Statistics II

(3-0) Cr. 3. S.

Prereq: STAT 542.

Point estimation including method of moments, maximum likelihood and Bayes. Properties of point estimators, mean squared error, unbiasedness, consistency, loss functions. Large sample properties of maximum likelihood estimators. Exponential families, sufficiency, completeness, ancilarity, Basu's theorem. Hypothesis tests, Neyman-Pearson lemma, uniformly most powerful tests, likelihood ratio tests, Bayes tests. Interval estimation, inverting tests, pivotal quantities. Nonparametric theory, bootstrap.

STAT 544: Bayesian Statistics

(3-0) Cr. 3. S.

Prereq: STAT 543

Specification of probability models; subjective, conjugate, and noninformative prior distributions; hierarchical models; analytical and computational techniques for obtaining posterior distributions; model checking, model selection, diagnostics; comparison of Bayesian and traditional methods.

STAT 546: Nonparametric Methods in Statistics

(3-0) Cr. 3. Alt. F., offered even-numbered years.

Prereq: STAT 510, STAT 542

Overview of parametric versus nonparametric methods of inference; introduction to rank-based tests and/or nonparametric smoothing methods for estimating density and regression functions; smoothing parameter selection; applications to semiparametric models and goodness-of-fit tests of a parametric model.

STAT 547: Functional Data Analysis

(3-0) Cr. 3. Alt. S., offered odd-numbered years.

Prereq: STAT 543, STAT 511

Theory and methods for analyzing functional data, which are high dimensional data resulted from discrete, error-contaminated measurements on smooth curves and images. The topics include kernel and spline smoothing, basis expansion, semiparametric regression, functional analysis of variance, covariance modeling and estimation, functional principal component analysis, functional generalization linear models, joint modeling, dimension reduction, classification and clustering functional data.

STAT 551: Time Series Analysis

(3-0) Cr. 3. F.

Prereq: STAT 447 or STAT 542

Concepts of trend and dependence in time series data; stationarity and basic model structures for dealing with temporal dependence; moving average and autoregressive error structures; analysis in the time domain and the frequency domain; parameter estimation, prediction and forecasting; identification of appropriate model structure for actual data and model assessment techniques. Possible extended topics include dynamic models and linear filters.

STAT 554: Introduction to Stochastic Processes

(Cross-listed with MATH). (3-0) Cr. 3. F.

Prereq: STAT 542

Markov chains on discrete spaces in discrete and continuous time (random walks, Poisson processes, birth and death processes) and their long-term behavior. Optional topics may include branching processes, renewal theory, introduction to Brownian motion.

STAT 557: Statistical Methods for Counts and Proportions

(3-0) Cr. 3. F.

Prereq: STAT 500 or STAT 401; STAT 543 or STAT 447

Statistical methods for analyzing simple random samples when outcomes are counts or proportions; measures of association and relative risk, chi-squared tests, loglinear models, logistic regression and other generalized linear models, tree-based methods. Extensions to longitudinal studies and complex designs, models with fixed and random effects. Use of statistical software: SAS, S-Plus or R.

STAT 565: Methods in Biostatistics and Epidemiology
(Cross-listed with TOX). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 500 or STAT 401; STAT 543 or STAT 447
Statistical methods commonly used in epidemiology and human and animal health studies. Overview of cohort studies, case-control studies and randomized clinical trials. topics include inference procedures for disease risk factors, analysis of time-to-event and survival data, analysis of longitudinal studies of disease progression and health status, approaches to handling missing data, and meta-analysis. Examples will come from recent studies of physical and mental health, nutrition and disease progression in human and animal populations. Use of statistical software: SAS or R.

STAT 568: Bioinformatics II (Statistical Bioinformatics)
(Cross-listed with BCB, COM S, GDCB). (3-0) Cr. 3. S.
Prereq: BCB 567 or (BIOL 315 and STAT 430), credit or enrollment in GEN 409
Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models.

STAT 570: Bioinformatics IV (Systems Biology)
(Cross-listed with BCB, COM S, CPR E, GDCB). (3-0) Cr. 3. S.
Prereq: BCB 567 or COM S 311, COM S 228, GEN 409, STAT 430
Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration.

STAT 579: An Introduction to R
(0-2) Cr. 1. F.
Prereq: Enrollment in STAT 500
An introduction to the logic of programming, numerical algorithms, and graphics. The R statistical programming environment will be used to demonstrate how data can be stored, manipulated, plotted, and analyzed using both built-in functions and user extensions. Concepts of modularization, looping, vectorization, conditional execution, and function construction will be emphasized.

STAT 580: Statistical Computing
(3-0) Cr. 3. S.
Prereq: STAT 579; STAT 447 or STAT 542
Introduction to scientific computing for statistics using tools and concepts in R: programming tools, modern programming methodologies, modularization, design of statistical algorithms. Introduction to C programming for efficiency; interfacing R with C. Building statistical libraries. Use of algorithms in modern subroutine packages, optimization and integration. Implementation of simulation methods; inversion of probability integral transform, rejection sampling, importance sampling. Monte Carlo integration.

STAT 590: Special Topics
Cr. arr. Repeatable.

STAT 590A: Special Topics: Theory
Cr. arr. Repeatable.

STAT 590B: Special Topics: Methods
Cr. arr. Repeatable.

STAT 590C: Special Topics: Design of Experiments
Cr. arr. Repeatable.

STAT 590D: Special Topics: Sample Surveys
Cr. arr. Repeatable.

STAT 590E: Special Topics: Statistics Education
Cr. arr. Repeatable.

STAT 590F: Special Topics: Statistical Computing and Graphics
Cr. arr. Repeatable. F.

STAT 598: Cooperative Education
Cr. R. F.S.SS.
Prereq: Permission of the department chair
Off-campus work periods for graduate students in a field of statistics.

STAT 599: Creative Component
Cr. arr.

Courses for graduate students:

STAT 601: Advanced Statistical Methods
(3-0) Cr. 3. S.
Prereq: STAT 520, STAT 543 and MATH 414 or enrollment in STAT 641
Methods of constructing complex models including adding parameters to existing structures, incorporating stochastic processes and latent variables. Use of modified likelihood functions; quasi-likelihoods; profiles; composite likelihoods. Asymptotic normality as a basis of inference; Godambe information. Sample reuse; block bootstrap; resampling with dependence. Simulation for model assessment. Issues in Bayesian analysis.

STAT 602: Modern Multivariate Statistical Learning
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 520, STAT 543, STAT 579
Statistical theory and methods for modern data mining and machine learning, inference, and prediction. Variance-bias trade-offs and choice of predictors; linear methods of prediction; basis expansions; smoothing, regularization, and reproducing kernel Hilbert spaces; kernel smoothing methods; neural networks and radial basis function networks; bootstrapping, model averaging, and stacking; linear and quadratic methods of classification; support vector machines; trees and random forests; boosting; prototype methods; unsupervised learning including clustering, principal components, and multi-dimensional scaling; kernel mechanics.

STAT 606: Advanced Spatial Statistics
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: STAT 506, STAT 642
Consideration of advanced topics in spatial statistics, including areas of current research. Topics may include construction of nonstationary covariance structures including intrinsic random functions, examination of edge effects, general formulation of Markov random field models, spatial subsampling, use of pseudo-likelihood and empirical likelihood concepts in spatial analysis, the applicability of asymptotic frameworks for inference, and a discussion of appropriate measures for point processes.

STAT 611: Theory and Applications of Linear Models
(3-0) Cr. 3. F.
Prereq: STAT 510; STAT 542 or STAT 447; a course in matrix algebra
Matrix preliminaries, estimability, theory of least squares and of best linear unbiased estimation, analysis of variance and covariance, distribution of quadratic forms, extension of theory to mixed and random models, inference for variance components.

STAT 612: Advanced Design of Experiments
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 512
General theory of factorial experiments. Design optimality criteria, approximate design and general equivalence theory, computational approaches to constructing optimal designs for linear models, and extensions to nonlinear models. Advanced topics of current interest in the design of experiments, including one or more of: distance based design criteria and construction of spatial process models, screening design strategies for high-dimensional problems, and design problems associated with computational experiments.

STAT 615: Advanced Bayesian Methods
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 544 and STAT 601
Complex hierarchical and multilevel models, dynamic linear and generalized linear models, spatial models. Bayesian nonparametric methods. Specialized Markov chain Monte Carlo algorithms and practical approaches to increasing mixing and speed convergence. Summarizing posterior distributions, and issues in inference. Model assessment, model selection, and model averaging.

STAT 621: Advanced Theory of Survey Statistics
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 521
Advanced topics of current interest in the design of surveys and analysis of survey data, including: asymptotic theory for design and model-based estimators, use of auxiliary information in estimation, variance estimation techniques, small area estimation, non-response modeling and imputation.

STAT 641: Foundations of Probability Theory
(Cross-listed with MATH). (3-0) Cr. 3. F.
Prereq: MATH 414 or MATH 501 or equivalent course.
Sequences and set theory; Lebesgue measure, measurable functions. Absolute continuity of functions, integrability and the fundamental theorem of Lebesgue integration. General measure spaces, probability measure, extension theorem and construction of Lebesgue-Stieljes measures on Euclidean spaces. Measurable transformations and random variables, induced measures and probability distributions. General integration and expectation, Lp-spaces and integral inequalities. Uniform integrability and absolute continuity of measures. Probability densities and the Radon-Nikodym theorem. Product spaces and Fubini-Tonelli theorems.

STAT 642: Advanced Probability Theory
(Cross-listed with MATH). (3-0) Cr. 3. S.
Prereq: STAT 641, or STAT 543 and MATH 515.
Probability spaces and random variables. Kolmogorov's consistency theorem. Independence, Borel-Cantelli lemmas and Kolmogorov's 0 - 1 Law. Comparing types of convergence for random variables. Sums of independent random variables, empirical distributions, weak and strong laws of large numbers. Convergence in distribution and its characterizations, tightness, characteristic functions, central limit theorems and Lindeberg-Feller conditions. Conditional probability and expectation. Discrete parameter martingales and their properties and applications.

STAT 643: Advanced Theory of Statistical Inference
(3-0) Cr. 3. F.
Prereq: STAT 543, STAT 642
Sufficiency and related concepts, completeness, exponential families and statistical information. Elements of decision theory, decision rules, invariance and Bayes rule. Maximum likelihood and asymptotic inference. Generalized estimating equations and estimating functions, M-estimation, U-statistics. Likelihood ratio tests, simple and composite hypotheses, multiple testing. Bayesian inference. Nonparametric inference, bootstrap, empirical likelihood, and tests for nonparametric models.

STAT 644: Advanced Bayesian Theory
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 544 and STAT 642
Exchangeability, parametric models, consistency and asymptotic normality of posterior distributions, posterior robustness, selection of priors using formal rules, improper priors and posterior propriety, Bayes factors, model selection, MCMC theory, irreducibility, Harris recurrence, regeneration, minorization, drift, ergodicity, limit theorems, techniques for speeding up convergence of certain MCMC algorithms.

STAT 645: Advanced Stochastic Processes
(Cross-listed with MATH). (3-0) Cr. 3. S.
Weak convergence. Random walks and Brownian motion. Martingales. Stochastic integration and Ito's Formula. Stochastic differential equations and applications.

STAT 647: Advanced Multivariate Analysis
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 543, knowledge of matrix algebra
Multivariate normal distribution, estimation of the mean vector and the covariance matrix, multiple and partial correlation, Hotelling's T2 statistic, Wishart distribution, multivariate regression, principle components, discriminant analysis, high dimensional data analysis, latent variables.

STAT 648: Seminar on Theory of Statistics and Probability
Cr. arr. F.
Prereq: STAT 543.
Seminar topics change with each offering.

STAT 651: Advanced Time Series
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: STAT 551, STAT 642
Stationary and nonstationary time series models, including ARMA, ARCH, and GARCH. Covariance and spectral representation of time series. Fourier and periodogram analyses. Predictions. CLT for mixing processes. Estimation and distribution theory. Long range dependence.

STAT 680: Advanced Statistical Computing
(3-0) Cr. 3. F.
Prereq: STAT 543 and STAT 580
Normal approximations to likelihoods. The delta-method and propagation of errors. Topics in the use of the E-M algorithm including; its use in the exponential family, computation of standard errors, acceleration. Resampling methods: brief theory and application of the jackknife and the bootstrap. Randomization tests. Stochastic simulation: Markov Chain, Monte Carlo, Gibbs' sampling, Hastings-Metropolis algorithms, critical slowing-down and remedies, auxiliary variables, simulated tempering, reversible-jump MCMC and multi-grid methods.

STAT 690: Advanced Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690A: Advanced Special Topics: Theory
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690B: Advanced Special Topics: Methods
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690C: Advanced Special Topics: Design of Experiments
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690D: Advanced Special Topics: Sample Surveys
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690E: Advanced Special Topics: Statistical Computing
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 690F: Advanced Special Topics: Graphics
Cr. arr. Repeatable.
Prereq: Permission of instructor

STAT 699: Research
Cr. arr. Repeatable.

Teaching English as a Second Language (TESL)

The Minor in TESL prepares students to teach English to nonnative speakers of English, either in community programs in the United States or in overseas locations. The Minor provides understanding of how English works (ENGL/LING 219) and practical and theoretical applications in how English is taught to those who do not speak English natively (ENGL/LING 322, ENGL/LING 324, ENGL/LING 325, and ENGL/LING 425). The TESL

Minor prepares students to cross cultural boundaries to learn about, interact with, and assist speakers of other languages in learning English, the leading global language today. A TESL Minor will help students become global citizens through interacting with and teaching those from around the world who come to the United States and by giving students skills that will allow them to live and work in other countries. All classes listed are requirements for the Minor in TESL (15 credits). A C or better is required in each course used to satisfy the minor. Contact the Linguistics advising office for more information.

ENGL 219	Introduction to Linguistics	3
ENGL 425	Second Language Learning and Teaching	3
ENGL/LING 322X	Language and Society	3
ENGL/LING 324X	Introduction to Teaching ESL Literacy	3
ENGL/LING 325X	Teaching Methods for ESL Learners: Oral Communication Skills	3

Technical Communication

Technical Communication Major Requirements

Technical Communication majors must take 34-36 credits within the major and 6 hours in a designated area of concentration related to technology, science, or design (an acceptable minor will also fulfill this requirement). Majors develop advanced skills in multiple aspects of technical communication and apply their knowledge of technical communication to a specific discipline.

ENGL 310	Rhetorical Analysis	3
ENGL 314	Technical Communication	3
ENGL 350	Rhetorical Traditions	3
ENGL 487	Internship in Business, Technical, and Professional Communication	1-3
Choose 3:		9
(Note: Students planning to take ENGL 415 Business and Technical Editing in the future should take ENGL 220 Descriptive English Grammar for 3 of these credits.)		
ENGL 220	Descriptive English Grammar	
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 312	Biological Communication	
ENGL 313	Rhetorical Website Design	
ENGL 332	Visual Communication of Quantitative Information	
Choose 5:		15
ENGL 411	Technology, Rhetoric, and Professional Communication	
ENGL 415	Business and Technical Editing	
ENGL 416	Visual Aspects of Business and Technical Communication	
ENGL 418	Seminar in Argumentation	
ENGL 477	Seminar in Technical Communication	
ENGL 529	Content Management	
ENGL 542	Document Design and Editing	
ENGL 549	Multimedia and Interaction Design	
Designated Area of Concentration (DAC) in technical, scientific, or design field		6
Total Credits		40-42

Designated Area of Concentration Courses

The Designated Area of Concentration (DAC) is a student-designed grouping of related courses in a technical, scientific, or design field that will meet the student's professional or academic interests. Courses for the 6-credit DAC must be taken outside the English Department and approved by the Technical Communication Program Adviser. A second major or a minor in areas such as computer science, social science, natural science, entrepreneurial studies, design studies, engineering studies, or another technical, scientific, or design field may substitute for the DAC.

Technical Communication, B.S.

Freshman

Fall	Credits	Spring	Credits
ENGL 150 (or Engl 250 by placement or transfer credit)	3	Social Science Choice	3
Humanities Choice	3	Natural Science Choice	3
Foreign Language/Elective	4	Humanities Choice	3
MATH or STAT	3	Foreign Language/Elective	4
LIB 160	1	Elective or Minor	3
Elective or Minor	3		
	17		16

Sophomore

Fall	Credits	Spring	Credits
TComm Elective from List - ENGL 200+	3	Technical/Scientific/Design Course	3
Social Science Choice	3	ENGL 314	3
U.S. Diversity Choice	3	ENGL 300+	3
Natural Science Choice	3	ENGL 310	3
ENGL 250	3	Humanities Choice	3
Computers in the Study of English (if student took ENGL 150 semester 1)		Natural Science Choice	2
	15		17

Junior

Fall	Credits	Spring	Credits
ENGL 300+	3	ENGL 350	3
International Perspectives Choice	3	Elective or Minor	3
TCOM Elective from List - ENGL 400+	3	TCOM Elective from List - ENGL 400+	3
Humanities Choice	3	Technical/Scientific/Design Course	3
Social Science Choice	3	Electives or Minor	3
	15		15

Senior

Fall	Credits	Spring	Credits
Technical/Scientific/Design Course	3	ENGL 487	3
TComm Elective from List - ENGL 400+	3	TComm Elective from List - ENGL 400+	3
TCOMM Elective from List - ENGL 400+	6	Electives or Minor	6
Electives or Minor	3		
	15		12

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.** You must also complete the LAS foreign language requirement.

Technical Communication Minor Requirements

The department offers a minor in Technical Communication, which students may earn by completing the following:

ENGL 314	Technical Communication	3
Choose 4:		12
ENGL 302	Business Communication	
ENGL 309	Proposal and Report Writing	
ENGL 310	Rhetorical Analysis	
ENGL 312	Biological Communication	
ENGL 313	Rhetorical Website Design	
ENGL 332	Visual Communication of Quantitative Information	
ENGL 350	Rhetorical Traditions	
ENGL 411	Technology, Rhetoric, and Professional Communication	
ENGL 415	Business and Technical Editing	
ENGL 416	Visual Aspects of Business and Technical Communication	
ENGL 418	Seminar in Argumentation	
ENGL 477	Seminar in Technical Communication	
ENGL 529	Content Management	
ENGL 542	Document Design and Editing	
ENGL 549	Multimedia and Interaction Design	
or with the appropriate prerequisites		
Total Credits		15

Nine of the 15 credits must be 300 level or above and students must earn a grade of C (not C-) or higher in each course taken in the minor. Up to 6 of the 15 credits taken for the minor may be used to meet other degree program requirements. Students may design their minor programs around their own interests but are encouraged to work with the Technical Communication Program Adviser.

Note: Students should check the ISU catalog to be sure that they meet prerequisites if they intend to register for 400+ courses.

Women's Studies

Degree: Women's Studies (B.A., B.S.)

The Women's and Gender Studies Program in the College of Liberal Arts and Sciences is cross-disciplinary, offering a minor and major in "Women's Studies". This program provides an opportunity for students to examine gender and women's roles, contributions, and status in social and cultural context and to investigate a variety of disciplines from feminist perspectives. The field of women's and gender studies creates an understanding that interrelated factors, e.g., race, ethnicity, class, age, disability, gender identity, religion, national origin, and sexual orientation, inform knowledge of women's history, culture, and social roles.

Women's and Gender Studies seeks to improve critical thinking and to provide students with the intellectual means to question prevailing assumptions. It encourages students to explore the contexts and ideological origins of knowledge and to examine the relationship between knowledge and power in society. By promoting social responsibility, this area of study focuses on the connections between personal experience and political activity, and validates student contributions and voices.

Graduates from this program are skilled in critical thinking, research methods, and effective communication. Because they have developed a thorough understanding of gender, race, and class, they can understand and work effectively with employers, colleagues, and clients to analyze and address complex social problems. Women's and Gender Studies graduates also acquire strong backgrounds for careers in areas such

as counseling, education, human resources, international development, public policy, politics, business, or law. The program includes core courses and cross-listed courses in anthropology, art history, classical studies, economics, English, history, health and human performance, political science, psychology, religion, sociology, speech communication, and world languages and cultures. An undergraduate major requires a minimum 2.00 GPA in the 33 credits of core and cross-listed courses. Women's Studies majors must satisfy the following requirements:

1. 21 credits selected from Women's Studies core courses (W S).

A. Required core courses:

W S 201	Introduction to Women's Studies	3
W S 301	International Perspectives on Women and Gender	3
W S 401	Feminist Theories	3
W S 402	Feminist Research in Action	3
W S 499	Senior Thesis	3
or W S 491	Senior Internship	

B. The remaining 6 credits should be chosen from the Women's Studies core courses:

W S 203	Introduction to Lesbian Studies	3
W S 205	Introduction to Queer Studies	3
W S 320	Ecofeminism	3
W S 350	Women of Color in the U.S	3
W S 425	Intersections of Race, Class and Gender	3
W S 435	Women and Development	3
W S 450	Topics in Women's Studies (may be taken more than once)	3

2. 12 credits selected from W S cross-listed courses or W S core courses.

A minor or second major is recommended. The typical degree awarded is a Bachelor of Arts; students wishing to earn a Bachelor of Science may do so by taking an appropriate minor or second major.

Communication Proficiency requirement:
The Women's Studies major requires credit for ENGL 150; ENGL 250 (or ENGL 250H) (with a grade of C or better); and W S 301 or W S 401 or W S 402.

Women's Studies, B.A., B.S. (1)

Freshman

Fall	Credits	Spring	Credits
ENGL 150	3	Math Choice	3
LIB 160	1	W S 201	3
Foreign Language/Minor/Second Major[1]	4	Foreign Language/Minor/Second Major	4
Humanities Choice	3	Humanities Choice	3
Natural Science Choice	3	Social Science Choice	3
Social Science Choice	3		
	17		16

Sophomore

Fall	Credits	Spring	Credits
W S 301	3	Women's Studies Choices - 200/300 Level	6
Minor/Second Major Choice	3	Minor/Second Major Choice	3
Humanities Choice	3	Humanities Choice	3
ENGL 250	3	Social Science Choice	3
Natural Science Choice	3		
	15		15

Junior

Fall	Credits	Spring	Credits
Women's Studies Choice - 300/400 Level	3	Women's Studies Core Course Choices - 300/400 Level	3
Minor/Second Major Choice - 300/400 Level	6	Minor/Second Major Choice - 300/400 Level	6
Natural Science Choice	3	Minor/Second Major Choice	3
W S 401	3	Women's Studies Choice - 300/400 Level	3
	15		15

Senior

Fall	Credits	Spring	Credits
Women's Studies Choice - 300/400 Level	6	Electives	4
W S 491 or 499	3	Second Major/Electives	6
Second Major/Elective	3	Women's Studies Choice - 300/400 Level	3
Minor/Second Major Choice - 300/400 Level	3		
	15		13

Students in all ISU majors must complete a three-credit course in U.S. diversity and a three-credit course in international perspectives. Check (http://www.registrar.iastate.edu/courses/div-ip-guide.html) for a list of approved courses. Discuss with your adviser how the two courses that you select can be applied to your graduation plan.

LAS majors require a minimum of 120 credits, **including a minimum of 45 credits at the 300/400 level.** You must also complete the LAS foreign language requirement.

[1] A minor or second major is recommended. The typical degree awarded is a Bachelor of Arts; students wishing to earn a Bachelor of Science may do so by taking an appropriate minor or second major.

Minor

Undergraduate students may minor in Women's Studies by taking 15 semester hours of Women's Studies classes, including:

W S 201	Introduction to Women's Studies	3
W S 301	International Perspectives on Women and Gender	3
one 400 level core Women's Studies course		3
6 additional credits of core or cross-listed courses		6

Any student can declare a major or minor in Women's Studies or choose to co-major in another program. Students interested in a minor or major in Women's Studies should contact the Director of the program.

Graduate Study

The graduate minor in Women's Studies is designed to provide students with knowledge of theories and methods within a variety of approaches in feminist scholarship. The program seeks to integrate and synthesize knowledge from many disciplines and to offer students opportunities for systematic study of gender and women's experiences and perspectives in all knowledge fields. Students will be prepared to take leadership roles in supporting gender equity and diversity in their careers in education, social service work, business, law, public policy, governmental and non-governmental organizations, and research.

The graduate minor requires 12 credits for students enrolled in a master's or a doctoral degree program. Students are required to take either W S 501 Contemporary Feminist Theories or W S 502 Advanced Seminar in Feminist Research Methods; taking both is strongly recommended. Students will also take two or three electives selected from the list of core and cross-listed Women's Studies courses approved for graduate study. At least one member of the Women's Studies faculty will serve on the program of study for doctoral students. A list of eligible faculty members may be obtained from the Director of the Women's and Gender Studies Program.

Courses primarily for undergraduates:

W S 160: Gender Justice
(2-0) Cr. 1. F.S.
Half semester course. Examines the socialization process in the United States and how our perspectives are formed. An introduction to patriarchy, sexism, and ally development are explored. Skills to enhance communication and understanding among women and men will be developed. Offered on a satisfactory-fail basis only.
Meets U.S. Diversity Requirement

W S 201: Introduction to Women's Studies
(3-0) Cr. 3.
Introduction to the interdisciplinary field of Women's Studies. Contemporary status of women in the U.S. and worldwide from social, economic, historical, political, philosophical and literary perspectives. Analysis of intersection of gender, race, class, and sexuality. Subject matter includes work, health, sexuality, and violence. Foundation for the other courses in the program.
Meets U.S. Diversity Requirement

W S 203: Introduction to Lesbian Studies
(3-0) Cr. 3. S.
Study of contemporary and historic lesbian cultures and communities from a US and international perspective. Addresses issues of race, class, gender and sexuality as they intersect with the formation of lesbian identities. Explores who identifies as lesbian and how that dis/enables political resistance and formation of community.
Meets U.S. Diversity Requirement

W S 205: Introduction to Queer Studies
(3-0) Cr. 3. F.
Prereq: ENGL 150
Interdisciplinary study of issues relating to lesbian, gay, bisexual, transgender, and queer identities in the U.S. Attention will be given to race and socioeconomic class.
Meets U.S. Diversity Requirement

W S 301: International Perspectives on Women and Gender
(3-0) Cr. 3. F.S.
Prereq: W S 201 or 3 credits in Women's Studies at the 300 level or above
Study of women in a range of cultures, depending on faculty specialization. Special emphasis on women in development seen in postcolonial context.
Meets International Perspectives Requirement.

W S 307: Women in Science and Engineering
(Cross-listed with BIOL). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: a 200 level course in science, engineering or women's studies; ENGL 250
The interrelationships of women and science and engineering examined from historical, sociological, philosophical, and biological perspectives. Factors contributing to under-representation; feminist critiques of science; examination of successful strategies. Does not satisfy biology major advanced credit requirements.
Meets U.S. Diversity Requirement

W S 308: Write Like a Woman
(Cross-listed with ENGL). (3-0) Cr. 3. F.
Prereq: ENGL 250
Writing and reading interpretive fiction written by women. Emphasis on stories that embody a female literary life, gender-specific ways of creating characters and conflicts, analytical reading and writing, workshop criticism and shared commentaries. Includes multi-modal projects.

W S 320: Ecofeminism
(Cross-listed with ENV S). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: W S 201 or 3 credits in Women's Studies at the 300 level or above
Women's relationships with the earth, non-human nature, and other humans. The course explores the connections between society's treatment of women and nature; origins of ecofeminism and how it relates to the science of ecology, conventional and sustainable agriculture as well as how ecofeminism relates to other branches of feminist philosophy. Evaluation and critique of modern science, technology, political systems and SOLUTIONS will be included.

W S 321: Economics of Discrimination
(Cross-listed with ECON). (3-0) Cr. 3.
Prereq: ECON 101
Economic theories of discrimination. Analysis of the economic problems of women and minorities in such areas as earnings, occupations, and unemployment. Public policy concerning discrimination. Poverty measurement and antipoverty programs in the U.S.
Meets U.S. Diversity Requirement

W S 323: Gender and Communication
(Cross-listed with SP CM). (3-0) Cr. 3.
Examines how understanding and enactment of gender identity is shaped by communication. Verbal and nonverbal communication across various contexts including personal relationships and the media. Explores discourse of social movements aiming to transform cultural definitions of gender.
Meets U.S. Diversity Requirement

W S 325: Portrayals of Gender and Sexualities in the Media
(3-0) Cr. 3.
Prereq: Sophomore classification
Survey of how the media and popular culture portray gender and sexualities and the impact on individuals and society. Images of women, men, transgender as well as heterosexual, non-heterosexual and others. Studies both historical and emerging images in the media in terms of stereotypes and positive images.
Meets U.S. Diversity Requirement

W S 327: Sex and Gender in Society
(Cross-listed with SOC). (3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
How the biological fact of sex is transformed into a system of gender stratification. The demographics and social positions of women and men in the family, education, media, politics, and the economy. Theories of the social-psychological and sociological bases for behavior and attitudes of women and men. The relationship between gender, class, and race.
Meets U.S. Diversity Requirement

W S 328: Sociology of Masculinities and Manhood
(Cross-listed with SOC). (3-0) Cr. 3. S.
Prereq: SOC 134 or W S 201
Examination of socially constructed and idealized images of manhood, the nature of social hierarchies and relations constructed on the basis of imagery, ideologies, and norms of masculinity. Theories on gender (sociological, psychological, and biological). Particular attention given to theory and research on gender variations among men by race, class, ethnicity, sexual orientation, physical ability and age.
Meets U.S. Diversity Requirement

W S 333: Women and Leadership
(Cross-listed with LD ST). (3-0) Cr. 3.
Prereq: Sophomore classification
This course will examine historical and contemporary barriers to and opportunities for women's leadership in a variety of contexts, including professions and public service. It will examine theories of women's leadership, gender differences in leadership styles, and the perceptions and expectations about women's leadership. Multiple perspectives of women's leadership will be highlighted through lectures, readings, videos, guest speakers and group work.
Meets U.S. Diversity Requirement

W S 336: Women and Religion
(Cross-listed with RELIG). (3-0) Cr. 3. F.
Prereq: RELIG 205, RELIG 210 or W S 201 recommended
Examines the status of women in various religions, feminist critiques of religious structures and belief systems, and contemporary women's spirituality movements.
Meets U.S. Diversity Requirement

W S 338: Feminist Philosophy
(Cross-listed with PHIL). (3-0) Cr. 3. F.
Prereq: 3 credits in philosophy or women's studies recommended
A critical, theoretical examination of the oppression of women, especially as it relates to issues of race, class, and sexual orientation. How concepts such as sex and gender, self and other, nature and nurture, complicate our understanding of what it means to be a woman. Historical and contemporary feminist philosophers addressing topics such as violence, sexuality, pornography, political power, family structure and women's paid and unpaid labor.
Meets U.S. Diversity Requirement

W S 340: Women's Literature
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 250
Historical and thematic survey of literature by and about women. May include autobiographies, journals, letters, poetry, fiction, and drama.
Meets U.S. Diversity Requirement

W S 342: American Indian Women Writers
(Cross-listed with AM IN, ENGL). (3-0) Cr. 3.
Prereq: ENGL 250
Literature of American Indian women writers which examines their social, political, and cultural roles in the United States. Exploration of American Indian women's literary, philosophical, and artistic works aimed at recovering elements of identity, redescribing stereotypes, resisting colonization, and constructing femininity.
Meets U.S. Diversity Requirement

W S 344: Human Reproduction
(Cross-listed with BIOL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 212
Biology of human reproduction, including reproductive systems, hormones, and endocrinology of pregnancy, presented from a clinically-oriented perspective. Reviews health-related conditions such as infertility, sexually-transmitted diseases, and complicated pregnancy.

W S 345: Women and Literature: Selected Topics
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250
Literature by women and/or dealing with the images of women, e.g., study of individual authors or related schools of authors; exploration of specific themes or genres in women's literature; analysis of recurrent images of women in literature.
Meets U.S. Diversity Requirement

W S 346: Psychology of Women
(Cross-listed with PSYCH). (3-0) Cr. 3. S.
Prereq: 2 courses in psychology including PSYCH 101
Survey of theory and research related to major biological, interpersonal, and cultural issues affecting girls' and women's psychological development and behavior.
Meets U.S. Diversity Requirement

W S 350: Women of Color in the U.S
(Cross-listed with AF AM). (3-0) Cr. 3. S.
Prereq: 3 credits in Women's Studies or African American Studies
Economic, social, political and cultural roles of Women of Color in the U.S. Includes literary, philosophical, and artistic expressions. Myths and realities explored.
Meets U.S. Diversity Requirement

W S 352: Gay and Lesbian Literature
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 250
Literary portrayals of gay and lesbian lives and relationships from many different genres. Attention to changing definitions and representations of sexual orientation and gender identity over time.
Meets U.S. Diversity Requirement

W S 370: Studies in English Translation
(3-0) Cr. 3.
Readings, discussions, and papers in English.
Meets International Perspectives Requirement.

W S 370F: Studies in English Translation: French Topics on Women and Gender Studies
(Cross-listed with FRNCH). (3-0) Cr. 3. Repeatable.
Topics vary according to faculty interest. Readings, discussions, and papers in English.
Meets International Perspectives Requirement.

W S 370G: Studies in English Translation: German Topics on Women or Feminism
(Cross-listed with GER). (3-0) Cr. 3-4. Repeatable, maximum of 6 credits.
Prereq: Sophomore classification. For fourth credit, 6 credits in German at the 300 level
Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Three credits: English, open to all students. Four credits: Required for German concentration credit, supplementary readings and compositions in German.
Meets International Perspectives Requirement.

W S 370R: Studies in English Translation: Russian Topics on Women or Feminism
(Cross-listed with RUS). (3-0) Cr. 3. Repeatable.
Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English.
Meets International Perspectives Requirement.

W S 370S: Studies in English Translation: Hispanic Topics on Women or Feminism
(Cross-listed with SPAN). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English. May not be counted as a prerequisite.
Meets International Perspectives Requirement.

W S 374: Sex, Gender, and Culture in the Ancient Mediterranean World
(Cross-listed with CL ST, HIST). (3-0) Cr. 3. S.
Prereq: Any one course in Cl St, W S, Latin, or Greek
Chronological and topical survey of the status of women and men, focusing on sex and gender issues in the Ancient Mediterranean world; study of constructs of the female and the feminine. Readings from ancient and modern sources. Emphasis on ancient Greece, Rome, and Egypt.
Meets International Perspectives Requirement.

W S 380: History of Women in Science, Technology, and Medicine
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
History of women's relationship to the fields of science, technology, and medicine, as students and professionals, consumers, subjects and patients, family members, workers and citizens. Concentrates especially on 19th and 20th century United States, concluding with an examination of current issues of special interest to women in science, technology, and medicine.
Meets U.S. Diversity Requirement

W S 385: Women in Politics
(Cross-listed with POL S). (3-0) Cr. 3. S.
Examination of the entry and participation of women in politics in the United States and other countries including a focus on contemporary issues and strategies for change through the political process.
Meets U.S. Diversity Requirement

W S 386: History of Women in America
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
A survey of social, economic, and political aspects of women's role from colonial era to present; emphasis on employment, education, concepts of sexuality, and changing nature of the home.
Meets U.S. Diversity Requirement

W S 401: Feminist Theories
(3-0) Cr. 3.
Prereq: W S 201 or 3 credits in Women's Studies at the 300 level or above
Current theories of feminism, the feminine and sexual difference.
Topics in race, class, sexuality, and ethnicity as they are addressed in diverse feminisms. May include readings in lesbian, Black, postcolonial, psychoanalytic and postmodern thought.

W S 402: Feminist Research in Action
(3-0) Cr. 3. S.
Prereq: W S 201 and W S 301
Feminist research methods and scholarship. Class collaborates on a community research and action project to improve women's lives.

W S 422: Women, Men, and the English Language
(Cross-listed with ENGL, LING). (3-0) Cr. 3. S.
Prereq: ENGL 219 or LING 219
The ways men and women differ in using language in varied settings and the ways in which language both creates and reflects gender divisions.
Meets U.S. Diversity Requirement

W S 425: Intersections of Race, Class and Gender
(Dual-listed with W S 525). (3-0) Cr. 3.
Prereq: W S 201 and one additional W S course
Race, ethnicity, class and gender distinctions and intersections lead to inequitable distributions of power, social well-being, and resources. Explores how inequities are institutionalized and how multiple identities are experienced by women in daily life.

W S 435: Women and Development
(Dual-listed with W S 535). (3-0) Cr. 3.
Prereq: W S 301
Cross-cultural study of development utilizing both case studies and theoretical works. Explores the nature of women's roles in developing countries and the ways women and their needs have been excluded/included in development approaches, policies, and projects. Includes discussion of actual development projects as well as women's organizing.

W S 439: Goddess Religions
(Cross-listed with RELIG). (3-0) Cr. 3.
Prereq: RELIG 205 recommended
Exploration of the foundational myths of Goddess spirituality, including historical and cross-cultural female images of the divine and their modern usage by American women.

W S 444: Sex and Gender in Cross-cultural Perspective
(Dual-listed with W S 544). (Cross-listed with ANTHR). (3-0) Cr. 3. S.
Prereq: ANTHR 201; ANTHR 306 recommended
Cross-cultural examination of the social construction of genders out of the biological fact of sex. Emphasis on non-western societies. Topics, presented through examination of ethnographic data, will include the range of gender variation, status and roles, the institution of marriage, and symbols of gender valuation.
Meets International Perspectives Requirement.

W S 450: Topics in Women's Studies
(Dual-listed with W S 550). (3-0) Cr. 3. Repeatable, maximum of 6 credits. S.
Prereq: W S 201 or 3 credits in Women's Studies at the 300 level or above
Special and/or experimental topics in a specific discipline, e.g., women and education, women and religion, women and the law, women and science.

W S 460: Seminar in Gender and Ethnicity
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Completion of 9 credits of surveys; completion of or concurrent enrollment in ENGL 339; junior classification
Selected readings of various authors, movements, eras, or genres. Readings in criticism; required research paper.

W S 488: Research on Women and Leadership
(Cross-listed with LD ST). (3-0) Cr. 3.
Research on women and leadership in selected content areas (e.g., business, education, politics and public service, and popular culture). Following an overview of quantitative and qualitative methods and critical analyses of journal articles on women and leadership, students will work in groups in selected content areas to research, write and present paper.

W S 490: Independent Study
Cr. 1-3. Repeatable, maximum of 6 credits.
Prereq: Any two courses in Women's Studies
Independent study on a topic in Women's Studies.

W S 491: Senior Internship
(3-0) Cr. 3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: Senior classification
Internship designed to provide an application of Women's Studies principles and methods in a workplace. To be arranged with an internal or external employer and conducted under the supervision of a member of the Women's Studies faculty.

W S 494: Women/Gender in Art
(Cross-listed with ART H). (3-0) Cr. 3.
Issues of gender related to cultural environments from the Middle Ages to contemporary times in Europe and America. Feminist movement beginning in the 1970s and specifically gender issues in art that are becoming widespread in the artistic culture.
Meets U.S. Diversity Requirement

W S 499: Senior Thesis
(3-0) Cr. 3. F.S.SS.
Prereq: Senior classification
Senior thesis to be independently researched and written under the supervision of a member of the Women's Studies faculty.

Courses primarily for graduate students, open to qualified undergraduates:

W S 501: Contemporary Feminist Theories
(3-0) Cr. 3. F.
Advanced study of current theoretical developments in Women's Studies in the U.S. and around the world. Examination of the epistemological bases of feminist scholarship.

W S 502: Advanced Seminar in Feminist Research Methods
(3-0) Cr. 3. S.
Focus on feminist interdisciplinary research methods. Analysis of contemporary issues facing feminist scholars. Students conduct original research.

W S 525: Intersections of Race, Class and Gender
(Dual-listed with W S 425). (3-0) Cr. 3.
Prereq: W S 201 and one additional W S course
Race, ethnicity, class and gender distinctions and intersections lead to inequitable distributions of power, social well-being, and resources. Explores how inequities are institutionalized and how multiple identities are experienced by women in daily life.

W S 535: Women and Development
(Dual-listed with W S 435). (3-0) Cr. 3.
Prereq: W S 301
Cross-cultural study of development utilizing both case studies and theoretical works. Explores the nature of women's roles in developing countries and the ways women and their needs have been excluded/ included in development approaches, policies, and projects. Includes discussion of actual development projects as well as women's organizing.

W S 544: Sex and Gender in Cross-cultural Perspective
(Dual-listed with W S 444). (Cross-listed with ANTHR). (3-0) Cr. 3. S.
Prereq: ANTHR 201; ANTHR 306 recommended
Cross-cultural examination of the social construction of genders out of the biological fact of sex. Emphasis on non-western societies. Topics, presented through examination of ethnographic data, will include the range of gender variation, status and roles, the institution of marriage, and symbols of gender valuation.
Meets International Perspectives Requirement.

W S 545: Women's Literature
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Graduate classification or 6 credits in literature at 300 level or above
Primary texts by women writers; historical, thematic, formal, or theoretical approaches; secondary readings; e.g., Nineteenth-Century Women Writers; American Women's Personal Narratives; Southern Women Writers of the U.S.

W S 550: Topics in Women's Studies
(Dual-listed with W S 450). (3-0) Cr. 3. Repeatable, maximum of 6 credits. S.
Prereq: W S 201 or 3 credits in Women's Studies at the 300 level or above
Special and/or experimental topics in a specific discipline, e.g., women and education, women and religion, women and the law, women and science.

W S 586: Proseminar in Women's History and Feminist Theory
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: Permission of instructor
Feminism as a movement and feminst theory from the early modern period to the present as it relates to the writing of women's history. Analysis of intepretations of European and U.S. women's history from patriarchal and postmodernist perspectives.

W S 590: Special Topics
Cr. arr.
Prereq: Permission of Women's Studies Program Director
Independent study on a topic in Women's Studies.

W S 594: Women/Gender in Art
(Cross-listed with ART H). (3-0) Cr. 3.
Prereq: Graduate classification or permission of instructor
Issues of gender related to cultural environments from the Middle Ages to contemporary times in Europe and America. Feminist movement beginning in the 1970s and specifically gender issues in art that are becoming widespread in the artistic culture.

Courses for graduate students:

W S 621: Pedagogies of Dissent
(Cross-listed with EL PS). (3-0) Cr. 3. S.
Prereq: EL PS 620
Critical examination of the philosophical foundations of education that seek to challenge the status quo and advance radical educational change. Exploration of macro-level (and some micro-level) issues relevant to educational change, in relation to how they inform practices of dissent and every day social relations.

World Languages and Cultures

Degree: World Languages and Cultures, B.A.

Curriculum: World language study should be an integral part of an academic program for most students. The theoretical understanding of and practical experience in language underlie many intellectual disciplines that try to meet the complex problems of contemporary society. Courses offered by the Department of World Languages and Cultures are designed to develop students' understanding of a second culture through the language spoken by that culture.

Upon the completion of their program of studies in the Department of World Languages and Cultures, majors with a concentration in French, German, or Spanish will demonstrate proficiency in five goal areas: Communication, Cultures, Connections, Comparisons, and Communities. Students will be able to:

1. use their concentration language to present and interpret information and to communicate both orally and in writing;
2. demonstrate an understanding of the relationships among the products, practices, and perspectives of the culture(s) in which their concentration language is spoken;
3. demonstrate their ability to acquire information and further their knowledge through their concentration language;
4. demonstrate an understanding of the nature of language and the concept of culture by making comparisons with their own language and culture(s); and
5. demonstrate a desire to become a life-long learner of their concentration language.

Graduates will achieve both linguistic proficiency and cultural literacy through the study of the language and culture of their program. Linguistic proficiency entails the ability to function effectively in the target language and the ability to communicate competently with native speakers of the target language. Students of Latin and Ancient Greek demonstrate proficiency by becoming able to read the languages and to translate from these languages into clear and idiomatic English. Cultural literacy includes a general knowledge of the culture's history, familiarity with its literature, and basic knowledge of its social and political institutions.

The Department offers a major in World Languages and Cultures with two options, leading to the Bachelor of Arts degree:

1. Languages and Cultures with a Concentration in French, German, or Spanish;
2. Languages and Cultures for Professions (as a second major only) with a Concentration in French, German, or Spanish.

The Department also houses ISU's program in Anthropology, leading to a Bachelor of Arts or Bachelor of Science degree (http://catalog.iastate.edu/collegeofliberalartsandsciences/anthropology/).

The Department offers minors in Anthropology, Chinese Studies, French, German, Russian Studies, Spanish, and World Film Studies; and instruction in American Sign Language, Arabic, Italian (see Experimental Course List), and Classical Greek and Latin. The Department also houses the College of Liberal Arts and Sciences' Cross Disciplinary Studies Programs in American Indian Studies, Classical Studies, International Studies, and U.S. Latino/a Studies.

A full statement of requirements for majors and minors may be obtained from the Department. For a complete statement of all the college degree requirements, see Liberal Arts and Sciences, Curriculum. Current and detailed information about the Department, including placement information, is available on-line at www.language.iastate.edu (http://www.language.iastate.edu).

Policies

Students who have had formal training in world languages offered at Iowa State may obtain credit by passing appropriate examinations. Students with native fluency in languages taught at Iowa State may not enroll in or take the Exam for Credit in elementary or intermediate courses (100 and 200 level) in their native language. Students are considered to have native fluency if their ethnic first language as indicated on the matriculation form is the language in which they wish to enroll. Students are also considered to have native fluency if they have had substantial attendance at a secondary school or university where the language of instruction is the language in which they wish to enroll at ISU. Students with native fluency may be eligible to enroll in literature and civilization courses in their native language at the 300 level or above; such students must also consult the department office to determine eligibility for advanced composition and conversation courses (300 level and above). Students who have completed three or more years of high-school world language study may not enroll in or receive credit for 101-102 in those languages; credit may be obtained by passing the appropriate Exam for Credit or by completing an advanced sequence (200-level or higher) in that language Students who complete an approved sequence of courses in a single language at the 200- or 300-level (e.g., 201 and 202 or 301 and 302) with a grade of C- or higher are eligible to receive credit for 101 and 102 in that same language if they have not received credit for a 101 or 102 course in the language. Students who complete a 102 course with a grade of C- or higher are eligible to receive credit for 101 in that same language if they have not received credit for 101 in the same language. Students should contact the department after completion of the course sequence to receive credit. Courses in the 101-102 level may not be taken on a remedial basis.

Students who have completed two years but less than three years of a single high-school world language may not enroll in a 101 course in that language. These students may enroll in either a 102 course in that language, or in the case of Spanish, SPAN 097 Accelerated Spanish Review. Before enrolling in either SPAN 097 Accelerated Spanish Review or a 102 language course, students are recommended to take the on-line placement test available at www.language.iastate.edu (http://www.language.iastate.edu). After completing the online placement test, students who believe that they have extenuating circumstances may appeal to the Department of World Languages and Cultures in order to request enrollment in a 101 language course.

SPAN 097 Accelerated Spanish Review is designed for students who need additional work in the language at the first-year level (101-102) and are not planning to continue their language study at the second-year 201-202 level. Students who complete with a passing grade will have fulfilled the LAS world language requirement. Students who have completed SPAN 097 Accelerated Spanish Review and wish to pursue further study in Spanish at the 201-202 level may enroll in 102.

Students with disabilities who need to satisfy the world language requirement may direct questions to their academic adviser, the Department of World Languages and Cultures, or the Disability Resources Office.

Credit by examination in the Department of World Languages and Cultures for courses numbered 101, 102, 201, and 202 is available only to students who are not currently enrolled in the course. Credit by examination for other courses in the Department is not normally available.

The Department also offers faculty-led summer study abroad programs in Costa Rica, France, Germany, Greece, Italy, and Spain; and semester study abroad programs in Spain. Programs and exchanges in other areas of the

world are offered through study abroad providers. Information concerning these programs can be obtained directly from the Department.

Language and literature courses numbered 300 and above are principally taught in the target language; courses numbered in the 270s, 370s, and 470s are taught in English. For courses taught in English about Ancient Greek and Rome, see Classical Studies. Students may not take intermediate (200 level) courses for credit after successfully completing any advanced (300/400 level) course, except those in the 370 series or courses taught in English translation. Students who have successfully completed any course in the intermediate (200 level) sequence may not take a lower-numbered course in that sequence for a grade.

Students at all levels of world language study will have access to the Language Studies Resource Center, located in 3142 Pearson. The Resource Center contains an extensive collection of world language materials, including audio-visual materials, electronic resources, music, books, language specific software and hardware, and other course-related materials.

Materials fees: Each student enrolled in a 100- through 200- level world language course is assessed a materials and professional support fee of $25.00 per course. If a student drops a course subject to the fee by the 15th day of the semester the fee for that course will not be assessed.

Communication Proficiency requirement: The LAS College requires a grade of C or better in ENGL 250 Written, Oral, Visual, and Electronic Composition (or ENGL 250H Written, Oral, Visual, and Electronic Composition: Honors). In addition, the Department requires a grade of C or better in any course numbered between 370 and 379 taught by the Department of World Languages and Cultures or the interdepartmental program in Classical Studies.

Languages and Cultures for Professions (LCP)

Students with primary majors in the College of Business, the College of Engineering, or the College of Agriculture and Life Sciences are encouraged to complete an LCP second major option in World Languages and Cultures with a concentration in French, German, Spanish, or an LCP minor option in those languages plus Chinese Studies or Russian. The primary objective of the LCP option is to provide learning environments within which students can achieve global literacy, linguistic proficiency, and inter-cultural competence. In the LCP curriculum, students will learn how professions are shaped by social and cultural forces and, alternatively, how professions shape society. In courses on contemporary culture and society, students will identify and analyze issues dealing with the complex interrelationships of languages and cultures and consider how they may affect their chosen profession. Students will experience living and working in diverse cultural settings through study abroad and internship opportunities offered through the LCP program and/or in collaboration with the Colleges of Business, Engineering, and Agriculture and Life Sciences. Students enrolled in the LCP second major option may receive non-graded academic credit for the successful completion of internships (WLC courses numbered 499 in each language area).

For the LCP second major option, students will complete 30 credits within their language concentration beyond the fourth-semester level, selected from the list of approved LCP core courses and electives designated for their respective college curricula in either Business, Engineering, or Agriculture and Life Sciences. Students may only enroll in the LCP option as a second major and may not graduate with the LCP option in the WLC major alone.

Students in the College of Business may combine course work in the International Business (IB) Secondary Major with course work in LCP by selecting from a list of approved options. Students should consult their academic adviser in the College of Business and the WLC adviser for coursework and international experience that fulfill requirements in both the IB and LCP major options.

American Sign Language (ASL)
Courses primarily for undergraduate students

ASL 101: American Sign Language I

(4-0) Cr. 4. F.S.

Introduction to American Sign Language (ASL). Development of expressive and receptive skills including vocabulary, grammar, usage, and cultural information. Note: Distinct from “Signed English”. ASL is a natural language with its own rules of grammar and usage.

Meets U.S. Diversity Requirement

ASL 102: American Sign Language II

(4-0) Cr. 4. S.

Prereq: ASL 101

Introduction to American Sign Language (ASL) II continues development of expressive and receptive skills introduced in American Sign Language I, including vocabulary, grammar, usage, and cultural information. Distinct from “Signed English”. ASL is a natural language with its own rules of grammar and usage.

Meets U.S. Diversity Requirement

ASL 201: Intermediate American Sign Language I

(4-0) Cr. 4. F.

Prereq: ASL 102 or equivalent.

Development of fluency for intermediate conversational skills. Review of grammar and varying grammatical forms for both structured and unstructured social situations such as sharing opinions, discussing weekend activities, and exchanging views on current topics.

ASL 202: Intermediate American Sign Language II

(4-0) Cr. 4. S.

Prereq: ASL 201 or equivalent.

A continuation and further application of language principles learned in ASL 201, to deepen ability to actively engage in dialogue both in structured and unstructured social situations. Further fluency in intermediate conversational skills will be developed, particularly in the areas of sematic equivalence and dialogic/monologic register.

ASL 275: Topics in Deaf Culture

(3-0) Cr. 3.

Focus on contemporary topics in Deaf Culture, Communities, and History. Readings and discussion from a wide range of sources. Topics vary according to faculty interest.

Meets U.S. Diversity Requirement

ASL 490: Independent Study

Cr. 1-6. Repeatable, maximum of 6 credits. F.S.SS.

Prereq: 6 credits in ASL and permission of department chair

Designed to meet the needs of students in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. No more than 6 credits of ASL 490 may be counted towards graduation.

Arabic (Arabc)

Courses primarily for undergraduate students

ARABC 101: Elementary Arabic I

(4-0) Cr. 4. F.

Beginning level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture. Attention to the use of the Arabic alphabet.

ARABC 102: Elementary Arabic II

(4-0) Cr. 4. S.

Prereq: ARABC 101 or placement by department exam.

Continuation of ARABC 101. Beginning level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture.

Meets International Perspectives Requirement.

ARABC 195: Study Abroad

Cr. arr. Alt. SS., offered irregularly.

Supervised instruction in Arabic language and culture, formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Arabic.

ARABC 201: Intermediate Arabic I

(4-0) Cr. 4. F.

Prereq: ARABC 102 or placement by department exam

Intermediate level development of reading, writing, listening comprehension, and speaking in Arabic, within the context of Arabic culture.

Meets International Perspectives Requirement.

ARABC 202: Intermediate Arabic II

(4-0) Cr. 4.

Prereq: ARABC 201 or placement by department exam

Intermediate development of reading, writing, listening comprehension, and speaking skills in Modern Standard Arabic within the context of the Arabic world.

Meets International Perspectives Requirement.

ARABC 295: Study Abroad

Cr. arr. Alt. SS., offered irregularly.

Prereq: ARABC 102 or equivalent

Supervised instruction in Arabic language and culture, formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Arabic.

Chinese Studies (Chin)

Chinese Studies Minor Option 1: Chinese Studies

CHIN 201	Intermediate Mandarin Chinese I	4
CHIN 202	Intermediate Mandarin Chinese II	4
9 credits at the 300 level		9
One of the following		3
CHIN 375	China Today	
HIST 337	History of Modern China II	
6 credits from the following		6
ARCH 427	History, Theory, and Criticism of Chinese Architecture	
CHIN 272	Introduction to Chinese Culture	
CHIN 301	Advanced Mandarin Chinese I	
CHIN 302	Advanced Mandarin Chinese II	
CHIN 304	Chinese for Global Professionals	
CHIN 370	Chinese Literature in English Translation	
CHIN 375	China Today	
CHIN 403	Seminar in Chinese Language and Culture	
CHIN 490	Independent Study	
HIST 336	History of Modern China I	
HIST 337	History of Modern China II	

Chinese Studies Minor Option 2: Languages and Cultures for Professions

A. Agriculture and Life Sciences, Business, or Engineering Major and Languages and Cultures for Professions Minor Emphasis in Chinese Studies (18 credits)

CHIN 202	Intermediate Mandarin Chinese II	4
CHIN 304	Chinese for Global Professionals	4
CHIN 499X ------Internship in Chinese		3
6 cr - choose from only one of the following categories		6
CATEGORY 1		
CHIN 272	Introduction to Chinese Culture	
CHIN 370	Chinese Literature in English Translation	
CHIN 375	China Today	
CATEGORY 2		
CHIN 272	Introduction to Chinese Culture	
CHIN 301	Advanced Mandarin Chinese I	
CHIN 302	Advanced Mandarin Chinese II	
HIST 336	History of Modern China I	
HIST 337	History of Modern China II	
CHIN 403	Seminar in Chinese Language and Culture	

Courses primarily for undergraduate students

CHIN 101: Elementary Mandarin Chinese I

(4-0) Cr. 4. F.

Introduction to spoken and written colloquial Mandarin through pinyin and simplified characters.

CHIN 102: Elementary Mandarin Chinese II

(4-0) Cr. 4. S.

Prereq: CHIN 101

Introduction to spoken and written colloquial Mandarin through pinyin and simplified characters.

Meets International Perspectives Requirement.

CHIN 201: Intermediate Mandarin Chinese I

(4-0) Cr. 4. F.

Prereq: CHIN 102

Development of speaking, writing, reading, and listening skills. Review and expansion of grammar skills, intensification of character acquisition.

Meets International Perspectives Requirement.

CHIN 202: Intermediate Mandarin Chinese II

(4-0) Cr. 4. S.

Prereq: CHIN 201

Development of speaking, writing, reading, and listening skills. Review and expansion of grammar skills, intensification of character acquisition.

Meets International Perspectives Requirement.

CHIN 272: Introduction to Chinese Culture

(3-0) Cr. 3. S.

Interdisciplinary introduction to Chinese society and culture from earliest times to the present. Topics include ancient literature, philosophy, religion, art, architecture, customs, transition to a modern society, social changes, urban life, popular culture, and contemporary values and ideas.

Meets International Perspectives Requirement.

CHIN 301: Advanced Mandarin Chinese I

(3-0) Cr. 3. F.

Prereq: CHIN 202 or equivalent

Continuing development of speaking, writing, reading, and listening skills beyond intermediate level. Expansion of cultural literacy through a variety of texts from the humanities, social sciences, mass media and business.

Meets International Perspectives Requirement.

CHIN 302: Advanced Mandarin Chinese II

(3-0) Cr. 3. S.

Prereq: CHIN 301 or equivalent

Continuing development of speaking, writing, reading, and listening skills beyond intermediate level. Expansion of cultural literacy through a variety of texts from the humanities, social sciences, mass media and business.

Meets International Perspectives Requirement.

CHIN 304: Chinese for Global Professionals

(4-0) Cr. 4. S.

Prereq: CHIN 202 or equivalent

Introduction to professional language and culture in China and Chinese-speaking regions in Asia. Development of all four language skills, focusing on practical applications in the professional contexts. Development of global awareness and cross-cultural understanding. Preparation for internships.

Meets International Perspectives Requirement.

CHIN 370: Chinese Literature in English Translation

(3-0) Cr. 3. Repeatable. F.

Prereq: ENGL 150 or equivalent

Topics may include traditional prose, poetry, novel and drama; twentieth-century fiction and film. All readings and class discussions in English.

Meets International Perspectives Requirement.

CHIN 375: China Today

(3-2) Cr. 3-4. Repeatable. S.

Prereq: ENGL 250 or equivalent

Focusing on contemporary society, culture, literature and the arts. All readings, discussions, and papers in English. Topics vary from year to year.

Meets International Perspectives Requirement.

CHIN 403: Seminar in Chinese Language and Culture

(3-0) Cr. 3.

Prereq: CHIN 302 or equivalent

Critical understanding of authentic texts at the advanced level through reading, translation, and/or application in professional contexts; consolidation of existing language skills, in-depth analysis of cultural issues, and development of professional language proficiency. Taught in Chinese.

Meets International Perspectives Requirement.

CHIN 403A: Seminar in Chinese Language and Culture: Translating Contemporary Chinese Texts

(3-0) Cr. 3.

Prereq: CHIN 302

Critical understanding of authentic texts at the advanced level through reading, translation, and/or application in professional contexts; consolidation of existing language skills, in-depth analysis of cultural issues, and development of professional language proficiency. Taught in Chinese.

Meets International Perspectives Requirement.

CHIN 403B: Seminar in Chinese Language and Culture: Topics on Business and Professions

(3-0) Cr. 3.

Prereq: CHIN 302 or equivalent

Critical understanding of authentic texts at the advanced level through reading, translation, and/or application in professional contexts; consolidation of existing language skills, in-depth analysis of cultural issues, and development of professional language proficiency. Taught in Chinese.

Meets International Perspectives Requirement.

CHIN 403C: Seminar in Chinese Language and Culture: Reading Chinese Texts

(3-0) Cr. 3.

Prereq: CHIN 302 or equivalent

Critical understanding of authentic texts at the advanced level through reading, translation, and/or application in professional contexts; consolidation of existing language skills, in-depth analysis of cultural issues, and development of professional language proficiency. Taught in Chinese.

Meets International Perspectives Requirement.

CHIN 490: Independent Study

Cr. 1-6. Repeatable.

Prereq: 6 credits in Chinese and permission of department chair

Designed to meet student needs in areas beyond current course offerings or to accommodate the desire to integrate a study of literature or language with special issues in major fields.

French (Frnch)

World Languages and Cultures majors with a concentration in French have two options:

WLC Option I: French Studies

Under WLC Option I, students with a concentration in French Studies must complete at least 30 credits beyond the intermediate (FRNCH 201 Intermediate French I-FRNCH 202 Intermediate French II) level.

Major option in French Studies (30 credits total)

A. Required Core Courses (12 credits)

FRNCH 301	French Writing and Grammar	3
FRNCH 302	Reading and Writing French	3
FRNCH 340	Studies in French or Francophone Literature	3
FRNCH 476	French Civilization Seminar in English	3

B. Additional Courses (18 credits)

FRNCH 304	French for Global Professionals	3
FRNCH 305	French Conversation	3
FRNCH 320	France Today	3
FRNCH 326	Studies in French or Francophone Film	3
FRNCH 340	Studies in French or Francophone Literature	3
FRNCH 370	French Studies in English	3
FRNCH 378	French Film Studies in English	3

c. Communication Proficiency Requirements: The LAS College requires a grade of C or better in ENGL 250 Written, Oral, Visual, and Electronic Composition (or ENGL 250H Written, Oral, Visual, and Electronic Composition: Honors). In addition, the Department requires a grade of C or better in any course numbered between 370 and 379 taught by the Department of World Languages and Cultures or the interdepartmental program in Classical Studies.

Curricular Notes: no more than 6 credits from FRNCH 370 French Studies in English and/or FRNCH 378 French Film Studies in English may be counted toward the major. major. FRNCH 476 French Civilization Seminar in English and 3 credits of FRNCH 340 Studies in French or Francophone Literature must be completed on campus and may not be fulfilled through transfer or study abroad.

Minor in French

The French Minor requires 15 credits of courses taught in French. Six credits must be in the required core: French 301 and 302. At least three credits must be chosen from French 304 and 340. Courses instructed in English (French 370, 378, and 476) cannot count toward the French minor.

Six credits must be in the required core:

FRNCH 301	French Writing and Grammar	3
FRNCH 302	Reading and Writing French	3

Three credits must be in literature or business culture taught in French:

FRNCH 304	French for Global Professionals	3
FRNCH 340	Studies in French or Francophone Literature	3

WLC Option II: Languages and Cultures for Professions

Under WLC Option II students with a concentration in French must complete at least 30 credits beyond the intermediate (FRNCH 201 - FRNCH 202) level.

I. Languages and Cultures for Professions (Colleges of Agriculture and Life Sciences, Business, and Engineering)

Students with a primary major in the Colleges of Agriculture and Life Sciences, Business, or Engineering pursuing the second major option in French are required to take at least 30 credits beyond the intermediate (FRNCH 201 - FRNCH 202) level.

A. Required Core Courses (21 credits) Additional study abroad credit from an approved study abroad program may be applied to the major.

FRNCH 301	French Writing and Grammar	3
FRNCH 302	Reading and Writing French	3
FRNCH 304	French for Global Professionals	3
FRNCH 320	France Today	3
FRNCH 340	Studies in French or Francophone Literature	3
FRNCH 476	French Civilization Seminar in English	3
FRNCH 499	Internship in French	1-3

Additional Courses (9 credits)

FRNCH 305	French Conversation	3
FRNCH 326	Studies in French or Francophone Film	3
FRNCH 340	Studies in French or Francophone Literature	3
FRNCH 370	French Studies in English	3
FRNCH 378	French Film Studies in English	3

Curricular Notes: no more than 6 credits from FRNCH 370 French Studies in English and/or FRNCH 378 French Film Studies in English may be counted toward the major. Students may enroll in the Languages and Cultures for Professions (LCP) Option in French as a Second Major only. They may not graduate with the Second Major in LCP alone.

Courses primarily for undergraduate students

FRNCH 101: Elementary French I

(4-0) Cr. 4. F.SS.

Beginning level development of reading, writing, listening comprehension, and speaking in French, within the context of French culture.

FRNCH 102: Elementary French II

(4-0) Cr. 4. S.SS.

Prereq: FRNCH 101

Beginning level development of reading, writing, listening comprehension, and speaking in French, within the context of French culture.

Meets International Perspectives Requirement.

FRNCH 201: Intermediate French I

(4-0) Cr. 4. F.

Prereq: FRNCH 102

Intermediate level development of reading, writing, listening comprehension, and speaking in French within the context of French culture.

Meets International Perspectives Requirement.

FRNCH 202: Intermediate French II

(4-0) Cr. 4. S.

Prereq: FRNCH 201

Intermediate level development of reading, writing, listening comprehension, and speaking in French within the context of French culture.

Meets International Perspectives Requirement.

FRNCH 301: French Writing and Grammar

(3-0) Cr. 3. F.

Prereq: FRNCH 202

Emphasis on developing functional language skills in reading and writing. Selective review of grammar within the context of cultural and literary prose.

Meets International Perspectives Requirement.

FRNCH 302: Reading and Writing French
(3-0) Cr. 3. S.
Prereq: FRNCH 301
Readings in French prose, theater and poetry. Introduction to close reading and analysis. Development of reading and writing skills for upper-level courses.
Meets International Perspectives Requirement.

FRNCH 304: French for Global Professionals
(3-0) Cr. 3.
Prereq: FRNCH 301
Communication in business and professional contexts in French-speaking countries. Development of effective communication strategies and project management in the workplace. Cultural contexts of business and professional practice. Emphasis on working across French-American cultures. Preparation for internships.
Meets International Perspectives Requirement.

FRNCH 305: French Conversation
(3-0) Cr. 3.
Prereq: FRNCH 202
Intensive conversational and listening practice emphasizing contemporary France and the Francophone world. Native or near-native speakers are not eligible to enroll.
Meets International Perspectives Requirement.

FRNCH 320: France Today
(3-0) Cr. 3.
Prereq: FRNCH 202
Selected topics dealing with contemporary French society and culture.
Meets International Perspectives Requirement.

FRNCH 326: Studies in French or Francophone Film
(3-0) Cr. 3. Repeatable.
Prereq: FRNCH 302 or concurrent enrollment in FRNCH 302
In-depth study of a selected filmmaker, genre, or movement. Emphasis on analytical interpretation and relationship between film and French or Francophone culture, history, and society.
Meets International Perspectives Requirement.

FRNCH 340: Studies in French or Francophone Literature
(3-0) Cr. 3. Repeatable.
Prereq: FRNCH 302 or concurrent enrollment in FRNCH 302
In-depth study of a selected topic, genre, movement or writer in French or Francophone literature, civilization or culture. Emphasis on close readings and discussion.
Meets International Perspectives Requirement.

FRNCH 370: French Studies in English
(3-0) Cr. 3. Repeatable.
Author, genre, or period study in French or Francophone history, literature, or culture. Readings, discussions, and papers in English.
Meets International Perspectives Requirement.

FRNCH 370F: Studies in English Translation: French Topics on Women and Gender Studies
(Cross-listed with W S). (3-0) Cr. 3. Repeatable.
Topics vary according to faculty interest. Readings, discussions, and papers in English.
Meets International Perspectives Requirement.

FRNCH 378: French Film Studies in English
(2-2) Cr. 3. Repeatable.
Analysis and interpretation of film in French society. Topics vary according to faculty interest. Film directors, genres, movements (e.g. The New Wave), historical survey, aesthetics, and cinematography. Readings, discussions and papers in English.
Meets International Perspectives Requirement.

FRNCH 476: French Civilization Seminar in English
(3-0) Cr. 3. S.
Advanced seminar in French civilization. Topics vary according to faculty interest. Readings, discussions, and paper in English.
Meets International Perspectives Requirement.

FRNCH 490: Independent Study
Cr. 1-6. Repeatable, maximum of 9 credits.
Prereq: Permission of French staff and department chair
Designed to meet the needs of students who wish to focus on areas other than those in which courses are offered. No more than 9 credits in Frnch 490 may be counted toward graduation.

FRNCH 499: Internship in French
Cr. 1-3. Repeatable, maximum of 3 credits. F.S.SS.
Prereq: 9 credits of French at the 300 level; permission of advisor and WLC Internship Coordinator. Work experience using French language skills in the public or private sector, combined with academic work under faculty supervision
Credits may be applied only to LCP major. Offered on a satisfactory-fail basis only. No more than 3 credits of Frnch 499 may be applied to the major.

FRNCH 590: Special Topics in French
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credtis of 400 level French

FRNCH 590A: Special Topics in French: Literature or Literary Criticism
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credtis of 400 level French

FRNCH 590B: Special Topics in French: Linguistics
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credtis of 400 level French

FRNCH 590C: Special Topics in French: Language Pedagogy
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credtis of 400 level French

FRNCH 590D: Special Topics in French: Civilization
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credtis of 400 level French

Courses primarily for graduate students, open to qualified undergraduate students

FRNCH 590: Special Topics in French
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credtis of 400 level French

German (Ger)

WLC Option I: German Studies

Under WLC Option I, students with a concentration in German must complete at least 30 credits beyond the intermediate (GER 201 (https://currentcatalog.registrar.iastate.edu/collegeofliberalartsandsciences/worldlanguagesandcultures) - GER 202 (https://currentcatalog.registrar.iastate.edu/collegeofliberalartsandsciences/worldlanguagesandcultures)) level. Students electing the German Studies option may count a maximum of two of the following courses towards the major:

GER 370	German Studies in English	3-4
GER 371	The Holocaust in Text, Image, and Memory	3-4
GER 375	Grimms' Tales	3-4
GER 378	German Film and Media Studies	3-4

A. German Studies Required Core Courses: (22 credits)

GER 301	Reading: Problems of the Early Twentieth Century	3
GER 302	Composition	3
GER 304	German for Global Professionals	3
GER 305	Conversation: The City in Contemporary Europe	3
GER 320	Germany Today	3
GER 330	German Literature and Culture	3
GER 476	Topics in German Cultural Studies	3-4

B. Additional Courses:

The remaining 8 credits may be chosen from the following courses:

Repeatable course:

GER 330	German Literature and Culture	3

Study Abroad and Internship option:

GER 499	Internship in German	1-3

Courses taught in English (up to 8 credits applicable towards major; majors must enroll for 4 credits):

GER 370	German Studies in English	3-4
GER 371	The Holocaust in Text, Image, and Memory	3-4
GER 375	Grimms' Tales	3-4
GER 378	German Film and Media Studies	3-4

C. Study Abroad: The department strongly recommends that all students of German participate in an approved study abroad program based in a German-speaking country. Credit from an approved study abroad program may be applied to the major.

D. Communication Proficiency Requirements: The LAS College requires a grade of C or better in ENGL 250 Written, Oral, Visual, and Electronic Composition (or ENGL 250H Written, Oral, Visual, and Electronic Composition: Honors). In addition, the Department requires a grade of C or better in any course numbered between 370 and 379 taught by the Department of World Languages and Cultures or the interdepartmental program in Classical Studies.

Curricular Notes: GER 330 German Literature and Culture may be repeated once for major credit when offered with a different topic (6cr. total). GER 476 Topics in German Cultural Studies is required for the WLC major option in German Studies. Majors must enroll in GER 476 Topics in German Cultural Studies for 4 credits. Majors choosing the German Studies option may select two additional courses for 4 cr. from the following:

GER 370	German Studies in English	3-4
GER 371	The Holocaust in Text, Image, and Memory	3-4
GER 375	Grimms' Tales	3-4
GER 378	German Film and Media Studies	3-4

Minor in German

The German minor requires 15 credits of courses taught in German. At least six credits must be chosen from among German 301, 302, 304, 305, 320, and 330. At least three credits must be chosen from German 320 and 330. Courses taught primarily in English (German 370, 371, 375, 378, and 476) cannot count toward the German minor.

Three credits must be in literature or culture taught in German		3
GER 320	Germany Today	
GER 330	German Literature and Culture	
Eligible minor courses		12

GER 301	Reading: Problems of the Early Twentieth Century	
GER 302	Composition	
GER 304	German for Global Professionals	
GER 305	Conversation: The City in Contemporary Europe	
GER 320	Germany Today	
GER 330	German Literature and Culture	

WLC Option II: Languages and Cultures for Professions (LCP)

Under WLC Option II students with a concentration in German must complete a minimum of 30 credits beyond the intermediate (GER 201 Intermediate German I - GER 202 Intermediate German II) level.

I. Languages and Cultures for Professions (Colleges of Agriculture and Life Sciences, Business, and Engineering)

Students with a primary major in the Colleges of Agriculture and Life Sciences, Business, or Engineering pursuing the second major option in German are required to take at least 30 credits beyond the intermediate (GER 201 Intermediate German I - GER 202 Intermediate German II) level.

A. Required Core Courses (19 credits). Additional study abroad credit from an approved study abroad program may be applied to the major.

GER 301	Reading: Problems of the Early Twentieth Century	3
GER 304	German for Global Professionals	3
GER 305	Conversation: The City in Contemporary Europe	3
GER 320	Germany Today	3
GER 476	Topics in German Cultural Studies	3-4
GER 499	Internship in German *	1-3

*or approved credit-bearing study abroad experience

B. Additional Courses (11 credits)

GER 302	Composition	3
GER 330	German Literature and Culture	3
GER 370	German Studies in English	3-4
GER 371	The Holocaust in Text, Image, and Memory	3-4
GER 375	Grimms' Tales	3-4
GER 378	German Film and Media Studies	3-4

Curricular Notes: students may only enroll in the Languages and Cultures for Professions (LCP) Option as a Second Major. They may not graduate with the Second Major in LCP alone. LCP Majors may select two of the following courses, which must be taken for 4 credits:

GER 370	German Studies in English	3-4
GER 371	The Holocaust in Text, Image, and Memory	3-4
GER 375	Grimms' Tales	3-4
GER 378	German Film and Media Studies	3-4

GER 101: Elementary German I

(4-0) Cr. 4. F.SS.

Beginning level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. For beginning-level learners who have little or no prior exposure to German.

GER 102: Elementary German II

(4-0) Cr. 4. S.SS.

Prereq: GER 101

Beginning level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. For beginning level learners with only one semester of German (or exposure equivalent to two years or less in high school.).

Meets International Perspectives Requirement.

GER 201: Intermediate German I

(4-0) Cr. 4. F.

Prereq: GER 102

Intermediate level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. Intensive review of basic grammar covered in the first-year German class (or equivalent high school courses) while exploring cultural topics and themes.

Meets International Perspectives Requirement.

GER 202: Intermediate German II

(4-0) Cr. 4. S.

Prereq: GER 201

Intermediate level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. Emphasis on intermediate level grammar and communication about topics and themes beyond the personal realm.

Meets International Perspectives Requirement.

GER 301: Reading: Problems of the Early Twentieth Century

(3-0) Cr. 3. F.

Prereq: GER 202

Emphasis on the development of reading skills through a variety of text types with a focus on German Culture from circa 1900 to 1933.

Meets International Perspectives Requirement.

GER 302: Composition

(3-0) Cr. 3. S.

Prereq: GER 202

Emphasis on writing skills, with further development of grammar and reading skills using a variety of current and historical materials.

Meets International Perspectives Requirement.

GER 304: German for Global Professionals

(3-0) Cr. 3. F.

Prereq: GER 202

Communication in business and professional contexts in German-speaking countries. Development of effective communication strategies and project management in the workplace. Cultural contexts of business and professional practice. Preparation for internships.

Meets International Perspectives Requirement.

GER 305: Conversation: The City in Contemporary Europe

(3-0) Cr. 3. S.

Prereq: GER 202 minimum, GER 301 recommended

Intensive conversational and listening practice in German with an emphasis on a major German-speaking city.

Meets International Perspectives Requirement.

GER 320: Germany Today

(3-0) Cr. 3. S.

Prereq: GER 301 or GER 304

Selected topics dealing with contemporary German society and culture. Introduction to materials, resources, and forms of communication available on the Internet, and in other electronic and print media.

Meets International Perspectives Requirement.

GER 330: German Literature and Culture

(3-0) Cr. 3. Repeatable. F.

Prereq: GER 301 or permission of instructor

Selected readings in German literature from Classicism to present. Emphasis on techniques of reading and analysis of literary texts. No more than six credits of Ger 330 may be counted toward the major.

Meets International Perspectives Requirement.

GER 370: German Studies in English

(3-0) Cr. 3-4. Repeatable, maximum of 6 credits.

Prereq: Sophomore classification. For fourth credit, 6 credits in German at the 300 level

Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Three credits: English, open to all students. Four credits: Required for German concentration credit, supplementary readings and compositions in German.

Meets International Perspectives Requirement.

GER 370G: Studies in English Translation: German Topics on Women or Feminism

(Cross-listed with W S). (3-0) Cr. 3-4. Repeatable, maximum of 6 credits.

Prereq: Sophomore classification. For fourth credit, 6 credits in German at the 300 level

Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Three credits: English, open to all students. Four credits: Required for German concentration credit, supplementary readings and compositions in German.

Meets International Perspectives Requirement.

GER 371: The Holocaust in Text, Image, and Memory

(3-0) Cr. 3-4.

Prereq: Sophomore classification. For fourth credit, 6 credits in German at the 300 level

Examination of such topics as the origins and expressions of Anti-Semitism in central Europe, the political events and structures of the Holocaust, the reality of ghettos and concentration camps, the impact of technological modernization on the Final Solution, and resistance to the Nazis. Materials will include non-fictional texts, literature, art, and music. Three credits: English, open to all students. Four credits: required for German major credit, supplementary readings and compositions in German. Four credits: required for German concentration credit, supplementary readings and compositions in German.

Meets International Perspectives Requirement.

GER 375: Grimms' Tales

(3-0) Cr. 3-4.

Prereq: Sophomore classification. For fourth credit, 6 credits in German at the 300 level

Introduction to Germanic antiquities, mythology, and heroic legends; Herder's concept of Naturpoesie. Emphasis on the Grimm tales: theoretical approaches to the tales from the late 19th and early 20th centuries; perversions of these traditional tales by the National Socialists (Nazis). Readings in contemporary Grimm scholarship. Taught in English. Three credits: English, open to all students. Four credits: required for German concentration credit, supplementary readings and compositions in German.

Meets International Perspectives Requirement.

GER 378: German Film and Media Studies
(3-0) Cr. 3-4. S.
Prereq: Sophomore classification. For fourth credit, 6 credits in German at the 300 level
Analysis and interpretation of film or media in German society. Study of media production and reception within multicultural and global contexts. Thematic emphases based on faculty and student interest including: 1) film directors, genres, movements (e.g. New German Cinema), aesthetics, and cinematography or 2) media studies (e.g. television, mass press, popular culture). Three credits: English, open to all students. Four credits: required for German concentration credit, supplementary readings and compositions in German.
Meets International Perspectives Requirement.

GER 395: Study Abroad
Cr. 1-10.
Prereq: 2 years university-level German
Supervised instruction in language and culture of Germany; formal class instruction at level appropriate to student's training, augmented by practical living experience.
Meets International Perspectives Requirement.

GER 476: Topics in German Cultural Studies
(3-0) Cr. 3-4. S.
Prereq: Sophomore classification. For fourth credit, six credits in German at the 300-level courses instructed in German
Key topics and themes in German history and culture up to the modern era. Three credits: Taught in English, open to all students. Four credits: Required for German concentration credit, supplementary readings and compositions in German.
Meets International Perspectives Requirement.

GER 490: Independent Study
Cr. 1-6. Repeatable, maximum of 9 credits.
Prereq: 6 credits in German and permission of department chair
Designed to meet the needs of students who seek work in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. No more than 9 credits of Ger 490 may be counted toward graduation.

GER 499: Internship in German
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: 9 credits of German at the 300 level; permission of advisor and the World Languages and Cultures Internship coordinator
Work experience using German language skills in the public or private sector, combined with academic work under faculty supervision. Available only to majors and minors. Offered on a satisfactory-fail basis only. Ger 499 may be repeated to a maximum of 6 credits. No more than 3 credits of Ger 499 may be applied to the major.

GER 590: Special Topics in German
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level German

GER 590A: Special Topics in German: Literature or Literary Criticism
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level German

GER 590B: Special Topics in German: Linguistics
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level German

GER 590C: Special Topics in German: Language Pedagogy
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level German

GER 590D: Special Topics in German: Civilization
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level German

Greek (Greek)

For courses in Greek literature taught in English, see Classical Studies.

Courses primarily for undergraduate students

GREEK 101: Elementary Ancient and New Testament Greek I
(5-0) Cr. 5. F.
Grammar and vocabulary of ancient Greek, within the context of Greek culture; reading knowledge through texts adapted from classical and New Testament works.

GREEK 102: Elementary Ancient and New Testament Greek II
(5-0) Cr. 5. S.
Prereq: GREEK 101
Grammar and vocabulary of ancient Greek, within the context of Greek culture; reading knowledge through texts adapted from classical and New Testament works.
Meets International Perspectives Requirement.

GREEK 201: Intermediate Classical Greek
Cr. arr. F.
Prereq: GREEK 102
Emphasis on grammatical principles, composition and reading classical or Hellenistic texts.
Meets International Perspectives Requirement.

GREEK 332: Introduction to Classical Greek Literature

Cr. arr. S.

Prereq: GREEK 201

Readings in ancient Greek Literature with emphasis on critical analysis of style, structure or thought.

Meets International Perspectives Requirement.

GREEK 490: Independent Study

Cr. 1-6. Repeatable, maximum of 9 credits.

Prereq: 6 credits in Greek and permission of department chair

Designed to meet the needs of students who seek work in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. No more than 9 credits of Greek 490 may be counted toward graduation.

Latin (Latin)

For courses in Latin literature taught in English, see Classical Studies.

Courses primarily for undergraduate students

LATIN 101: Elementary Latin I

(4-0) Cr. 4. F.

Grammar and vocabulary of classical Latin, within the context of Roman culture; reading knowledge through texts adapted from classical authors.

LATIN 102: Elementary Latin II

(4-0) Cr. 4. S.

Prereq: LATIN 101

Grammar and vocabulary of classical Latin, within the context of Roman culture; reading knowledge through texts adapted from classical authors.

Meets International Perspectives Requirement.

LATIN 201: Intermediate Latin

Cr. arr. F.

Prereq: LATIN 102

Emphasis on grammatical principles, composition and reading Latin texts.

Meets International Perspectives Requirement.

LATIN 332: Introduction to Latin Literature

Cr. arr. S.

Prereq: LATIN 201

Readings in Latin Literature with emphasis on critical analysis of style, structure or thought.

Meets International Perspectives Requirement.

LATIN 490: Independent Study

Cr. 1-6. Repeatable, maximum of 9 credits.

Prereq: 6 credits in Latin and permission of department chair

Designed to meet the needs of students who seek work in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. No more than 9 credits in Latin 490 may be counted toward graduation.

Russian Studies (Rus)

Minors in Russian Studies are required to complete RUS 201 and RUS 202. The remaining 9 credits must be at the 300 level and above, including at least 3 credits in the Russian curriculum (courses taught in English or Russian).

Russian Studies Minor Option 1: Russian Studies.

9 credits at the 300 level may be selected from the following courses:

RUS 201	Intermediate Russian I	4
RUS 202	Intermediate Russian II	4
9 credits must be at the 300 level and above *		9
RUS 301	Composition and Conversation	
RUS 304	Russian for Global Professionals	
RUS 314	Reading Russian Literary and Cultural Texts	
RUS 370	Russian Studies in English Translation	
RUS 375	Russia Today	
RUS 378	Russian Film Studies in English	
RUS 395	Study Abroad	
RUS 490	Independent Study	
RUS 499	Internship in Russian	
RUS 590	Special Topics in Russian	
HIST 421	History of Russia I	
HIST 422	History of Russia II	
HIST 530	Proseminar in Modern Russian/Soviet History	
POL S 349	Politics of Russia and the Soviet Successor States	

* including at least 3 credits in the Russian curriculum (courses taught in English or Russian).

Russian Studies Minor Option 2: Languages and Cultures for Professions

A. Agriculture and Life Sciences, Business, or Engineering Major and Languages and Cultures for Professions Minor Emphasis in Russian Studies (17 credits)

Required Core Courses		11
RUS 201	Intermediate Russian I	
RUS 202	Intermediate Russian II	

RUS 304	Russian for Global Professionals	
Electives		6
RUS 301	Composition and Conversation	
RUS 314	Reading Russian Literary and Cultural Texts	
RUS 370	Russian Studies in English Translation	
RUS 375	Russia Today	
RUS 378	Russian Film Studies in English	
RUS 395	Study Abroad	
RUS 490	Independent Study	
RUS 499	Internship in Russian	
RUS 590	Special Topics in Russian	
HIST 421	History of Russia I	
HIST 422	History of Russia II	
HIST 530	Proseminar in Modern Russian/Soviet History	
POL S 349	Politics of Russia and the Soviet Successor States	

Courses primarily for undergraduate students

RUS 101: Elementary Russian I

(4-0) Cr. 4. F.

Introduction to the Russian language, grammar and syntax. Practice in the four basic skills (listening, speaking, reading, and writing) within the context of Russian culture.

RUS 102: Elementary Russian II

(4-0) Cr. 4. S.

Prereq: RUS 101

Introduction to the Russian language, grammar and syntax. Practice in the four basic skills (listening, speaking, reading, and writing) within the context of Russian culture.

Meets International Perspectives Requirement.

RUS 201: Intermediate Russian I

(4-0) Cr. 4. F.

Prereq: RUS 102

Thorough review of grammar and growth of vocabulary. Selected readings. Continued use of the four basic skills.

Meets International Perspectives Requirement.

RUS 202: Intermediate Russian II

(4-0) Cr. 4. S.

Prereq: RUS 201

Thorough review of grammar and growth of vocabulary. Selected readings. Continued use of the four basic skills.

Meets International Perspectives Requirement.

RUS 301: Composition and Conversation

(3-0) Cr. 3. F.

Prereq: RUS 202

Thorough study of the Russian language, with emphasis on strengthening proficiency in writing, speaking, reading, and listening. Increased focus on syntax and word formation.

Meets International Perspectives Requirement.

RUS 304: Russian for Global Professionals

(3-0) Cr. 3. F.

Prereq: RUS 102

Communication in business and professional contexts in Russian-speaking countries. Development of effective communication strategies and project management in the workplace. Cultural contexts of business and professional practice.

Meets International Perspectives Requirement.

RUS 314: Reading Russian Literary and Cultural Texts

(3-0) Cr. 3. Repeatable.

Prereq: RUS 102

Selected readings in Russian literature and culture. Emphasis on techniques of reading and analysis of literary and cultural texts.

Meets International Perspectives Requirement.

RUS 370: Russian Studies in English Translation

(3-0) Cr. 3. Repeatable.

Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English.

Meets International Perspectives Requirement.

RUS 370R: Studies in English Translation: Russian Topics on Women or Feminism

(Cross-listed with W S). (3-0) Cr. 3. Repeatable.

Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English.

Meets International Perspectives Requirement.

RUS 375: Russia Today

(3-0) Cr. 3. Repeatable.

A survey of social, political, economic, and cultural topics relevant to contemporary Russia. Readings, discussions and papers in English.

Meets International Perspectives Requirement.

RUS 378: Russian Film Studies in English
(3-0) Cr. 3.
Analysis and interpretation of cinema in Russia and the Soviet Union. Topics vary according to faculty interest. Film directors, genres, movements, historical survey, aesthetics, and cinematography. Readings, discussions and papers in English.
Meets International Perspectives Requirement.

RUS 395: Study Abroad
Cr. 1-6. Repeatable.
Supervised instruction in language and culture of Russia; formal class instruction at level appropriate to student's training, augmented by practical living experience.
Meets International Perspectives Requirement.

RUS 490: Independent Study
Cr. 1-6. Repeatable.
Prereq: 6 credits in Russian and permission of department chair
Designed to meet the needs of students who seek work in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. No more than 9 credits of Rus 490 may be counted toward graduation.

RUS 499: Internship in Russian
Cr. 1-3. Repeatable. F.S.SS.
Prereq: 9 credits of Russian at the 300 level; permission of advisor and WLC Internship Coordinator
Work experience using Russian language skills in the public or private sector combined with academic work under faculty supervision. Available only to minors. No more than 3 credits may be applied to the minor.

RUS 590: Special Topics in Russian
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Russian

RUS 590A: Special Topics in Russian: Literature or Literary Criticism
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Russian

RUS 590B: Special Topics in Russian: Linguistics
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Russian

RUS 590C: Special Topics in Russian: Language Pedagogy
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Russian

RUS 590D: Special Topics in Russian: Civilization
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Russian

Courses primarily for graduate students, open to qualified undergraduate students

RUS 590: Special Topics in Russian
Cr. 2-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Russian

Spanish (Span)

Go to Spanish Minor

World Languages and Cultures majors with a concentration in Spanish have two options:

WLC Option I: Hispanic Studies

Under WLC Option I, students with a concentration in Spanish must complete a minimum of 30 credits beyond the intermediate (SPAN 201 Intermediate Spanish I- SPAN 202 Intermediate Spanish II) level.

A. Hispanic Studies Required Core Courses: (12 cr.)

SPAN 303A	Spanish Conversation and Composition: through Culture	3
or SPAN 303B	Spanish Conversation and Composition: for Professionals	
SPAN 314	Textual and Media Analyses	3
SPAN 352	Introduction to Spanish Phonology	3

B. Additional Courses: Students must take at least 15 credits chosen from a, b, and c below (minimum of 3 credits from each section).

a) At least 3 credits of literary studies chosen from the following:

SPAN 330	Studies in Spanish Literature	3
SPAN 332	Studies in Latin American Literature	3

b) At least 3 credits of cultural studies chosen from the following:

SPAN 304	Spanish for Global Professionals	3
SPAN 321	Spanish Civilization	3
SPAN 322	Latin American Civilization	3
SPAN 323	Spain Today	3
SPAN 324	Latin America Today	3
SPAN 326	Studies in Hispanic Art or Film	3

c) At least 3 credits of applied language and linguistics chosen from the following:

SPAN 351	Introduction to Spanish-English Translation	3
SPAN 354	Introduction to Spanish-English Interpretation	3
SPAN 401	Advanced Composition and Grammar	3

SPAN 462	Contrastive Analysis of Spanish/ English for Translators	3
SPAN 463	Hispanic Dialectology	3
SPAN 499	Internship in Spanish	1-3

Students may apply up to 6 credits of SPAN 395 Study Abroad to section a, b, or c above (appropriate section based upon course content and assigned by the WLC adviser).

C. Students must take at least 6 credits of literature and/or culture at the 400 level, chosen from the following (each repeatable to 6 credits.):

SPAN 440	Seminar on the Literatures and Cultures of Spain	3
SPAN 441	Seminar on Cervantes and the Golden Age	3
SPAN 445	Seminar on the Literatures and Cultures of Latin America	3

D. Study Abroad: The department strongly recommends that all students of Spanish participate in an approved study abroad program based in a Spanish-speaking country. Under Option I, any student who chooses not to participate in a department-approved program will be required to take 3 additional elective credits of Spanish at or above the SPAN 321 level (for a total of 33 credits beyond the intermediate 201-202 level).

E. Communication Proficiency Requirements: The LAS College requires a grade of C or better in ENGL 250 Written, Oral, Visual, and Electronic Composition (or ENGL 250H Written, Oral, Visual, and Electronic Composition: Honors). In addition, the Department requires a grade of C or better in any course numbered between 370 and 379 taught by the Department of World Languages and Cultures or the interdepartmental program in Classical Studies. Such a course will also fill an LAS Area I (Arts and Humanities) requirement.

WLC Option II: Language and Cultures for Professions

Under WLC Option II students with a concentration in Spanish must complete a minimum of 30 credits beyond the intermediate (SPAN 201 Intermediate Spanish I-SPAN 202 Intermediate Spanish II) level.

I. Languages and Cultures for Professions (Colleges of Agriculture and Life Sciences, Business, and Engineering)

Students with a primary major in the Colleges of Agriculture and Life Sciences, Business, or Engineering pursuing the second major option in Spanish are required to take at least 30 credits beyond the intermediate (SPAN 201 Intermediate Spanish I-SPAN 202 Intermediate Spanish II) level.

A. Required LCP Core Courses: (12 Credits)

SPAN 303B	Spanish Conversation and Composition: for Professionals	3
SPAN 304	Spanish for Global Professionals	3
SPAN 351	Introduction to Spanish-English Translation	3
SPAN 499	Internship in Spanish *	1-10
or SPAN 395	Study Abroad	

B. Literature and Culture Courses: (9 Credits)

SPAN 314	Textual and Media Analyses	3
SPAN 323	Spain Today **	3
or SPAN 321	Spanish Civilization	
SPAN 324	Latin America Today	3
or SPAN 322	Latin American Civilization	

C. Additional Courses: (6 credits)

Select one course from each of the following two literature categories:

Category 1:

SPAN 330	Studies in Spanish Literature	3
SPAN 332	Studies in Latin American Literature	3

Category 2:

SPAN 440	Seminar on the Literatures and Cultures of Spain	3
SPAN 441	Seminar on Cervantes and the Golden Age	3
SPAN 445	Seminar on the Literatures and Cultures of Latin America	3

D. Additional three credits taken at the 300-level or higher.

*Additional credit from an approved study abroad program may be applied to the major.

**SPAN 321 Spanish Civilization and SPAN 322 Latin American Civilization may be substituted.

Curricular Notes: students may only enroll in the Languages and Cultures for Professions (LCP) Option as a second major. They may not graduate with the second major in LCP alone.

Minor in Spanish

The Spanish minor: Option 1:Hispanic Studies, Option 2: Languages and Cultures for Professions

Option 1: The Spanish minor in Hispanic Studies requires at least 15 credits, 12 of which must be at the 300 level or higher. The department strongly recommends that all students of Spanish participate in an approved study abroad program based in a Spanish-speaking country. Any student who chooses not to participate in a department-approved

study abroad program will be required to take 3 additional elective credits of Spanish at the 300 level or higher.

Option 2: Language and Cultures for Professions. The Spanish minor in Languages and Cultures for Professions requires the following courses (12 credits):

SPAN 303B	Spanish Conversation and Composition: for Professionals	3
SPAN 304	Spanish for Global Professionals	3
SPAN 351	Introduction to Spanish-English Translation	3
One of the following		3
SPAN 321	Spanish Civilization	
SPAN 322	Latin American Civilization	
SPAN 323	Spain Today	
SPAN 324	Latin America Today	

The department strongly recommends that all students of Spanish participate in an approved study abroad program based in a Spanish-speaking country. Any student who chooses not to participate in a department-approved study abroad program will be required to take 3 additional credits in culture chosen from the following:

SPAN 321	Spanish Civilization	3
SPAN 322	Latin American Civilization	3
SPAN 323	Spain Today	3
or SPAN 324	Latin America Today	

Note: students taking either SPAN 321 Spanish Civilization or SPAN 323 Spain Today must take either SPAN 322 Latin American Civilization or SPAN 324 Latin America Today; students taking either SPAN 322 Latin American Civilization or SPAN 324 Latin America Today must take either SPAN 321 Spanish Civilization or SPAN 323 Spain Today.

Courses primarily for undergraduate students

SPAN 097: Accelerated Spanish Review

(3-2) Cr. 0. F.S.

Prereq: Two years but less than three years of high-school Spanish

For students who require additional review at the first year (101-102) level. Course components include a compact review of 101 and the essential elements of 102. Course completed with a passing grade fulfills the LAS foreign language requirement. Not recommended for students who wish to continue language at the second year (201-202) level without completing 102.

SPAN 101: Elementary Spanish I

(4-0) Cr. 4. F.SS.

A communicative approach to grammar and vocabulary within the context of Hispanic culture. For students whose native language is not Spanish.

SPAN 102: Elementary Spanish II

(4-0) Cr. 4. S.SS.

Prereq: SPAN 101, SPAN 97 or placement by departmental exam

Continuation of Spanish 101. A communicative approach to grammar and vocabulary within the context of Hispanic culture. For students whose native language is not Spanish.

Meets International Perspectives Requirement.

SPAN 195: Study Abroad

Cr. 3. SS.

Supervised instruction in Spanish and Hispanic culture; formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Spanish. Consult the department regarding equivalency with SPAN 101 or 102.

Meets International Perspectives Requirement.

SPAN 201: Intermediate Spanish I

(4-0) Cr. 4. F.

Prereq: SPAN 102 or placement by departmental exam

Intensive review of basic grammar and conversation. For students whose native language is not Spanish. Practice in oral and written communication. Development of fluency with idiomatic expressions. Selected readings on culture and literature.

Meets International Perspectives Requirement.

SPAN 202: Intermediate Spanish II

(4-0) Cr. 4. S.

Prereq: SPAN 201 or placement by departmental exam

Continuation of Spanish 201. Intensive review of basic grammar. Practice in oral and written communication. Development of fluency with idiomatic expressions. Selected readings on culture and literature. For students whose native language is not Spanish.

Meets International Perspectives Requirement.

SPAN 295: Study Abroad

Cr. 3. SS.

Prereq: SPAN 102 or equivalent

Supervised instruction in Spanish and Hispanic culture; formal class instruction at level appropriate to student's training, augmented by practical living experience. Taught in Spanish. Consult the department regarding equivalency with Span 201 or 202.

Meets International Perspectives Requirement.

SPAN 297: Intensive Intermediate Spanish
(4-0) Cr. 4. F.S.
Prereq: 4 years of high school Spanish, two years of Spanish at a community college, Spanish 201, or equivalent by placement
Bridge course between 200- and 300-level Spanish courses that focuses on application of advanced grammatical concepts within the context of Hispanic culture. Accelerated review of SPAN 201 and SPAN 202 designed for students who want to continue at the 300 level. Taught in Spanish for students whose native language is not Spanish.
Meets International Perspectives Requirement.

SPAN 301: Spanish Grammar and Composition
(3-0) Cr. 3. F.S.
Prereq: SPAN 202 or placement by departmental exam
Review and application of grammar concepts in the development of writing skills within the context of Hispanic culture. Taught in Spanish. For students whose native language is not Spanish.
Meets International Perspectives Requirement.

SPAN 303: Spanish Conversation and Composition
(3-0) Cr. 3. F.S.
Prereq: SPAN 202 or placement by departmental exam
Intensive oral practice and improvement of oral proficiency. Application of specific grammatical concepts for development of conversational and writing skills within the context of Hispanic culture. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 303A: Spanish Conversation and Composition: through Culture
(3-0) Cr. 3. F.S.
Prereq: SPAN 202 or placement by departmental exam
Intensive oral practice and improvement of oral proficiency. Application of specific grammatical concepts for development of conversational and writing skills within the context of Hispanic culture. Taught in Spanish. For students whose native language is not Spanish.
Meets International Perspectives Requirement.

SPAN 303B: Spanish Conversation and Composition: for Professionals
(3-0) Cr. 3. F.S.
Prereq: SPAN 202 or placement by departmental exam
Intensive oral practice and improvement of oral proficiency. Application of specific grammatical concepts for development of conversational and writing skills within the context of Hispanic culture. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 304: Spanish for Global Professionals
(3-0) Cr. 3. F.S.
Prereq: SPAN 202 or placement by departmental exam (SPAN 301 recommended)
Introduction to professional communication within a cultural context. Grammar review as needed. Individual projects will focus on special interests. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 314: Textual and Media Analyses
(3-0) Cr. 3. F.S.
Prereq: SPAN 301
Critical reading of Hispanic cultural texts. Presentation of techniques and terminology of textual criticism. Study of basic genres and media-generated artifacts and literary texts. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 321: Spanish Civilization
(3-0) Cr. 3.
Prereq: One course at the 300 level
A survey of the social, political, religious, and cultural history of Spain. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 322: Latin American Civilization
(3-0) Cr. 3.
Prereq: One course at the 300 level
A survey of the social, political, religious, and cultural history of Spanish America. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 323: Spain Today
(3-0) Cr. 3.
Prereq: One course at the 300 level
A survey of social, political, economic, and cultural topics relevant to contemporary Spain. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 324: Latin America Today
(3-0) Cr. 3.
Prereq: One course at the 300 level
A survey of social, political, economic, and cultural topics relevant to contemporary Latin America. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 326: Studies in Hispanic Art or Film
(Dual-listed with SPAN 526). (3-0) Cr. 3.
Prereq: One course at the 300 level
Survey of major currents and figures in Spanish and Latin American art and/or film. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 330: Studies in Spanish Literature
(3-0) Cr. 3.
Prereq: SPAN 314
Introduction to Spanish literature from the earliest times through the present; techniques of literary criticism. Lectures, discussion, and analysis of individual selections in Spanish. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 332: Studies in Latin American Literature
(3-0) Cr. 3.
Prereq: SPAN 314
Introduction to Latin American literature from the earliest times to the present; techniques of literary criticism. Lectures, discussion, and analysis of individual selections in Spanish. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 351: Introduction to Spanish-English Translation
(Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: SPAN 301, SPAN 303 or SPAN 304
Introduction to the theory, methods, techniques, and problems of translation. Consideration of material from business, literature, and the social sciences. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 352: Introduction to Spanish Phonology
(Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: SPAN 301, SPAN 303 or SPAN 304
An introductory study of the articulation, classification, distribution, and regional variations of the sounds of the Spanish language. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 354: Introduction to Spanish-English Interpretation
(Dual-listed with SPAN 554). (Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: SPAN 351
Introduction to the theory, methods, techniques, and problems of consecutive and simultaneous interpretation. Consideration of material from business, agriculture, law, design, medicine, literature, advertisement, and sports. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 370: Hispanic Topics in English Translation
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English. May not be counted as a prerequisite.
Meets International Perspectives Requirement.

SPAN 370A: Hispanic Topics in English Translation: Agriculture
(3-0) Cr. 3. Repeatable, maximum of 6 credits.
Topics vary according to faculty interest. Knowledge and understanding of major cultural, ethical, sociopolitical and economic issues directly related to agriculture and agribusiness in Latin America, Spain, and/or Equatorial Guinea. Readings, discussions, and papers in English. May not be counted as a prerequisite.

SPAN 370S: Studies in English Translation: Hispanic Topics on Women or Feminism
(Cross-listed with W S). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Topics vary according to faculty interest. Author, genre or period study, women writers, cinema, or contemporary theory. Readings, discussions, and papers in English. May not be counted as a prerequisite.
Meets International Perspectives Requirement.

SPAN 395: Study Abroad
Cr. 1-10. Repeatable.
Prereq: 2 years university-level Spanish or equivalent
Supervised instruction in Spanish and Hispanic culture; formal class instruction at level appropriate to students' training, enhanced by practical living experience.
Meets International Perspectives Requirement.

SPAN 401: Advanced Composition and Grammar
(Dual-listed with SPAN 501). (3-0) Cr. 3. F.
Prereq: SPAN 314 and one course at the 320-level or above
Advanced study of Spanish grammar and syntax. Students' writing of compositions incorporates an advanced understanding of grammar, syntax, and principles of organization of thought and ideas. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 440: Seminar on the Literatures and Cultures of Spain
(Dual-listed with SPAN 540). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, or SPAN 333. (Recommended SPAN 330 and SPAN 331)
Discussion and analysis of selected topics in Spanish literature and culture from the Middle Ages to the Present. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 441: Seminar on Cervantes and the Golden Age
(Dual-listed with SPAN 541). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, or SPAN 333. (SPAN 330 recommended)
Discussion and analysis of selected works of Cervantes within the social and cultural context of the Golden Age. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 445: Seminar on the Literatures and Cultures of Latin America
(Dual-listed with SPAN 545). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, SPAN or SPAN 333. (SPAN 332 and SPAN 333 recommended)
Discussion and analysis of selected topics in Latin American literature and culture from Pre-Colonial times to the Present. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 462: Contrastive Analysis of Spanish/ English for Translators
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: SPAN 351
Linguistic study of the major differences between the Spanish and English grammatical systems and their applications in the translation of Spanish to English. Taught in Spanish.

SPAN 463: Hispanic Dialectology
(Cross-listed with LING). (3-0) Cr. 3.
Prereq: SPAN 352
Intensive study of the phonology, morphosyntax and lexicon of the Hispanic dialects of Spain and Latin America in their historical context. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 490: Independent Study
Cr. 1-6. Repeatable, maximum of 6 credits.
Prereq: 6 credits in Spanish and permission of department chair
Designed to meet the needs of students in areas other than those in which courses are offered, or who desire to integrate a study of literature or language with special problems in major fields. No more than 6 credits in Span 490 may be counted toward graduation.

SPAN 499: Internship in Spanish
Cr. 1-3. Repeatable, maximum of 6 credits. F.S.SS.
Prereq: 9 credits of Spanish at the 300 level; permission of advisor and WLC Internship Coordinator
Work experience using Spanish language skills in the public or private sector, combined with academic work under faculty supervision. Up to 3 credits may apply toward the major. Available only to majors and minors.

SPAN 501: Advanced Composition and Grammar
(Dual-listed with SPAN 401). (3-0) Cr. 3. F.
Prereq: SPAN 314 and one course at the 320-level or above
Advanced study of Spanish grammar and syntax. Students' writing of compositions incorporates an advanced understanding of grammar, syntax, and principles of organization of thought and ideas. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 526: Studies in Hispanic Art or Film
(Dual-listed with SPAN 326). (3-0) Cr. 3.
Prereq: 6 credits in Spanish literature or culture at 400 level
Survey of major currents and figures in Spanish and Latin American art and/or film.

SPAN 540: Seminar on the Literatures and Cultures of Spain
(Dual-listed with SPAN 440). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, or SPAN 333. (Recommended SPAN 330 and SPAN 331)
Discussion and analysis of selected topics in Spanish literature and culture from the Middle Ages to the Present. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 541: Seminar on Cervantes and the Golden Age
(Dual-listed with SPAN 441). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, or SPAN 333. (SPAN 330 recommended)
Discussion and analysis of selected works of Cervantes within the social and cultural context of the Golden Age. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 545: Seminar on the Literatures and Cultures of Latin America
(Dual-listed with SPAN 445). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, SPAN or SPAN 333. (SPAN 332 and SPAN 333 recommended)
Discussion and analysis of selected topics in Latin American literature and culture from Pre-Colonial times to the Present. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 554: Introduction to Spanish-English Interpretation
(Dual-listed with SPAN 354). (Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: SPAN 351
Introduction to the theory, methods, techniques, and problems of consecutive and simultaneous interpretation. Consideration of material from business, agriculture, law, design, medicine, literature, advertisement, and sports. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 590: Special Topics in Spanish
Cr. 1-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Spanish

SPAN 590A: Special Topics in Spanish: Literature or Literary Criticism
Cr. 1-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Spanish

SPAN 590B: Special Topics in Spanish: Linguistics
Cr. 1-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Spanish

SPAN 590C: Special Topics in Spanish: Language Pedagogy
Cr. 1-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Spanish

SPAN 590D: Special Topics in Spanish: Civilization
Cr. 1-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Spanish

Courses primarily for graduate students, open to qualified undergraduate students

SPAN 501: Advanced Composition and Grammar
(Dual-listed with SPAN 401). (3-0) Cr. 3. F.
Prereq: SPAN 314 and one course at the 320-level or above
Advanced study of Spanish grammar and syntax. Students' writing of compositions incorporates an advanced understanding of grammar, syntax, and principles of organization of thought and ideas. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 526: Studies in Hispanic Art or Film
(Dual-listed with SPAN 326). (3-0) Cr. 3.
Prereq: 6 credits in Spanish literature or culture at 400 level
Survey of major currents and figures in Spanish and Latin American art and/or film.

SPAN 540: Seminar on the Literatures and Cultures of Spain
(Dual-listed with SPAN 440). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, or SPAN 333. (Recommended SPAN 330 and SPAN 331)
Discussion and analysis of selected topics in Spanish literature and culture from the Middle Ages to the Present. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 541: Seminar on Cervantes and the Golden Age
(Dual-listed with SPAN 441). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, or SPAN 333. (SPAN 330 recommended)
Discussion and analysis of selected works of Cervantes within the social and cultural context of the Golden Age. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 545: Seminar on the Literatures and Cultures of Latin America
(Dual-listed with SPAN 445). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: SPAN 330, SPAN 331, SPAN 332, SPAN or SPAN 333. (SPAN 332 and SPAN 333 recommended)
Discussion and analysis of selected topics in Latin American literature and culture from Pre-Colonial times to the Present. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 554: Introduction to Spanish-English Interpretation
(Dual-listed with SPAN 354). (Cross-listed with LING). (3-0) Cr. 3. F.S.
Prereq: SPAN 351
Introduction to the theory, methods, techniques, and problems of consecutive and simultaneous interpretation. Consideration of material from business, agriculture, law, design, medicine, literature, advertisement, and sports. Taught in Spanish.
Meets International Perspectives Requirement.

SPAN 590: Special Topics in Spanish
Cr. 1-4. Repeatable.
Prereq: Permission of instructor; 6 credits of 400 level Spanish

World Film Studies

The World Film Studies undergraduate minor is an interdisciplinary, cross-cultural program in the department of World Languages and Cultures that provides coursework in the history, theory, and aesthetics of cinemas of the non-English-speaking world. Upon completion of the World Film Studies minor students will

1) demonstrate solid skills of formal film analysis and knowledge of the essential theoretical concepts of cinema studies;

2) become familiar with prominent film directors, influential cinematic works, and cinematic traditions across the world;

3) gain an understanding of the evolution of cinema as an art form; understand the relations between cinema and other arts;

4) acquire knowledge and understanding of cinema as a mode of cultural expression and communication; develop new perspectives on U.S. culture and cinema through comparison with other non-English-speaking world cultures and cinemas.

A student seeking an undergraduate minor in World Film Studies must successfully complete a minimum of 15 credits, which must include WLC 278 Introduction to Global Film (Introduction to Global Film) and 12 credits selected from the following list of electives. Of these, at least 6 credits must be from courses taught in the department of World Languages and Cultures.

Courses taught in WLC (at least 6 credits)		
CHIN 370	Chinese Literature in English Translation	3
FRNCH 326	Studies in French or Francophone Film	3
FRNCH 378	French Film Studies in English	3
GER 378	German Film and Media Studies	3-4
RUS 378	Russian Film Studies in English	3
SPAN 326	Studies in Hispanic Art or Film	3

Courses outside of WLC		
ENGL 237	Survey of Film History	3
ENGL 315	Creative Writing: Screenplays	3
ENGL 335	Studies in Film	3
ENGL 450	Seminar in Literary Genres	3
JL MC 307	Digital Video Production	3

Curricular note: no more than 6 credits of each repeatable course (FRNCH 326 and FRNCH 378) may be applied to the minor.

World Languages and Cultures B.A-French/German/Spanish

Freshman

Fall	Credits	Spring	Credits
ENGL 150		3 Humanities Choice	3
Language 101[1]		4 Language 102[1]	4
Elective		3 Humanities Choice	3
Humanties Choice		3 Natural Science Choice	2
Natural Science Choice		3 Social Science Choice	3
		LIB 160	1
	16		16

Sophomore

Fall	Credits	Spring	Credits
Language 201		4 Language 202	4
ENGL 250		3 Humanities Choice	3
Natural Science Choicer		3 Social Science Choice	3
Social Science Choice		3 Elective	3
Elective		2 Elective	3
	15		16

Junior

Fall	Credits	Spring	Credits
Language Choice - 300 Level		3 Language Choice - 300 Level	3
Language Choice - 300 Level		3 Language Choice - 300 Level	3
English Proficiency Requirement[2]		3 Language Choice - 300 Level	3
Math Choice		3-4 Elective	3
Elective		3-4 Elective	3
	15-17		15

Senior

Fall	Credits	Spring	Credits
Language Choice - 300 or 400 Level		3 Language Choice - 300 or 400 Level	3
Language Choice - 400 Level		3 Language Choice - 400 Level	3
Language Choice - 400 Leve		3 Language Choice - 400 Level	3
Electives		6 Elecitves[3]	6
	15		15

Graduate Study

The Department of World Languages and Cultures offers course work leading to a graduate minor in French, German, Latin, Russian Studies or Spanish. The graduate minor in each of these languages is designed to provide an opportunity for graduate students to further their knowledge of that language to complement work in their major disciplines. The graduate minor provides formal recognition of student achievement and expertise in one of the languages above. Graduate minor credits are also offered in Greek.

Graduate Minor

Program Requirements:

Prerequisites

Graduate students who wish to minor in one of the languages above must have 400-level proficiency in that language. When this is not the case, the student may be required to take a language course below the 400-level, which would not count towards the graduate minor requirements.

Course Requirements

For the M.A. or M.S.: Three courses in the language of the minor. No more than three credits may be in courses numbered 401, 402, and 403. For the Ph.D.: Four courses in the language of the minor which must include at least one three credit course at the 500 level. No more than three credits may be in courses numbered 401, 402, or 403. At least two courses for the M.A. and the Ph.D. minors must be taken in residence at Iowa State University. Papers written for these courses are expected to

have a content and depth commensurate with the graduate status of the student.

Courses primarily for undergraduates:

WLC 119: Introduction to World Languages
(Cross-listed with LING). (3-0) Cr. 3.
Study of language diversity and the personal, social and political effects of diversity. Language families, attitudes toward language and language use, language and culture, multilingualism, foreign language learning, written codes, official languages, and language policy.
Meets International Perspectives Requirement.

WLC 270: Cultures in Transition
(3-0) Cr. 3.
An interdisciplinary introduction to a world region in a state of rapid social and cultural transition. Discussion of the history, social and political institutions, arts, economy, agriculture, and environment of the new nations.
Meets International Perspectives Requirement.

WLC 278: Introduction to Global Film
(3-0) Cr. 3. F.
Introduction to the cinema of non-English speaking regions and cultures of the world through representative subtitled films, lectures, and readings. Topics vary according to faculty interest. Emphasis on selected national cinemas and film as a mode of cultural expression as well as on diverse cultural contexts of cinema.
Meets International Perspectives Requirement.

WLC 370: Topics in World Languages and Cultures in English Translation
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English.
Meets International Perspectives Requirement.

WLC 370A: Topics in World Languages and Cultures in English Translation: Global Sustainability
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English.
Meets International Perspectives Requirement.

WLC 370B: Topics in World Languages and Cultures in English Translation: Middle East
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English.
Meets International Perspectives Requirement.

WLC 370C: Topics in World Languages and Cultures in English Translation: Global Urban Cultures
(3-0) Cr. 3. Repeatable, maximum of 9 credits.
Topics vary according to faculty interest. Author, genre or period study, women's writing, cinema, or cultural studies of a non-English speaking world culture or cultures. Readings, discussion, and written work in English.
Meets International Perspectives Requirement.

WLC 417: Student Teaching
Cr. 8-12. F.S.
Prereq: minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in the liberal arts and sciences.

WLC 417G: Student Teaching: World Language
(Dual-listed with WLC 517G). (Cross-listed with C I). Cr. arr. F.S.
Prereq: minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in world languages, secondary grades.

WLC 484: Technology, Globalization and Culture
(Dual-listed with WLC 584). (Cross-listed with M E). (3-0) Cr. 3. F.
Prereq: junior or senior classification for M E 484; graduate classification for M E 584
Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists.
Meets International Perspectives Requirement.

WLC 486: Methods in Elementary School World Language Instruction
(Cross-listed with C I, LING). (3-0) Cr. 3. F.
Prereq: 25 credits in a world language
Planning, implementation, and assessment of standards-based, student-centered, and thematic instruction in the elementary (K-8) classroom. Special emphasis on K-8 students' communicative skills, cultural knowledge, and content learning.

WLC 487: Methods in Secondary School World Language Instruction
(Cross-listed with C I, LING). (3-0) Cr. 3. F.
Prereq: 25 credits in a world language, admission to the teacher education program, OPI
Theories and principles of contemporary world language learning and teaching. Special emphasis on designing instruction and assessments for active learning.

WLC 491: Experiences Abroad: Learning to Think Globally
(Cross-listed with INTST). (1-0) Cr. 1. Repeatable, maximum of 2 credits.
Prereq: Minimum of 3 cr. study abroad and/or internship abroad
Students returning from study abroad gain perspective on the personal, academic, and professional impact of their time spent abroad through readings and discussions. Students will be expected to make one presentation about the culture they experienced to an audience outside ISU. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

WLC 517G: Student Teaching: World Language
(Dual-listed with WLC 417G). (Cross-listed with C I). Cr. arr. F.S.
Prereq: minimum GPA of 2.5; Admission to teacher education, approval of coordinator during semester before student teaching
Evaluation of instruction, lesson planning, and teaching in world languages, secondary grades.

WLC 584: Technology, Globalization and Culture
(Dual-listed with WLC 484). (Cross-listed with M E). (3-0) Cr. 3. F.
Prereq: junior or senior classification for M E 484; graduate classification for M E 584
Cross-disciplinary examination of the present and future impact of globalization with a focus on preparing students for leadership roles in diverse professional, social, and cultural contexts. Facilitate an understanding of the threats and opportunities inherent in the globalization process as they are perceived by practicing professionals and articulated in debates on globalization. Use of a digital forum for presenting and analyzing globalization issues by on-campus and off-campus specialists.
Meets International Perspectives Requirement.

Department of Ecology, Evolution, and Organismal Biology

Undergraduate Study

Within the Biological Sciences, studies of ecology, evolution, and organismal biology are essential in understanding the complex relationships of life on Planet Earth. Ecology focuses on the interactions among organisms as well as the interactions between organisms and their physical environments. Evolutionary theory addresses the origins and interrelationships of species. Organismal biology studies both the diversity of biological organisms and the structure and function of individual organisms.

The EEOB Department offers several undergraduate majors with other departments. Students interested in the areas of ecology, evolution, and organismal biology should major in Biology, Environmental Science, or Genetics. The Biology Major is administered and offered jointly by the EEOB and GDCB departments. The faculty of EEOB, together with those in GDCB and BBMB, administer and offer the Genetics Major. Faculty in EEOB, in cooperation with faculty from other departments on campus, administer and offer the Environmental Science Major. Each of these majors is available through the College of Liberal Arts and Sciences or through the College of Agriculture and Life Sciences. Faculty in the EEOB Department also teach undergraduate courses at Iowa Lakeside Laboratory (see the Iowa Lakeside Laboratory listing).

The Biology Major, the Environmental Science Major, and the Genetics Major prepare students for a wide range of careers in biological sciences. Some of these careers include conservation of natural resources and biodiversity, human and veterinary medicine, and life science education. These majors are also excellent preparation for graduate study in systematics, ecology, biological diversity, physiology, and related fields. Faculty members in EEOB contribute to the undergraduate courses listed below. The titles and descriptions of these courses are in the Biology section of the catalog.

BIOL 101	Introductory Biology	3
BIOL 110	Introduction to Biology	1
BIOL 111	Opportunities in Biology	0.5
BIOL 155	Human Biology	3
BIOL 173	Environmental Biology	3
BIOL 204	Biodiversity	2
BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 255	Fundamentals of Human Anatomy	3

BIOL 255L	Fundamentals of Human Anatomy Laboratory	1
BIOL 256	Fundamentals of Human Physiology	3
BIOL 256L	Fundamentals of Human Physiology Laboratory	1
BIOL 307	Women in Science and Engineering	3
BIOL 312	Ecology	4
BIOL 313	Principles of Genetics	3
BIOL 313L	Genetics Laboratory	1
BIOL 315	Biological Evolution	3
BIOL 335	Principles of Human and Other Animal Physiology	4
BIOL 336	Ecological and Evolutionary Animal Physiology	3
BIOL 351	Comparative Chordate Anatomy	5
BIOL 352	Vertebrate Histology	4
BIOL 353	Introductory Parasitology	3
BIOL 354	Animal Behavior	3
BIOL 355	Plants and People	3
BIOL 356	Dendrology	4
BIOL 364	Invertebrate Biology	3-4
BIOL 365	Vertebrate Biology	4
BIOL 366	Plant Systematics	4
BIOL 371	Ecological Methods	3
BIOL 381	Environmental Systems I: Introduction to Environmental Systems	3-4
BIOL 382	Environmental Systems II: Analysis of Environmental Systems	3
BIOL 393	North American Field Trips in Biology	1-4
BIOL 394	International Field Trips in Biology	1-4
BIOL 434	Endocrinology	3
BIOL 439	Environmental Physiology	3-4
BIOL 454	Plant Anatomy	4
BIOL 455	Bryophyte and Lichen Biodiversity	3
BIOL 456	Principles of Mycology	3
BIOL 457	Herpetology	2
BIOL 458	Ornithology	2
BIOL 459	Mammalogy	2
BIOL 462	Evolutionary Genetics	3
BIOL 471	Introductory Conservation Biology	3
BIOL 472	Community Ecology	3
BIOL 474	Plant Ecology	3
BIOL 476	Functional Ecology	3
BIOL 486	Aquatic Ecology	3
BIOL 486L	Aquatic Ecology Laboratory	1
BIOL 487	Microbial Ecology	3
BIOL 488	Identification of Aquatic Organisms	1
BIOL 489	Population Ecology	3
BIOL 490	Independent Study	1
BIOL 491	Undergraduate Teaching Experience	1-2
BIOL 494	Biology Internship	1-3
BIOL 495	Undergraduate Seminar	1-3
BIOL 498	Cooperative Education	R

Graduate Study

The department offers graduate work leading to both Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees. EEOB graduate students major in one of several interdepartmental majors including Bioinformatics and Computational Biology, Ecology and Evolutionary Biology, Environmental Science, Genetics, Interdisciplinary Graduate Studies, Neuroscience, and Toxicology. The EEOB faculty members are active in the interdepartmental graduate majors and teach a wide range of graduate courses. Faculty research programs cover a wide range of specializations including physiology and physiological ecology; Microbiology; animal behavior; evolutionary genetics of plants and animals; modeling of evolutionary and ecological processes; plant and animal systematics; neurobiology; developmental biology; aquatic and wetland ecology; functional, population, community, landscape, and ecosystem ecology; and conservation biology. For further information on faculty research interests check the EEOB web site (www.eeob.iastate.edu (http://www.eeob.iastate.edu)). Some EEOB faculty teach graduate courses at Iowa Lakeside Laboratory. Field Station courses are also available through the Gulf Coast Marine Laboratory and the Organization for Tropical Studies (see the Biology listing).

Prospective graduate students need a sound background in the physical and biological sciences, as well as in mathematics and English. Interested students should check the Graduate Program link from the EEOB web site for specific admission procedures and updates. The department and majors require submission of Graduate Record Examination (GRE) aptitude test scores. Subject area GRE scores are recommended. International students whose native language is other than English must also submit TOEFL or IELTS scores with their application.

Students who are enrolled in the interdepartmental graduate majors with EEOB affiliation are required to participate in departmental seminars, to participate in research activities, and to show adequate progress and professional development while pursuing their degree. For both the M.S. and Ph.D. degrees, it is expected that research conducted by the student will culminate in the writing and presentation of a thesis or dissertation. Requirements and guidelines for study are provided by the Graduate College, the EEOB faculty, and the individual student's major professor and Program of Study Committee. General information about graduate study requirements can be found at the web site for the Graduate College

and requirements for the interdepartmental majors can be found by following the links from the EEOB web site above. Although not a formal requirement, the EEOB faculty recommends that students pursuing the Ph.D. include teaching experience in their graduate training.

Courses primarily for graduate students, open to qualified undergraduates:

EEOB 507: Advanced Animal Behavior
(3-0) Cr. 3. S.
Prereq: Graduate standing, BIOL 354, or permission of instructor
Analysis of current research in animal behavior. Topics covered may include behavioral ecology, mechanisms of behavior, evolution of behavior, applications of animal behavior to conservation biology, and applications of animal behavior to wild animals in captivity.

EEOB 514: Life History and Reproductive Strategies
(Dual-listed with BIOL 414). (3-0) Cr. 3. F.
Prereq: BIOL 315 or equivalent recommended.
Evolution of ecological adaptations at the individual, population, and species level. Emphasis is on evolutionary mechanisms and adaptive strategies related to life histories and reproduction; age and size at maturity; lifespan and senescense; offspring size/number trade-offs; sex and mating systems; sex determination and sex ratios.

EEOB 531: Conservation Biology
(Cross-listed with A ECL). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 312; BIOL 313 or graduate standing
Examination of conservation issues from a population and a community perspective. Population-level analysis will focus on the role of genetics, demography, and environment in determining population viability. Community perspectives will focus on topics such as habitat fragmentation, reserve design, biodiversity assessment, and restoration ecology.

EEOB 531I: Conservation Biology
(Cross-listed with A ECL, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: IA LL 312I
Population-and community-level examination of factors influencing the viability of plant and animal populations from both demographic and genetic perspectives; assessment of biodiversity; design and management of preserves.

EEOB 534: Endocrinology
(Dual-listed with BIOL 434). (3-0) Cr. 3. S.
Prereq: BIOL 211, BIOL 212
Chemical integration of vertebrate organisms. The structure, development, and evolution of the endocrine glands and the function and structure of their hormones.

EEOB 535: Restoration Ecology
(Cross-listed with ENSCI, NREM). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 366 or BIOL 474 or graduate standing
Theory and practice of restoring animal and plant diversity, structure and function of disturbed ecosystems. Restored freshwater wetlands, forests, prairies and reintroduced species populations will be used as case studies.

EEOB 535I: Restoration Ecology
(Cross-listed with A ECL, ENSCI, IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: A course in ecology
Ecological principles for the restoration of native ecosystems; establishment (site preparation, selection of seed mixes, planting techniques) and management (fire, mowing, weed control) of native vegetation; evaluation of restorations. Emphasis on the restoration of prairie and wetland vegetation.

EEOB 539: Environmental Physiology
(Dual-listed with BIOL 439). Cr. 3-4. Alt. S., offered even-numbered years.
Prereq: BIOL 335; physics recommended
Physiological adaptations to the environment with an emphasis on vertebrates.

EEOB 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

EEOB 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

EEOB 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

EEOB 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

EEOB 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

EEOB 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

EEOB 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

EEOB 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

EEOB 551: Plant Evolution and Phylogeny
(Dual-listed with BIOL 451). (3-3) Cr. 4. F.
Prereq: BIOL 315 or equivalent.
Survey of land plant evolution; phylogenetic comparison of anatomical, reproductive, and life history specializations. Relationships among bryophytes, lycophytes, pteridophytes, gymnosperms, and angiosperms emphasizing significant evolutionary changes documented by paleobotanical, morphological, and molecular studies.

EEOB 553: Agrostology
(2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BIOL 366
Structure, identification, classification, phylogeny, and economic aspects of grasses and related families.

EEOB 555: Bryophyte and Lichen Biodiversity
(Dual-listed with BIOL 455). Cr. 3.
Prereq: BIOL 211, BIOL 211L
Introduction to the biology and ecology of mosses, liverworts, and lichens. Emphasis on identification and diversity of local representatives of these three groups of organisms. Required field trips and service-learning.

EEOB 558: Ornithology
(Cross-listed with A ECL). (2-0) Cr. 2. S.
Prereq: A ECL 365 or BIOL 351
Dual-listed with Biol 458. Biology, ecology, evolution, and taxonomy of birds. Emphasis on structure, physiology, behavior, communication, navigation, reproduction, and conservation.

EEOB 559: Mammalogy
(Dual-listed with BIOL 459). (2-0) Cr. 2. S.
Prereq: BIOL 351 or A ECL 365
Biology, ecology, and evolution of mammals. Emphasis on structure, physiological adaptation to different environments, behavior, reproduction, roles of mammals in ecosystems, and conservation.

EEOB 561: Evolutionary and Ecological Genomics
(3-0) Cr. 3. S.
Prereq: Permission of instructor; BCBIO 444 recommended.
Use of genomic and other "omic" data in evolution and ecology. Review of data-generation platforms, computational methods, and examples of how phylogenomics, metagenomics, epigenomics, and population genomics are transforming the disciplines of evolution and ecology.

EEOB 562: Evolutionary Genetics
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Seminar/discussion course covering the genetic basis of evolutionary processes in multicellular organisms.

EEOB 563: Molecular Phylogenetics
(2-3) Cr. 3. F.
Prereq: BIOL 313 and BIOL 315
An overview of the theory underlying phylogenetic analysis and the application of phylogenetic methods to molecular datasets. The course emphasizes a hands-on approach to molecular phylogenetics and combines lecture presentations with computer exercises and discussion of original scientific literature.

EEOB 564: Wetland Ecology
(Dual-listed with BIOL 464). (Cross-listed with ENSCI). (3-0) Cr. 3. S.
Prereq: 15 credits in biological sciences.
Ecology, classification, creation and restoration, and management of wetlands. Emphasis on North American temperate wetlands.

EEOB 564I: Wetland Ecology
(Cross-listed with ENSCI, IA LL). Cr. 4. SS.
Prereq: Ia LL 312I
Ecology, classification, creation, restoration, and management of wetlands. Field studies will examine the composition, structure and functions of local natural wetlands and restored prairie pothole wetlands. Individual or group projects.

EEOB 566: Molecular Evolution
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Permission of instructor
Seminar/discussion course covering the fundamentals of molecular evolution. Emphasis is placed on original scientific literature and current topics, including rates and patterns of genetic divergence; nucleotide and allelic diversity; molecular clocks; gene duplications; genome structure; organellar genomes; polyploidy; transposable elements; and modes and mechanisms of gene and genome evolution.

EEOB 567: Empirical Population Genetics
(3-0) Cr. 3. F.
Prereq: Permission of instructor
An overview of fundamental population genetic theory and the ecological and evolutionary factors underlying the distribution of genetic variation within and among natural populations. Emphasis on the analysis of inbreeding, breeding systems, parentage, relatedness, spatial autocorrelation, effective population size, hierarchial population models, and phylogeography.

EEOB 568: Advanced Systematics
(Cross-listed with ENT). (2-3) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Principles and practice of systematic biology; taxonomy, nomenclature and classification of plants and animals; sources and interpretation of systematic data; speciation; fundamentals of phylogenetic systematics.

EEOB 569: Biogeography
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: BIOL 315 or equivalent; permission of instructor
Principles underlying the geographic distribution of organisms throughout the world; biological influences of geological history and tectonic movements; role of climate, migration, dispersal, habitat, and phylogeny on past and present organismal distribution patterns; biogeographic methods.

EEOB 570: Landscape Ecology
(Cross-listed with A ECL). (2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Permission of instructor; EEOB 588; a course in calculus
The study of ecological and evolutionary processes within a spatial context with emphasis on behavior, population, and community dynamics.

EEOB 573: Techniques for Biology Teaching
(Cross-listed with A ECL, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573A: Techniques for Biology Teaching : Animal Biology
(Cross-listed with A ECL, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573B: Techniques for Biology Teaching: Plant Biology
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573C: Techniques for Biology Teaching: Fungi and Lichens
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573D: Techniques for Biology Teaching: Aquatic Ecology
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573E: Techniques for Biology Teaching: Prairie Ecology
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573F: Techniques for Biology Teaching: Wetland Ecology
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573G: Techniques for Biology Teaching: Limnology
(Cross-listed with A ECL, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573H: Techniques for Biology Teaching: Animal Behavior
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573I: Techniques for Biology Teaching: Insect Ecology
(Cross-listed with A ECL, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573J: Techniques for Biology Teaching: Biology of Invertebrates
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573K: Techniques for Biology Teaching: Non-invasive Use of Living Organisms
(Cross-listed with IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 573W: Techniques for Biology Teaching: Project WET
(Cross-listed with A ECL, IA LL). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

EEOB 575I: Field Mycology
(Cross-listed with IA LL). Cr. 4. Alt. SS., offered even-numbered years.
Identification and classification of the common fungi; techniques for identification, preservation, and culture practiced with members of the various fungi groups.

EEOB 576: Functional Ecology
(Dual-listed with BIOL 476). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: BIOL 312
The nature of adaptations to physical and biotic environments. Biophysical, biomechanical, and physiological bases of the structure, form, growth, distribution, and abundance of organisms.

EEOB 577: Concepts in Theoretical Ecology and Evolution
(2-0) Cr. 1. Alt. F., offered even-numbered years.
Readings and discussion of influential ideas in ecological and evolutionary theory, with an emphasis on how models are used as conceptual tools for building synthetic paradigms. Topics are chosen according to student interests; may include spatial ecology, behavioral theory, chaos, community assembly and biodiversity, and others.

EEOB 578: Foundations of Theoretical Ecology and Evolution
(3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: 1 semester of calculus or permission of instructor.
Quantitative exploration of classic models and results in ecological and evolutionary theory. Introduction to conceptual, mathematical, and programming tools needed to build and analyze models.

EEOB 580I: Ecology and Systematics of Diatoms
(Cross-listed with IA LL). Cr. 4. SS.
Field and laboratory study of freshwater diatoms; techniques in collection, preparation, and identification of diatom samples; study of environmental factors affecting growth, distribution, taxonomic characters; project design and execution including construction of reference and voucher collections and data organization and analysis.

EEOB 581: Environmental Systems I: Introduction to Environmental Systems
(Dual-listed with BIOL 381). (Cross-listed with ENSCI). Cr. 3-4. F.
Prereq: 12 credits of natural science including biology and chemistry
Introduction to the structure and function of natural environmental systems. Emphasis on the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

EEOB 582: Environmental Systems II: Analysis of Environmental Systems
(Dual-listed with BIOL 382). (Cross-listed with ENSCI). (2-2) Cr. 3. S.
Prereq: ENSCI 381
Continuation of EnSci 381. Systems approach to the analysis of material and energy flows in natural environmental systems and the primary environmental factors controlling these systems.

EEOB 584: Advanced Ecosystem Ecology
(Cross-listed with ENSCI). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Combined 12 credits in biology, chemistry, and physics.
Advanced studies of ecosystems and the biological and physical factors that influence their properties and dynamics. Conceptual foundations and modern approaches to ecosystem studies. Interactions among organisms, biological diversity, and ecosystem attributes. Quantitative analyses of accumulations, transformations, and fluxes of nutrients, water, and energy within and among ecosystems. Global change issues.

EEOB 585: Advanced Community Ecology
(2-3) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BIOL 312
Factors controlling species diversity, species abundance, and the structure and function of communities in space and time. Relationships between species diversity and ecosystem process rates and community stability.

EEOB 586: Aquatic Ecology
(Dual-listed with BIOL 486). (Cross-listed with A ECL, ENSCI). (3-0) Cr. 3. F.
Prereq: Biol 312 or EnSci 381 or EnSci 402 or NREM 301
Structure and function of aquatic ecosystems with application to fishery and pollution problems. Emphasis on lacustrine, riverine, and wetland ecology.

EEOB 586L: Aquatic Ecology Laboratory
(Dual-listed with BIOL 486L). (Cross-listed with A ECL, ENSCI). (0-3) Cr. 1. F.
Prereq: Concurrent enrollment in BIOL 486
Field trips and laboratory exercises to accompany 486. Hands-on experience with aquatic research and monitoring techniques and concepts.

EEOB 587: Microbial Ecology
(Dual-listed with BIOL 487). (Cross-listed with ENSCI, MICRO). (3-0) Cr. 3. F.
Prereq: Six credits in biology and 6 credits in chemistry
Introduction to major functional groups of autotrophic and heterotrophic microorganisms and their roles in natural systems.

EEOB 589: Population Ecology
(Dual-listed with BIOL 489). (Cross-listed with A ECL). (2-2) Cr. 3. F.
Prereq: BIOL 312, STAT 101 or STAT 104, a course in calculus, or graduate standing
Concepts and theories of population dynamics with emphasis on models of growth, predation, competition, and regulation.

EEOB 590: Special Topics
Cr. 1-3. Repeatable.
Prereq: 10 credits in biology, permission of instructor

EEOB 590A: Special Topics: Current Topics in Ecology
Cr. 1-3. Repeatable.
Prereq: 10 credits in biology, permission of instructor

EEOB 590B: Special Topics: Current Topics in Evolutionary Biology
Cr. 1-3. Repeatable.
Prereq: 10 credits in biology, permission of instructor

EEOB 590C: Special Topics: Current Topics in Organismal Biology
Cr. 1-3. Repeatable.
Prereq: 10 credits in biology, permission of instructor

EEOB 590I: Special Topics: Graduate Independent Study
(Cross-listed with A ECL, ANTHR, IA LL). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

EEOB 596: Ecology and Society
(Cross-listed with PHIL). (3-0) Cr. 3.
Prereq: Graduate classification in biological or environmental sciences/ studies with at least one course in ecology
Analysis of conceptual and methodological debates in ecology. Historical development of competing research traditions and philosophies. Topics include i) methodological issues in ecological science, ii) conceptual issues in theoretical ecology, iii) conceptual issues in applied ecology, iv) relation of ecology to environmental and social issues.

EEOB 599: Creative Component
Cr. arr.
Research toward nonthesis master's degree.

Courses for graduate students:

EEOB 611: Analysis of Populations
(Cross-listed with A ECL). (2-2) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 312; STAT 401; a course in calculus
Quantitative techniques for analyzing vertebrate population data to estimate parameters such as density and survival. Emphasis on statistical inference and computing.

EEOB 698: Seminar
Cr. 1. Repeatable.
Meetings of graduate students and faculty to discuss recent literature and problems under investigation.

EEOB 699: Research
Cr. arr. Repeatable.
Research for thesis or dissertation. Offered on a satisfactory-fail basis only.

EEOB 699I: Iowa Lakeside Laboratory. (Cross-listed with Ia LL 699I) (Cross-listed with A ECL, ANTHR, GDCB, IA LL). Cr. arr. Repeatable. Research for thesis or dissertation. Offered on a satisfactory-fail basis only.

Genetics, Development and Cell Biology

The Department of Genetics, Development and Cell Biology (GDCB) is dedicated to biological discovery and excellence in undergraduate and graduate education. The research and teaching mission of the department is to achieve a greater understanding of fundamental principles of life by focusing on basic cellular and subcellular processes, including genome dynamics, cell structure and function, cellular response to environmental and developmental signals, and molecular mechanisms of development. Recognizing that student education is of paramount importance, GDCB strives for excellence in teaching and research. GDCB plays a leading role in undergraduate and graduate training through a variety of activities, including traditional courses, undergraduate internships in research laboratories, and advanced graduate seminar and literature-based courses. Innovative approaches to learning are emphasized throughout the curriculum.

Undergraduate Study

The GDCB Department offers undergraduate majors in conjunction with other departments. Students interested in the areas of genetics, development and cell biology should major in Biology, Genetics or Bioinformatics and Computational Biology (BCBio). The Biology Major is administered and offered jointly by the GDCB and EEOB departments. The GDCB faculty, together with those in EEOB and BBMB, administer and offer the Genetics Major. Each of these majors is available through the College of Liberal Arts and Sciences or through the College of Agriculture and Life Sciences. BCBio is administered by GDCB and the Departments of Computer Science and Mathematics, and is available through the College of Liberal Arts and Sciences.

The Biology Major and the Genetics Major prepare students for a wide range of careers in biological sciences. Training in Biology or Genetics may lead to employment in teaching, research, or any of a variety of health-related professions. Some of these careers include biotechnology, human and veterinary medicine, agricultural sciences and life science education. BCBio majors are prepared for careers at the interfaces of biological, informational and computational sciences in the above fields. These majors are also excellent preparation for graduate study in bioinformatics, molecular genetics, cell and developmental biology, neuroscience and related fields. Faculty members in GDCB contribute to the undergraduate courses listed below. The full descriptions of these courses can be found in the Biology, Genetics and BCBio sections of the catalog.

BIOL 101	Introductory Biology	3
BIOL 110	Introduction to Biology	1
BIOL 111	Opportunities in Biology	0.5
BIOL 155	Human Biology	3
BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
BIOL 255	Fundamentals of Human Anatomy	3
BIOL 255L	Fundamentals of Human Anatomy Laboratory	1
BIOL 256	Fundamentals of Human Physiology	3
BIOL 256L	Fundamentals of Human Physiology Laboratory	1
BIOL 313	Principles of Genetics	3
BIOL 313L	Genetics Laboratory	1
BIOL 314	Principles of Molecular Cell Biology	3
BIOL 328	Molecular and Cellular Biology of Human Diseases	3
BIOL 344	Human Reproduction	3
BIOL 350	Comprehensive Human Anatomy	3
BIOL 352	Vertebrate Histology	4
BIOL 394	International Field Trips in Biology	1-4
BIOL 423	Developmental Biology	3
BIOL 423L	Developmental Biology Laboratory	1
BIOL 428	Topics in Cell Biology	3
BIOL 436	Neurobiology	3
BIOL 444	Bioinformatic Analysis	4
BIOL 490	Independent Study	1
BIOL 494	Biology Internship	1-3
BIOL 495	Undergraduate Seminar	1-3
BIOL 499	Undergraduate Research Experience	1-3
GEN 110	Genetics Orientation	1
GEN 112	Genetics Orientation for Transfer Students	0.5
GEN 349	The Genome Perspective in Biology	3
GEN 409	Molecular Genetics	3
GEN 410	Analytical Genetics	3
GEN 490	Independent Study	1-5
GEN 491	Undergraduate Seminar	1
GEN 499	Genetics Research	1-5
BCBIO 110	BCBIO Orientation	0.5
BCBIO 322	Introduction to Bioinformatics and Computational Biology	3
BCBIO 401	Fundamentals of Bioinformatics and Computational Biology	3

BCBIO 402	Fundamentals of Systems Biology and Network Science	3
BCBIO 444	Bioinformatic Analysis	4

Graduate Study

Understanding the genetic blueprint and the functions of cells is critical to virtually all aspects of biology. The basic mission of the Department of Genetics, Development and Cell Biology is to achieve a greater understanding of fundamental principles of life. The GDCB faculty and students conduct hypothesis-driven research into the biology of animals, plants and microbes. While research in GDCB is often based on discovery and analysis of molecular mechanisms of life processes, a true understanding of living organisms will ultimately require the integration of molecular mechanisms in the context of dynamic structural components of the living cell. Thus, research efforts within GDCB use molecular, genetic, biochemical, computational and imaging techniques to study systems at increasingly complex levels of organization.

GDCB faculty contribute to a broad but integrated array of cutting-edge research topics, implementing interactive and multidisciplinary approaches that bridge conventional boundaries, and incorporating experimental and computational biology as complementary approaches. Examples include using genetics and molecular biology to investigate the cellular basis of development, or combining biochemical and computational approaches to study basic subcellular functions, signal transduction or metabolism.

The faculty in the GDCB Department train graduate students in several interdepartmental majors/programs, including Bioinformatics and Computational Biology, Ecology and Evolutionary Biology, Genetics, Immunobiology, Plant Biology, Interdisciplinary Graduate Studies, Microbiology, Molecular, Cellular and Developmental Biology, Neuroscience and Toxicology. Graduate work leading to both Master of Science (M.S.) and Doctor of Philosophy (Ph.D.) degrees are available.

Prospective graduate students need a sound background in the physical and biological sciences, as well as Mathematics and English. Interested students should check the links on the GDCB website (www.gdcb.iastate.edu/) for specific admissions procedures and the latest information about individual faculty and their research programs. The interdepartmental majors and programs require submission of Graduate Record Examination (GRE) aptitude test scores. Advanced GRE scores are recommended. International students whose native language is other than English must also submit TOEFL scores with their application.

Students who are enrolled in the interdepartmental graduate majors and who have affiliations with GDCB are required to actively participate in seminars, research activities, and to show adequate progress and professional development while pursuing their degree. Completion of either the M.S. or Ph.D. degrees requires that research conducted by the student culminates in the writing and presentation of a thesis or dissertation. The Graduate College, the GDCB Faculty, and the individual student's major professor and Program of Study Committee provide requirements and guidelines for study. General information about graduate study requirements can be found at the website for the Graduate College (www.grad-college.iastate.edu/), and requirements for the interdepartmental majors can be found by following the links from the GDCB website (www.gdcb.iastate.edu/ (http://www.gdcb.iastate.edu)). Although not a formal requirement, the GDCB faculty recommends that students pursuing the Ph.D. include teaching experience in their graduate training.

Courses primarily for graduate students, open to qualified undergraduates:

GDCB 505: Entrepreneurship in Science and Technology
(3-0) Cr. 3. Alt. F., offered even-numbered years.
High level success at modern science requires entrepreneurship both in and outside the laboratory. Scientists are in a unique position to not only think, but to thrive, "outside of the box" and take unorthodox approaches to research that lead to positive paradigm shifts in our lives. Exploration of many facets of science, technology, industry and commerce, with frequent guest lectures from entrepreneurs.

GDCB 510: Transmission Genetics
(3-0) Cr. 3. F.
Prereq: GEN 410 or graduate standing
In-depth investigations of modern research practices of transmission genetics. Designed for students interested in genetic research. Topics include: Mendelian genetic analysis, analysis of genetic pathways, mutational analysis of gene function, chromosomal mechanics, genetic mapping, epigenetic inheritance, human genetic analysis.

GDCB 511: Advanced Molecular Genetics
(Cross-listed with MCDB). (3-0) Cr. 3. S.
Prereq: BIOL 313 and BBMB 405
Mechanisms of molecular genetic processes in eukaryotes and prokaryotes, including DNA replication and repair, transcription, translation and regulation of gene expression. Critical evaluation and discussion of current primary literature, methodologies and experimental data.

GDCB 513: Plant Metabolism
(Cross-listed with PLBIO). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BIOL 330, PHYS 111, CHEM 331; one semester of biochemistry recommended
Photosynthesis, respiration, and other aspects of plant metabolism.

GDCB 528: Advances in Molecular Cell Biology
(Cross-listed with MCDB). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Courses in general cell biology and biochemistry
Cell biological processes including cell signaling, cell division, intracellular trafficking, biogenesis of organelles, cell adhesion and motility.

GDCB 533: Advances in Developmental Biology
(Cross-listed with MCDB). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 314 or Biol 423
Fundamental principles in multicellular development. Emphasis on cellular and molecular regulation of developmental processes, and experimental approaches as illustrated in the current literature.

GDCB 536: Statistical Genetics
(Cross-listed with STAT). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 401, STAT 447; GEN 320 or BIOL 313
Statistical models and methods for genetics covering models of population processes: selection, mutation, migration, population structure, and linkage disequilibrium, and inference techniques: genetic mapping, linkage analysis, and quantitative trait analysis. Applications include genetic map construction, gene mapping, genome-wide association studies (GWAS), inference about population structure, phylogenetic tree construction, and forensic and paternity identification.

GDCB 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

GDCB 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

GDCB 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

GDCB 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

GDCB 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

GDCB 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

GDCB 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

GDCB 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, FS HN, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

GDCB 544: Fundamentals of Bioinformatics
(Cross-listed with BCB, COM S, CPR E). (4-0) Cr. 4. F.
Prereq: MATH 165 or STAT 401 or equivalent
A practical, hands-on overview of how to apply bioinformatics to biological research. Recommended for biologists desiring to gain computational molecular biology skills. Topics include: sequence analysis, genomics, proteomics, phylogenetic analyses, ontology enrichment, systems biology, data visualization and emergent technologies.

GDCB 545: Plant Molecular, Cell and Developmental Biology
(Cross-listed with MCDB, PLBIO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: Biol 313, BIOL 314, BIOL 330 or BBMB 405
Plant nuclear and organelle genomes; regulation of gene expression; hormone signaling; organization, function, and development of plant cells and subcellular structures; regulation of plant growth and development.

GDCB 556: Cellular, Molecular and Developmental Neuroscience
(Cross-listed with B M S, NEURO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 335 or BIOL 436; physics recommended
Fundamental principles of neuroscience including cellular and molecular neuroscience, nervous system development, sensory, motor and regulatory systems.

GDCB 557: Advanced Neuroscience Techniques
(Cross-listed with NEURO). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Neuro 556 or equivalent course
Research methods and techniques; lectures, laboratory exercises and/or demonstrations representing individual faculty specialties.

GDCB 568: Bioinformatics II (Statistical Bioinformatics)
(Cross-listed with BCB, COM S, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or (BIOL 315 and STAT 430), credit or enrollment in GEN 409
Statistical models for sequence data, including applications in genome annotation, motif discovery, variant discovery, molecular phylogeny, gene expression analysis, and metagenomics. Statistical topics include model building, inference, hypothesis testing, and simple experimental design, including for big data/complex models.

GDCB 569: Bioinformatics III (Structural Bioinformatics)
(Cross-listed with BBMB, BCB, COM S, CPR E). (3-0) Cr. 3. F.
Prereq: BCB 567, BBMB 316, GEN 409, STAT 430
Molecular structures including genes and gene products: protein, DNA and RNA structure. Structure determination methods, structural refinement, structure representation, comparison of structures, visualization, and modeling. Molecular and cellular structure from imaging. Analysis and prediction of protein secondary, tertiary, and higher order structure, disorder, protein-protein and protein-nucleic acid interactions, protein localization and function, bridging between molecular and cellular structures. Molecular evolution.

GDCB 570: Bioinformatics IV (Systems Biology)
(Cross-listed with BCB, COM S, CPR E, STAT). (3-0) Cr. 3. S.
Prereq: BCB 567 or COM S 311, COM S 228, GEN 409, STAT 430
Algorithmic and statistical approaches in computational functional genomics and systems biology. Analysis of high throughput biological data obtained using system-wide measurements. Topological analysis, module discovery, and comparative analysis of gene and protein networks. Modeling, analysis, and inference of transcriptional regulatory networks, protein-protein interaction networks, and metabolic networks. Dynamic systems and whole-cell models. Ontology-driven, network based, and probabilistic approaches to information integration.

GDCB 590: Special Topics
Cr. arr. Repeatable.
Prereq: Permission of instructor

Courses for graduate students:

GDCB 661: Current Topics in Neuroscience
(Cross-listed with BBMB, NEURO). (2-0) Cr. 2-3. Repeatable. Alt. S., offered even-numbered years.
Prereq: NEURO 556 (or comparable course) or permission of instructor
Topics may include molecular and cellular neuroscience, neurodevelopment, neuroplasticity, neurodegenerative diseases, cognitive neuroscience, sensory biology, neural integration, membrane biophysics, neuroethology, techniques in neurobiology and behavior.

GDCB 690: Seminar in GDCB
Cr. 1. Repeatable.
Research seminars by faculty, invited speakers, and graduate students. Offered on a satisfactory-fail basis only.

GDCB 691: Faculty Seminar
Cr. 1. Repeatable.
Faculty research series.

GDCB 696: Research Seminar
(Cross-listed with AGRON, BBMB, FOR, HORT, PLBIO). Cr. 1. Repeatable.
Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

GDCB 698: Seminar in Molecular, Cellular, and Developmental Biology
(Cross-listed with BBMB, MCDB, MICRO, V MPM). (2-0) Cr. 1-2. Repeatable. F.S.
Student and faculty presentations.

GDCB 699: Research
Cr. arr. Repeatable.
Research for thesis or dissertation. Offered on a satisfactory-fail basis only.

GDCB 699I: Research
(Cross-listed with A ECL, ANTHR, EEOB, IA LL). Cr. 1-4. Repeatable.

Geological and Atmospheric Sciences

www.ge-at.iastate.edu/ (http://www.ge-at.iastate.edu)

The Department of Geological and Atmospheric Sciences seeks to establish innovative teaching and outstanding research programs that apply fundamental principles of physics, chemistry, biology, and mathematics to cross-disciplinary problems related to the earth sciences. As a basis for this mission, the Department maintains strength in fundamental topics of geology, meteorology, and hydrology that involve investigating the dynamic nature of the structure, composition, and interactive processes of the Earth and its component systems.

Study of these systems includes the application of scientific principles to a wide range of environmental, agricultural, and natural-resource problems, so that through its teaching and research activities, the department fosters a global perspective on the geosciences. Individual elements of study, such as atmospheric-circulation patterns, water cycling, geochemical interactions, glacier dynamics, or rock formation, are viewed not only in terms of their own intrinsic value, but also in terms of their role in the evolving earth system. The Department recognizes that many fundamental advances in the geosciences are occurring at the interfaces with other disciplines and between subdisciplines in the field, so department faculty strive to form mutually beneficial research and educational collaborations with other programs at Iowa State University and other institutions around the world by taking a leadership position in solving problems at these interfaces.

See also:

- Earth Science
- Geology
- Meteorology

Greenlee School of Journalism and Communication

http://www.greenlee.iastate.edu/

The Greenlee School of Journalism and Communication prepares students for the field of communication. The school offers three majors:

- Advertising Bachelor of Arts (ADVRT)
- Journalism and Mass Communication Bachelor of Science (JL MC)
- Public Relations Bachelor of Science (P R)

Professional skills are taught and practiced alongside academic requirements using the latest technology and leading-edge communication trends and methods.

Founded in 1905, the unit was one of the first journalism programs to be accredited in 1948 and continues to be one of the longest continuously accredited programs in the country. Accreditation is based on the principle that students need a broad-based, liberal arts education and solid core courses within the discipline. Students taking one major at the school may not seek a second major or minor in the school. All students are required to take a second major or minor outside the school as an area of expertise.

Undergraduate Study

Students who complete degrees in advertising, journalism and mass communication, or public relations are expected to develop competencies in 12 key areas:

- understand and apply the principles and laws of freedom of speech and press for the country in which the institution that invites ACEJMC is located, as well as receive instruction in and understand the range of systems of freedom of expression around the world, including the right to dissent, to monitor and criticize power, and to assemble and petition for redress of grievances;
- demonstrate an understanding of the history and role of professionals and institutions in shaping communications;
- demonstrate an understanding of gender, race ethnicity, sexual orientation and, as appropriate, other forms of diversity in domestic society in relation to mass communications;
- demonstrate an understanding of the diversity of peoples and cultures and of the significance and impact of mass communications in a global society;
- understand concepts and apply theories in the use and presentation of images and information;
- demonstrate an understanding of professional ethical principles and work ethically in pursuit of truth, accuracy, fairness and diversity;
- think critically, creatively and independently;
- conduct research and evaluate information by methods appropriate to the communications professions in which they work;
- write correctly and clearly in forms and styles appropriate for the communications professions, audiences and purposes they serve;
- critically evaluate their own work and that of others for accuracy and fairness, clarity, appropriate style and grammatical correctness;
- apply basic numerical and statistical concepts;
- apply current tools and technologies appropriate for the communications professions in which they work, and to understand the digital world.

Communication Proficiency Requirement

All majors in the School must complete ENGL 150 Critical Thinking and Communication (or be exempt) and earn a grade of C or better in ENGL 250, Oral, Visual, and Electronic Composition (or ENGL 250H). These additional requirements apply:

Advertising majors must earn a C+ or better in:

JL MC 201	Reporting and Writing for the Mass Media	3
and one of		
ADVRT 334	Advertising Creativity	3
ADVRT 336	Advertising Account Management	3

Journalism and mass communication majors must earn a C+ or better in:

JL MC 201	Reporting and Writing for the Mass Media	3
and one of		
JL MC 302	Intermediate Reporting and Writing for the Mass Media	3
JL MC 303	Reporting and Writing for the Electronic Media	3

Public relations majors must earn a C+ or better in:

JL MC 201	Reporting and Writing for the Mass Media	3
P R 321	Public Relations Writing	3

African and African American Studies

Interdepartmental Undergraduate Program

African and African American Studies, a cross-disciplinary program in the College of Liberal Arts and Sciences, offers students the opportunity to explore the African Americans' experience and African American contributions to American culture. Students in the program analyze and learn about African American experiences through the study of history, literature, art, religion, and society. They gain knowledge and develop skills and sensitivities to help them function effectively in today's diverse society.

African and African American Studies at Iowa State University is an expanding program. Most of the courses in the program satisfy general education requirements in the College of Liberal Arts and Sciences, the human relations requirement for teachers, and the university's diversity requirement. Students can minor or even design their own Interdisciplinary Studies major with an emphasis in African American Studies. Relevant courses are offered through other departments.

Graduate Study

Several courses can be applied to a graduate program as electives.

A minor in African and African American Studies requires six courses in the program with a minimum of 18 credits, including AF AM 201 Introduction to African American Studies Introduction to African American Studies and AF AM 460 Seminar in African American Culture Seminar in African American Culture. The remaining credits must come from at least two departments, with at least two courses taken at the junior level or above. Independent study and internship opportunities are available for credit, but do not count in the minimum requirements for the minor.

Courses primarily for undergraduates:

AF AM 201: Introduction to African American Studies
(3-0) Cr. 3. F.S.
An interdisciplinary introduction to the study of African American culture. Includes history, the social sciences, literature, religion, and the arts, as well as conceptual frameworks for investigation and analysis of the African American experience.
Meets U.S. Diversity Requirement

AF AM 311: Africa under Colonial Rule
(Cross-listed with HIST). (3-0) Cr. 3.
Prereq: 3 credits of 200-level HIST at Iowa State, and sophomore classification.
Development of Africa from imposition of colonial rule to independence, including processes of European domination, African reaction and resistance, emergence of nationalism, and dismantling of colonialism.
Meets International Perspectives Requirement.

AF AM 325: Peoples and Cultures of Africa.
(Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: 201 or 306 recommended.
Survey of diverse African culture areas across the continent and globally; local level description and analysis of individuals as members of African communities; regional, national and global scales of identification.
Meets International Perspectives Requirement.

AF AM 330: Ethnic and Race Relations
(Cross-listed with SOC). (3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
Analysis of ethnic and race relations, particularly in America; emphasis on the sociology and psychology of race and ethnic relations.
Meets U.S. Diversity Requirement

AF AM 334: African American Religious Experience
(Cross-listed with RELIG). (3-0) Cr. 3. F.
Prereq: Prior course work in Religious Studies or African American Studies recommended
Examination of African-American experience from the perspective of black religion with attention to political, economic, social, theological and artistic expressions, including music, that serve the life of African-American communities.".
Meets U.S. Diversity Requirement

AF AM 347: Studies in African American Literature
(Cross-listed with ENGL). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: ENGL 250
Literature by African Americans, which may include study of individual authors, movements, themes, genres.
Meets U.S. Diversity Requirement

AF AM 350: Women of Color in the U.S
(Cross-listed with W S). (3-0) Cr. 3. S.
Prereq: 3 credits in Womens' Studies or African American Studies
Economic, social, political and cultural roles of Women of Color in the U.S. Includes literary, philosophical, and artistic expressions. Myths and realities explored.
Meets U.S. Diversity Requirement

AF AM 353: History of African Americans I
(Cross-listed with HIST). (3-0) Cr. 3. S.
Prereq: Sophomore classification
Examines African roots of black culture and the African American experience in the United States from the colonial period through the Civil War. Topics include Atlantic Slave Trade, slavery and American identity, abolition, the emergence of Black Nationalism, and black participation in the Civil War.
Meets U.S. Diversity Requirement

AF AM 354: History of African Americans II
(Cross-listed with HIST). (3-0) Cr. 3. S.
Prereq: Sophomore classification
Explores African American political thought and political action from Reconstruction to the present. Topics include rise of Jim Crow segregation, urban migration, Garvey movement, Harlem Renaissance, Depression and world wars, Pan-Africanism, civil rights, Black Power, and black feminism.
Meets U.S. Diversity Requirement

AF AM 460: Seminar in African American Culture
(3-0) Cr. 3. S.
Intensive study of a selected topic in African-American Studies in one or more disciplines. Selected readings of various authors, movements, eras, or genres. Primary and secondary source materials.
Meets U.S. Diversity Requirement

AF AM 473: Civil Rights and Ethnic Power
(Cross-listed with HIST, US LS). (3-0) Cr. 3.
Prereq: Sophomore classification
Comparative history of the civil rights and ethnic power movements (African American, Chicano, American Indian, Puerto Rican, among others) in the U.S. from World War II to the present. Topics include institutional foundations, leadership, gender and racial dynamics, and the convergences and divergences of these differing ethnic struggles for rights.
Meets U.S. Diversity Requirement

AF AM 490: Independent Study
Cr. 1-3. Repeatable, maximum of 3 times.

Air Force Aerospace Studies

The objectives of the Department of Air Force Aerospace Studies (AFAS) are to provide qualified students the opportunity to earn a commission as an active duty officer in the United States Air Force (USAF) and to build better citizens for those not interested in serving in the USAF. Entry into the Air Force Reserve Officer Training Corps (AFROTC) program is not dependent on departmental major or year in the university, and is open to all qualified students.

The curriculum is divided into two basic phases: the General Military Course (GMC) and the Professional Officer Course (POC). The GMC is introductory and open to all ISU students. The GMC consists of four consecutive one-hour courses normally taken during the freshman and sophomore years.

Selection for the POC is on a competitive basis. Cadets enrolling in this course must meet certain academic, mental, and physical requirements as well as having high moral standards. Students who have completed the GMC will compete to participate in Field Training, a four-week summer training program which provides a concentrated experience in the Air Force environment. Field Training includes officer training, career orientation, expeditionary training, an introduction to typical base functions, and physical training. Prior to entry into the POC, students must successfully complete Field Training.

Upon enrollment and acceptance into the POC, all cadets complete a contractual agreement with the Air Force, which signs them up for at least four years of active duty as an USAF officer after graduation. Qualified cadets may compete for selection for flying jobs such as pilot,

combat systems operator (CSO), remotely-piloted aircraft (RPA) operator, and air battle manager (ABM).

AFROTC scholarships are available and provide payment of full tuition and fees. In addition, scholarship cadets receive a $250-$500 monthly subsistence allowance and $600 per year book allowance. Scholarships can be awarded for periods from two to five years, depending on academic major. Upon acceptance of a scholarship, complete a contractual agreement with the Air Force, which signs them up for at least four years of active duty as an USAF officer after graduation. To determine eligibility and initiate application procedures for the scholarship program, interested students should contact the AFAS department.

The College of Liberal Arts and Sciences offers a minor in military studies. Requirements for the minor include taking a minimum of 15 credits of ROTC instruction, which may be taken from one or more of the ROTC programs. At least six credits must be in courses numbered 300 or above.

Courses primarily for undergraduates:

AFAS 103: Introductory Leadership Laboratory with Physical Training
(0-4) Cr. 2. Repeatable, maximum of 4 credits. F.S.
Prereq: Membership as a cadet in AFROTC
Instruction for new cadets on Air Force customs and courtesies; drill and ceremonies, issuing military commands, studying the environment of an Air Force officer and learning about areas of opportunity available to commissioned officers while also using basic military training skills and instruction to develop confidence, leadership, and communication skills through physical fitness. Full participation in all events will be determined based on student's physical and medical eligibility. Offered on a satisfactory-fail basis only.

AFAS 141: Foundations of the United States Air Force
(1-0) Cr. 1. F.
Basic introduction to the United States Air Force and Air Force Reserve Officer Training Corps. Mission and organization of the Air Force, officership and professionalism, military customs and courtesies, Air Force officer opportunities, and communication skills.

AFAS 142: Foundations of the United States Air Force
(1-0) Cr. 1. S.
A continuation of 141. Topics include Air Force installations, Air Force core values, leadership and team building, further study of interpersonal communication, the Oath of Office and Commissioning.

AFAS 203: Basic Leadership Laboratory with Physical Training
(0-4) Cr. 2. Repeatable, maximum of 4 credits. F.S.
Prereq: Membership as a cadet in AFROTC
Instruction and critique of cadets on Air Force customs and courtesies, drill and ceremonies, and issuing military commands in preparation for AFROTC summer Field Training while also using basic military training skills and instruction to develop confidence, leadership, and communication skills through physical fitness. Full participation in all events will be determined based on student's physical and medical eligibility. Offered on a satisfactory-fail basis only.

AFAS 241: The Evolution of USAF Air & Space Power I
(1-0) Cr. 1. F.
Examines the general aspects of air and space power through a historical perspective. Utilizing this perspective, the course covers a time period from the first balloons and dirigibles to the Korean War. Historical examples are provided to illustrate the development of airpower capabilities and missions to demonstrate the evolution of what has become today's USAF air and space power.

AFAS 242: The Evolution of USAF Air & Space Power II
(1-0) Cr. 1. S.
A continuation of AFAS 241 that examines the general aspects of air and space power through a historical perspective. Utilizing this perspective, the course covers a time period from the Korean War to the space-age global positioning systems of the Persian Gulf War. Historical examples are provided to illustrate the development of airpower capabilities and missions to demonstrate the evolution of what has become today's USAF air and space power.

AFAS 303: Intermediate Leadership Laboratory with Physical Training
(0-4) Cr. 2. Repeatable, maximum of 4 credits. F.S.
Prereq: Membership as a cadet in AFROTC
Mid-level management of leadership experience involving planning and controlling of most AFROTC military activities. Students will help senior leadership to prepare and present briefings and other oral and written communications; provide interviews, guidance, and information that will increase the understanding, motivation, and performance of other cadets; and use advanced military training skills and instruction to develop confidence, leadership, and communication skills through physical fitness. Full participation in all events will be determined based on student's physical and medical eligibility. Offered on a satisfactory-fail basis only.

AFAS 341: Air Force Leadership Studies I

(3-0) Cr. 3. F.

A look at the fundamental issues of leadership and management in the U.S Air Force; a large and diverse organization. It examines the theoretical aspects of leadership, management, communications, motivation and problem-solving while studying them against the backdrop of the U.S. Air Force. The course also conducts hands-on exercises to apply principles learned. While the curriculum is focused on the Air Force as an organization, the principles studied are applicable to most organizations.

AFAS 342: Air Force Leadership Studies II

(3-0) Cr. 3. S.

Prereq: AFAS 341

A continuation of AFAS 341, that looks at the advanced issues of leadership and management in the U.S. Air Force; a large and diverse organization. It examines the theoretical aspects of leadership, managment, communications, motivation and problem-solving while studying them against the backdrop of the U.S. Air Force. The course also conducts hands-on exercises to apply principles learned. While the curriculum is focused on the Air Force as an organization, the principles studied are applicable to most oranizations.

AFAS 403: Advanced Leadership Laboratory with Physical Training

(0-4) Cr. 2. Repeatable, maximum of 6 credits. F.S.

Prereq: Membership as a cadet in AFROTC

Advanced leadership experience involving the planning and controlling of all upper-level AFROTC military activities. Students will prepare and present briefings and other oral and written communications; provide interviews, guidance, and information that will increase the understanding, motivation, and performance of other cadets; and use advanced military training skills and instruction to develop confidence, leadership, and communication skills through physical fitness. Full participation in all events will be determined based on student's physical and medical eligibility. Offered on a satisfactory-fail basis only.

AFAS 441: Preparation for Active Duty

(3-0) Cr. 3. F.

Traces the source of military authority and responsibilities from the U.S. Constitution through the DoD to an Air Force officer. Examines the structure and capabilities of the other services and joint structures. Addresses the supervisory duties of an Air Force officer associated with administrative actions and military law as force management tools. Builds upon leadership and management skill learned in AFAS 341/342 and includes demonstrations of written and verbal communications processes.

AFAS 442: National Security Affairs

(3-0) Cr. 3. S.

Examines the national security process through review of the Department of Defense's statutory administrative and operational relationships as context for this course's regional studies component. Reviews functions of air and space power as outlined in Air Force doctrine and introduces the concept of joint operations. Integrates these concepts with regional studies to survey issues of interest to professional military officers and governmental leaders. Selectively reviews and discusses Africa, Latin America, South Asia, East Asia, Europe, Russia and the Middle East. Meets International Perspectives Requirement.

American Indian Studies

American Indian Studies is a cross-disciplinary minor in the College of Liberal Arts and Sciences that allows students to learn more about the contemporary and historical realities of native communities in North America, to appreciate the variety of native cultures and experiences, and to be prepared for an attentive lifelong learning experience in a diverse world.

Courses focus on critical thinking and the application of knowledge in complex, diverse situations. Courses in American Indian Studies thus not only provide knowledge on specific native issues, but also prepare students for careers and further studies in fields such as community development and planning, social work, law, sociology, education, history, anthropology, agriculture, resource extraction, literature, policy, engineering, environmental issues.

Today, 80% of American Indians live outside of reservation communities. American Indian Studies students will gain the knowledge and skills they need for living and working with, in and around native communities and people who live everywhere in North America, and, increasingly, the world.

For students who are interested in deeper knowledge on the issues, a major can be pursued through the Interdisciplinary Studies major in the College of Liberal Arts and Sciences. Faculty members also are available to provide expertise to graduate students working on specific issues that involve American Indian themes.

Most American Indian Studies courses meet the university-wide U.S. Diversity requirement.

The minor in American Indian Studies is 15 credits and includes:

AM IN 210	Introduction to American Indian Studies	3
Two courses chosen from the following:		
AM IN 310	Topics in American Indian Studies	3
AM IN 322	Peoples and Cultures of Native North America	3
AM IN 332	Current Issues in Native North America	3

AM IN 346	American Indian Literature	3

And 6 additional credits of AM IN courswork.

Courses primarily for undergraduates:

AM IN 210: Introduction to American Indian Studies
(3-0) Cr. 3. F.S.SS.
Introduction to the multidisciplinary aspects of American Indian Studies. Topics include the relevant events and ideas defining the contemporary American Indian experience, on and off reservation, in the United States. Sovereignty, identity, jurisdiction, taxes, economic development, education, and other issues are addressed.
Meets U.S. Diversity Requirement

AM IN 240: Introduction to American Indian Literature
(Cross-listed with ENGL). (3-0) Cr. 3. F.
Prereq: Credit in or exemption from ENGL 150
Appreciation of oral and written forms of American Indian literatures. Tropes and techniques in oral, visual and written texts. Focus on the role of American Indians in interdisciplinary approaches to modern social and environmental issues as expressed in literary works.
Meets U.S. Diversity Requirement

AM IN 310: Topics in American Indian Studies
(3-0) Cr. 3. F.S.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. Topics vary by section. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310A: Topics in American Indian Studies: Federal Indian Policy
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section examines the impact of federal American Indian policies on Native communities. Topics discussed are sovereignty, recognition, the role of the Supreme Court, specific policies like allotment, and other relevant issues. The focus lies on contemporary Indian Country. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310B: Topics in American Indian Studies: Music, Performance, and Culture
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section examines American Indian cultures from the perspective of ethnomusicology and performances of identity. Topics include the role of music for culture, the development of an American Indian musical style, powwows and their significance, and other relevant issues. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310C: Topics in American Indian Studies: American Indian Film
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section examines the role of American Indians in the movie industry. The course explores the development of American Indian characters and filmmaking, and the relevance for Native communities, through feature films and academic analysis. One focus of the course is a comparison of non-Native and Native films in form, content, and message, and the changing character of Native representation in both. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310D: Topics in American Indian Studies: Religions and Spiritual Traditions
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section looks at American Indian religions, from traditional practices through the Native American Church to christianity and other mainstream religions. It explores the religious landscapes of contemporary Native North America and the connections to communities. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310E: Topics in American Indian Studies: American Indian Education
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section examines current and historical issues in American Indian education. Topics discussed include traditional education, changes to formal education, tribal colleges and universities, current school systems, and other relevant topics. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310F: Topics in American Indian Studies: Land, Water, and Resources
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section looks at land rights, water rights, and resource extraction. Topics discussed include the consequences of allotment and fractionation, water usage agreements, and resource policies as they apply to on- and off-reservation Native communities. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 310G: Topics in American Indian Studies: Native Art
(3-0) Cr. 3.
Prereq: AM IN 210, ANTHR 201, ANTHR 306, or ANTHR 322 recommended
Study of specific topics in American Indian society and culture from an interdisciplinary perspective. This section looks at Native art and the connections to identity and cultures. Topics discussed include traditional Native arts, the depiction of American Indians in art, the evolution of contemporary, modern Native art, the current global Native art market, and other relevant issues. Only 9 credits of AM IN 310A, 310B, 310C, 310D, 310E, 310F, 310G may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 315: Archaeology of North America
(Cross-listed with ANTHR). (3-0) Cr. 3. S.
Prereq: ANTHR 202
Prehistory and early history of North America as reconstructed from archaeological evidence; peopling of the New World; culture- historical sequences of major culture areas; linkages of archaeological traditions with selected ethnohistorically known Native American groups.
Meets U.S. Diversity Requirement

AM IN 320: Great Plains Archaeology
(Cross-listed with ANTHR). (3-0) Cr. 3. F.
Prereq: ANTHR 202
Prehistoric societies of the Great Plains region of North America, from initial occupation to European contact; emphasis on sociocultural changes, continuities, and adaptations to changing environments using archaeological, ecological, ethnographic information.
Meets U.S. Diversity Requirement

AM IN 322: Peoples and Cultures of Native North America
(Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 or AM IN 210
Origin, distribution, and pre-contact life of the indigenous peoples of North America. Survey of culture areas; language families, social and political systems, ecological and economic adaptations, religion and spirituality; impact of European contact; cultural resilience and revitalization in contemporary American Indian life.
Meets U.S. Diversity Requirement

AM IN 332: Current Issues in Native North America
(Dual-listed with AM IN 532). (Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 332A: Current Issues in Native North America: Gender and Family
(Dual-listed with AM IN 532A). (Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 332B: Current Issues in Native North America: Indigenous Ecologies and Geographies
(Dual-listed with AM IN 532B). (Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 332C: Current Issues in Native North America: Cultural and Political Movements
(Dual-listed with AM IN 532C). (Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 332D: Current Issues in Native North America: Regional Focus
(Dual-listed with AM IN 532D). (Cross-listed with ANTHR). (3-0) Cr. 3.
Prereq: ANTHR 201 or ANTHR 306; ANTHR 322 or AM IN 210 recommended
Exploration of key contemporary and historical issues in Native North America; discussion of current anthropological approaches to studying Native North America in a global context. Topics vary each time offered. Only 9 credits of ANTHR/AM IN 332A, 332B, 332C, 332D may count toward graduation.
Meets U.S. Diversity Requirement

AM IN 342: American Indian Women Writers
(Cross-listed with ENGL, W S). (3-0) Cr. 3.
Prereq: ENGL 250
Literature of American Indian women writers which examines their social, political, and cultural roles in the United States. Exploration of American Indian women's literary, philosophical, and artistic works aimed at recovering elements of identity, redescribing stereotypes, resisting colonization, and constructing femininity.
Meets U.S. Diversity Requirement

AM IN 346: American Indian Literature
(Cross-listed with ENGL). (3-0) Cr. 3.
Prereq: ENGL 250
Survey of literature by Native Americans from pre-Columbian tales and songs to contemporary novels and poetry.
Meets U.S. Diversity Requirement

AM IN 426: Topics in Native American Architecture
(Cross-listed with ARCH). (3-0) Cr. 3. Repeatable, maximum of 6 credits.
Prereq: Junior classification
History, theory, and principles of Native American/American Indian architecture, landscape architecture and planning considering relationships to the culture, visual arts, site, and surroundings. Credit counts toward fulfillment History, Theory, Culture. A maximum of 6 credits of ARCH 426 may be applied to degree program.
Meets U.S. Diversity Requirement

AM IN 490: Independent Study
Cr. arr. Repeatable, maximum of 9 credits.
Prereq: 6 credits in American Indian studies; permission of instructor and program director
Designed to meet the needs of students who wish to study in areas other than those in which courses are offered. No more than 6 credits in AM IN 490 may be counted toward graduation. If more than 3 credits in AM IN 490 are taken, they must be from different instructors.

Military Science

Interdisciplinary Program

The Military Science Department does not offer an academic degree and is embedded within the College of Liberal Arts and Sciences as an interdisciplinary program. The mission of the department is derived directly from regulations governing Army Reserve Officers' Training Corps (AROTC), which are issued by the U.S. Army Cadet Command and U.S. Army Training and Doctrine Command and cannot be modifiable by this department.

Freshmen Year Learning Outcomes

The student will have a working knowledge of the following areas: The Role of the Army, Roles and Origins of the Army, Army Customs and Traditions, Branches (Jobs) in the Army and Military Operations and Tactics, U.S. Army leadership and character development.

Sophomore Year Learning Outcomes

The student will have a working knowledge of the following areas: The Role of an Officer, Role of the Officer and Noncommissioned Officer, communications, code of conduct, first aid, principles of war and military operations and tactics, and begin to apply U.S. Army leadership through observed activities and demonstrate character development traits.

Junior Year Learning Outcomes

The student will have a working knowledge of the following areas: Small Unit Training, Command and Staff Functions, Nuclear, Biological and Chemical Warfare, Law of War, Weapons, Human Behavior, Math Reasoning, Computer Science and Military Operations and Tactics; Cadets will actively analyze character development and assess leadership skills.

Senior Year Learning Outcomes

The student will have a working knowledge of the following areas: Transition to Becoming an Officer, Military Justice, Intelligence and Electronic Warfare, Army Personnel Management, Army Logistics, Post and Installation Support and Military Operations and Tactics; Cadets will internalize and adhere to the U.S. Army's profession through active leadership and congruence of character development.

The mission of the Army Reserve Officers' Training Corps (AROTC) is to commission the future leaders of the United States Army. Since ROTC

produces over 65 percent of the Army's Officer Corps, our task is one of the most important undertakings in the Army and our country today. We seek top quality college students. We train these potential leaders, assess their abilities, and challenge them with the highest standards of profession/professionalism. Those who successfully complete the program, receive a commission as a second lieutenant in the U.S. Army. A commission as an Army officer affords the opportunity to pursue a profession in one or several of the 300 different jobs held by Army officers. Students may request to serve as an officer in either the active army, or part time in the Army Reserve or National Guard. Regardless of the method of service, officers in today's Army can be proud to know that they are doing their share in the defense of the United States of America.

The ISU Military Science program is divided into two segments, the basic program and the advanced program. The basic program (courses numbered 101-290) is designed primarily for freshmen and sophomores. No military obligation is incurred by a person participating in the basic program. The basic program is designed to be informative and to acquaint students with the military as a profession. The basic program or an allowed substitute is a prerequisite for the advanced program. Financial assistance is available on a competitive basis.

Persons interested in Military Science should visit the department located on the second floor of the Armory (east side).

Basic Program

The basic program courses are primarily for freshmen and sophomore students and, except for persons with prior military service and basic training graduates, are required for entry into the advanced program. Each scholarship cadet in the Basic Program receives a monthly allowance (freshmen $300; sophomore $350) for up to 10 months. The curriculum is designed to train freshmen and sophomores in individual and team skills. It also helps the Professor of Military Science identify individual leader developmental needs.

Advanced Program

The advanced program courses are for students who have completed the basic program (or received equivalent credit) and are mandatory for potential commissioning upon contracting at the beginning of their junior year. Each cadet receives a monthly allowance (junior $450; senior $500) for up to 10 months. These courses are primarily taught to academic juniors and seniors.

Successful completion normally obligates the student to military service on active or reserve duty. In addition to the advanced program of study, a student (cadet) will be expected to pass the Army Physical Fitness Test (precondition for commissioning) each semester and continually maintain military appearance standards in both personal grooming and uniform. Physical fitness training is regularly conducted outside of class and laboratory hours in a separate course, M S 150 Army Physical Readiness. Students are encouraged to attend and participate in this class.

Professional Military Science Education (PME) coursework outside of the military science curriculum is also a precondition to commissioning. The PME component consists of Basic Academic proficiency standards. These standards are explained to prospective students as they consider enrollment in the advanced program. Army Uniforms will be worn at least once a week. The 300-level courses are designed to prepare cadets for the Advanced Course, which is a 32 day summer internship/training program where cadets are trained to Army standards, develop leadership skills, and have their officer potential evaluated. The 400-level courses are the final preparation for commissioning as a second lieutenant in the United States Army. Students must meet academic alignment criteria and receive basic program credit before entering the advanced program.

Military Studies Minor

The College of Liberal Arts and Science offers a minor in Military Studies. Requirements for the minor include taking a minimum of 15 credits of ROTC instruction, which may be taken from one or a number of the ROTC programs. At least 6 credits must be in courses numbered 300 or above.

Courses primarily for undergraduates:

M S 101: Introduction to Military Science
(1-0) Cr. 1. F.
Prereq: Concurrent enrollment in M S 101L required
Examines the role of a Cadet in the Army Reserve Officer Training Corps and a Lieutenant in the United States Army. The course explores a military culture whose ultimate success is determined by the character and proficiency of its' leaders. Instruction introduces students to the cultural heritage and history of the U.S. Army. Students will begin to understand the structure of the U.S. Army and how it functions as an organization and institution. The curriculum promotes the development of students' communication skills to enhance their ability to transmit ideas. The class examines how the Army's cultural values drive the development of leadership in the Officer Corps. Hands-on activities enable students to gain insight on the skills and abilities required of cadets and officers interacting with civilians and soldiers.

M S 101L: Basic Leadership Laboratory I

(0-2) Cr. 1. F.

Prereq: Concurrent enrollment in M S 101 required

Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Students observe and participate in the rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. This concept provides a constant learning environment as they learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Marching, rifle firing, and tactical patrolling; students gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility.

M S 102: Structure and Function of the U.S. Army

(1-0) Cr. 1. S.

Prereq: Concurrent enrollment in M S 102L required

Instructs students on the fundamental skills and proficiencies required of Cadets in the Army Reserve Officer Training Corps and Officers in the United States Army. Allows students to explore the Army culture whose ultimate success is determined by the character and proficiency of its' leaders. Students will gain an insight to the effects of human behavior and communication on the function of the Army's basic unit structures. Special focus is given to the emphasis the Army puts on the development and character of the leader and how that affects the culture and operation of the Army as an institution. Students will develop an understanding of the role that morals and ethics play in becoming an Army Officer and leading American Soldiers. Introduction to basic officer/soldier skills will elucidate the complex role of the Officer in the modern Army.

M S 102L: Basic Leadership Laboratory II

(0-2) Cr. 1. S.

Prereq: Concurrent enrollment in M S 102 required

Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. Provides a constant learning environment as they learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Students also learn various military tasks such as marching, rifle firing, and tactical patrolling; gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility.

M S 150: Army Physical Readiness

(0-3) Cr. 1. Repeatable. F.S.

This lab is designed to use basic military skills and instruction to develop confidence, leadership, and physical fitness. The team approach is utilized in the instruction and application of Army physical fitness requirements. Students will learn various Army physical fitness techniques as well as how to conduct physical fitness sessions. Teaching locations include Lied Recreation Center, Beyer Hall, State Gym as well as around campus. Full participation in all events will be determined based on students physical and medical eligibility.

M S 201: Principles of Leadership and Communication Skills

(2-0) Cr. 2. F.

Prereq: Concurrent enrollment in M S 201L required

Explores the development of leadership and communication skills by understanding and studying the principles, traits, and dynamics of leadership and effective communication techniques. These include; leadership dimensions, human behavior, time management skills, stress management, values and ethics, decision making process, problem solving skills, team building exercises, communication techniques, briefing skills, delegating, nutrition, fitness, and counseling. Leadership assessment programs, role playing, active class participation, speeches, country briefs, and video clips are used to enhance and reinforce the instruction.

M S 201L: Basic Leadership Laboratory III

(0-2) Cr. 1. F.

Prereq: Concurrent enrollment in M S 201 required

Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Students observe and participate in the rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. Learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Students also learn various military tasks such as marching, rifle firing, and tactical patrolling; gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility.

M S 202: Map Reading and Land Navigation

(2-0) Cr. 2. S.

Prereq: Concurrent enrollment in M S 202L required

Class focuses on the characteristics and features of the earth's land mass and how to apply different methods of conducting navigation on land. These methods include; by use of topographical maps, compasses, aerial photographs, military maps, symbols, and all their practical application. These navigation techniques are used in class in conjunction with patrolling techniques and squad movement exercises. Students will utilize verbal and non-verbal communication, communication techniques, and briefing techniques during this class. Students are also assigned to read one professional book from the Army Reading List and complete a written review of the book in the Army writing style.

M S 202L: Basic Leadership Laboratory IV

(0-2) Cr. 1. S.

Prereq: Concurrent enrollment in M S 202 required

Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Students observe and participate in the rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. Learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Students also learn various military tasks such as marching, rifle firing, and tactical patrolling; gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility.

M S 250: Advanced Army Physical Readiness I

(0-5) Cr. 2. F.

Prereq: Successfully complete M S 150 and permission of Department Chair

Students learn to plan and conduct physical fitness sessions, following Army physical fitness readiness requirements. Development of physical fitness plan and leadership of training sessions. Participation determined by students' physical and medical eligibility.

M S 251: Advanced Army Physical Readiness II

(0-5) Cr. 2. S.

Prereq: Successfully complete M S 150 and M S 250

Students learn to plan and conduct physical fitness sessions, following Army physical fitness readiness requirements. Development of physical fitness plan, and leadership of training sessions. Participation determined by students' physical and medical eligibility.

M S 283: The U.S. Army in American Society to 1917

(3-0) Cr. 3. F.

Survey of U.S. Army history focused on the Army's social and cultural interactions from colonial wars up to the First World War. Examines the roles of race and culture in Army structure and operations.

M S 290: Independent Study: Basic Military Study

Cr. 1-3. Repeatable, maximum of 12 credits. F.S.SS.

Prereq: Permission of the Chair of Military Science Department

Investigation of an approved topic. Must result in a professional journal-worthy paper on ethics, current military issues, interpersonal communications, or leadership development.

M S 301: Methods of Instructing Military Skills

(3-0) Cr. 3. F.

Prereq: Completion of the basic Military Science program, concurrent enrollment in M S 301L, and permission of the Chair of the Military Science Department

Develops student's proficiency in analyzing, planning, and executing complex operations within a military organizational structure. Students are given situational opportunities and then measured on their leadership abilities through systematic feedback. Student's evaluations are based on sixteen leadership dimensions within the realms of values, attributes, skills, and actions. Students develop an understanding of human cultural heritage and history, as it pertains to the armed forces.

M S 301L: Advanced Leadership Laboratory I

(0-4) Cr. 1. F.

Prereq: Completion of the basic program, concurrent enrollment in M S 301 and permission of the Chair of the Military Science Department

The lab compliments M S 301 by providing opportunities to practice the lessons from class. On-the-job training and evaluation provided by the ROTC cadre. Developing training programs, structuring laboratories, presenting classes, planning various events, and accepting responsibility for the leadership labs. Participating in the Water Survival test, Army Physical Fitness test and the Land Navigation test are required.

M S 302: Applied Leadership

(3-0) Cr. 3. S.

Prereq: Completion of the basic Military Science program, concurrent enrollment in M S 302L and permission of the Chair of the Military Science Department

Prepares students to attend the Leadership Develop and Assessment Course at Fort Lewis, Washington in which they will be assigned specific and situational tasks to accomplish by providing purpose, motivation, and direction to fellow students across the nation. Students will learn how to identify sixteen leadership dimensions in the under classmen and provide specific feedback on their leadership behaviors. Students will develop their oral communication skills about the plans developed by the class, through small group presentation settings. Students will develop methods of studying human behavior.

M S 302L: Advanced Leadership Laboratory II

(0-4) Cr. 1. S.

Prereq: Completion of the basic program, concurrent enrollment in M S 302 and permission of the Chair of the Military Science Department

The lab compliments M S 302 by providing opportunities to practice the lessons from class. On-the-job training and evaluation provided by the ROTC cadre. Developing training programs, structuring laboratories, presenting classes, planning various events, and accepting responsibility for the leadership labs. Participating in the Water Survial Test, Army Physical Fitness Test and the Land Navigation test required.

M S 401: Seminar: The Military Team

(3-0) Cr. 3. F.

Prereq: Completion of the basic program, concurrent enrollment in M S 401L and permission of the Chair of the Military Science Department

Develops student proficiency in analyzing and evaluating leadership behaviors, such as values, attributes, skills, and actions. Students are given situational opportunities to assess leadership and provide feedback to other students placed in leadership roles. Students will be measured by their ability to both give and receive systematic and specific feedback on leadership behaviors. Students will develop their ability to communicate thoughts and ideas orally through small group presentations and group discussions. Students will supervise and evaluate the planning and execution of complex operations within a military organizational structure.

M S 401L: Advanced Leadership Laboratory III

(0-4) Cr. 1. F.

Prereq: Completion of the basic program, concurrent enrollment in M S 401 and permission of the Chair of the Military Science Department

The lab compliments the instruction from class by demonstrating the indelible link between personal values and successful leadership. On-the-job training and evaluation provided by the ROTC cadre. Developing training programs, structuring laboratories, presenting classes, planning various events, and accepting responsibility for the leadership labs.

M S 402: Seminar: The Professional Military Officer

(3-0) Cr. 3. S.

Prereq: Completion of the basic program, concurrent enrollment in M S 402L and permission of the Chair of the Military Science Department

Explores the dynamics of leading in the complex situations of current military operations in a contemporary world. Students will examine the differences in customs, courtesies and operational principles in the face of international terrorism. Students will also explore aspects of interaction with nongovernmental organizations, civilians and media in a war zone and foreign national governments. The course uses case studies, scenarios, and practical exercises, which prepare the student to face complex ethical and practical demands of leading soldiers within a multifaceted military organizational structure.

M S 402L: Advanced Leadership Laboratory IV

(0-4) Cr. 1. S.

Prereq: Completion of the basic program, concurrent enrollment in M S 402 and permission of the Chair of the Military Science Department

The lab compliments the instruction from class by demonstrating the indelible link between personal values and successful leadership. On-the-job training and evaluation provided by the ROTC cadre. Developing training programs, structuring laboratories, presenting classes, planning various events, and accepting responsibility for the leadership labs.

M S 490: Independent Study: Advanced Military Study
(1-0) Cr. 1. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: M S 301, M S 302, M S 401 and M S 402 and permission of the Chair of the Military Science Department
Investigation of an approved topic. Must result in a professional journal-worthy paper on ethics, current military issues, interpersonal communications, or leadership development.

Military Studies

Interdepartmental Minor

The Military Studies program is designed for students interested in learning about military skills and careers. The mission of the Reserve Officers' Training Corps (ROTC) programs is threefold. First, students are developed mentally, morally, and physically in order to make them strong leaders. Second, a desire for development in mind and character is instilled in students so they may assume the highest responsibilities of command, citizenship, and government. Finally, students are imbued with the highest ideals of duty, honor, and loyalty in order to graduate with a basic professional background and motivation toward their careers.

The Military Science, Naval Science and Air Force Aerospace departments accomplish this mission through detailed courses of instruction occurring throughout a typical student's college career. All academic courses offered by these departments focus on the development of professional military skills and their application. Each department offers courses unique to its branch of the military. Students in Army ROTC classes gain an appreciation for ground warfare and doctrine, while students in Naval Science develop an appreciation for naval surface and maritime engineering. The Air Force Aerospace Studies curriculum familiarizes students with Air Force structure and doctrine. On a broader scale, all three departments offer courses promoting leadership and sound management practices that investigate the military's role in American domestic and foreign policy, and can be employed in any career path.

Military Science, Naval Science and Air Force Aerospace courses are offered in the interdepartmental Military Studies program in the following participating departments: Military Science, Naval Science and Air Force Aerospace.

Undergraduate Study

Undergraduate study in this program provides the student with an opportunity to develop a minor in Military Studies. The three Iowa State University ROTC programs offer over 64 credits of specialized coursework. The minor in Military Studies is open to any Iowa State University student.

Undergraduate students may minor in Military Studies by taking 15 credits of coursework from a combination of any of the three ROTC programs - regardless of whether or not a commission in the Armed Forces is tendered. At least 6 of the 15 credits must be in courses numbered 300 or above.

Naval Science

The Department of Naval Science is embedded within the College of Liberal Arts and Sciences as an interdisciplinary program but does not offer an academic degree. The courses offered by the Department are developed by the Department of the Navy. The Naval Science Department and Naval ROTC (NROTC) Program develop individuals mentally, morally, and physically, and imbue in them the highest ideals of duty and loyalty, in order to commission them upon graduation as Navy and Marine Corps officers. Program graduates possess a basic professional background, are motivated towards careers in the Naval Service, and have a potential for future development in mind and character so as to assume the highest responsibilities of command, citizenship, and government. Emphasis is placed on the core values of courage, honor and commitment.

Naval Science courses are open to any ISU student who has met the course prerequisites. To participate in the Naval ROTC Program, students must apply through one of two programs: the NROTC Scholarship Program (full scholarship; which includes a book stipend, tuition, laboratory fees, uniforms, and a monthly stipend), or the College Program (non-scholarship, with limited financial assistance). Applicants for the Scholarship Program are selected through a comprehensive nationwide competition. Applicants for the College Program are selected by the Professor of Naval Science from among students already in attendance at, or selected for admission by, the university. The College Program involves limited financial assistance by application for a 2 or 3-year scholarship. Upon application, students choose between the Navy Option and Marine Corps Option, for the purposes of training focus. NROTC students pursue their studies like other university students except that they must meet certain additional requirements that will prepare them to serve as naval officers upon graduation.

A Marine Corps Option student incurs a minimum 4-year active duty military obligation as a commissioned officer after graduation; a Navy Option student incurs a minimum 5-year active duty obligation.

Further information is available from the Professor of Naval Science, Iowa State University, isunrotc@iastate.edu, 515-294-6050.

While in the NROTC Program, Scholarship Program students will participate (with pay) in at-sea training cruises during the summer. College Program students, accepted to receive a 2 or 3-year scholarship, will participate in at-sea training during the summer between their Junior and Senior year based on the specifics of their scholarship. Students are also exposed to regular and extracurricular activities that teach leadership principles and help them decide which field of the Navy or

Marine Corps they wish to enter. These activities also include weekly leadership laboratory periods and opportunities for involvement in several student societies.

Undergraduate Study

Naval Science courses are primarily for those students in the NROTC program, however, other university students may also enroll. Students enrolled in the NROTC program must fulfill the following requirements:

N S 111	Introduction to Naval Science	3
N S 212	Seapower and Maritime Affairs	3
N S 220	Leadership and Management	3
N S 230	Navigation	3
N S 320	Naval Ship Systems I (Engineering)	3
N S 330	Naval Ship Systems II (Weapons)	3
N S 410	Naval Operations and Seamanship	3
N S 412	Leadership and Ethics	3
N S 440	Senior Naval Science Seminar	1

Marine option students will complete:

N S 111	Introduction to Naval Science	3
N S 212	Seapower and Maritime Affairs	3
N S 220	Leadership and Management	3
N S 240X	Fundamentals of Maneuver Warfare	3
N S 321	Evolution of Warfare	3
N S 412	Leadership and Ethics	3
N S 440	Senior Naval Science Seminar	1

1. In addition to the normal Naval Science courses, all NROTC students are required to participate in laboratory periods that supplement the various academic courses. The Leadership Lab emphasizes human relations principles, teaches basic military formations, movements, commands, courtesies, and honors, and provides practice in unit leadership. Non NROTC program students enrolled in Naval Science courses are not required to participate in laboratory periods.
2. The College of Liberal Arts and Sciences offers a minor in military studies. Requirements for the minor include taking a minimum of 15 credits of ROTC instruction, which may be taken from any of the three ROTC programs offered on campus. At least 6 credits must be in courses numbered 300 or above.

For basic undergraduate curriculum requirements, see Liberal Arts and Sciences, Curriculum; or Engineering, Curricula.

Courses primarily for undergraduates:

N S 111: Introduction to Naval Science

(3-0) Cr. 3. F.

Introduction to the organization, regulations, and capabilities of the US Navy, with emphasis on mission and principal warfare components.

N S 212: Seapower and Maritime Affairs

(3-0) Cr. 3. S.

An historical survey of sea power in terms of national domestic environments, foreign policy, and the evolution of maritime forces with trends in technology, doctrine, and tactics. The student will develop an understanding of the role the US Navy has played in the nation's history, both in peace and war. Naval events, forces and policies will be studied as elements in the shaping of the national consciousness and sense of purpose. Course content will include the development of the concept of sea power, the role of various warfare components of the Navy, the implementation of sea power as an instrument of national policy, the evolution of naval tactics, and the influence of maritime affairs around the world.

N S 220: Leadership and Management

(3-0) Cr. 3. F.

Introduction to the basic concepts of management and organization, their application to operations and personnel management. Experiential approach to learning principles of leadership and management by examining various management theories and their applications. Skills are developed in the areas of communication, counseling, control, direction, management, and leadership through active guided participation.

N S 230: Navigation

(3-0) Cr. 3. S.

Prereq: Sophomore classification

Study of the fundamentals of marine navigation used by ships at sea; includes practical exercises in piloting using visual and electronic means. In-depth discussion of laws that govern conduct of vessels in national and international waters. Course is supplemented with review and analysis of case studies involving actual navigation incidents.

N S 240: Fundamentals of Maneuver Warfare

(3-0) Cr. 3. Alt. S., offered odd-numbered years.

Concepts, definition, and need for maneuver warfare and expeditionary operations. US Marine Corps case studies of specific battles, development, and implementation. Structure, operation and capabilities of the Marine expeditionary unit, Marine air-ground task force and expeditionary strike group, Discussion and incorporation of leadership traits and principles.

N S 320: Naval Ship Systems I (Engineering)
(3-0) Cr. 3. F.
Prereq: PHYS 221, sophomore classification
An introduction to naval engineering with emphasis on the equipment and machinery involved in the conversion of energy for propulsion and other purposes aboard the major ship types of the U.S. fleet. Basic concepts of the theory and design of steam, gas turbine, diesel, and nuclear propulsion. Introduction to ship design, stability, hydrodynamic forces, compartmentalization, electrical and auxiliary systems.

N S 321: Evolution of Warfare
(3-0) Cr. 3. S.
Prereq: Sophomore classification
Evolution of warfare from 3500 B.C. to contemporary times; analysis of the impact of historical precedents on modern military thought and action; emphasis on the historical development of military tactics, strategy, and technology.

N S 330: Naval Ship Systems II (Weapons)
(3-0) Cr. 3. S.
Prereq: PHYS 221, sophomore classification
Introduction to the theory and principles of operation of naval weapon systems. Included coverage of types of weapons and fire control systems, capabilities and limitations; theory of target acquisition, identification and tracking; basics of naval ordnance.

N S 410: Naval Operations and Seamanship
(3-0) Cr. 3. F.
Prereq: N S 230; senior classification
Study of tactical naval operations; employs practical use of maneuvering boards together with shiphandling principles to arrive at tactical shipboard maneuvering solutions. Study also of naval command and control, communications, and the Naval Warfare Doctrine.

N S 412: Leadership and Ethics
(3-0) Cr. 3. S.
Prereq: Requirements for NROTC students - N S 111, N S 212 or HIST 389, N S 220, N S 230, N S 320, N S 330 and N S 410
Basic background concerning the duties and responsibilities of the junior naval officer and division officer in the areas of integrity and ethics, human resources management, personnel management, material management, and the administration of discipline. Preparation for responsibilities encountered immediately upon commissioning.

N S 440: Senior Naval Science Seminar
(1-0) Cr. 1. F.S.
Prereq: Senior classification
Current leadership issues in the US Navy which will challenge the newly commissioned officer. Opportunities to analyze, provide solutions, and discuss actions related to a variety of real world situations.

N S 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: Senior classification and prior approval of Naval Science Department Chair, 6 credits in Naval Science
No more than 9 credits of N S 490 may be counted toward graduation.

Officer Education Programs

Iowa State University offers Reserve Officers Training Corps (ROTC) programs for the professional training of officers for the Army, Air Force, Navy and Marines.

The purpose of these programs is to provide an avenue for interested students to become reserve or regular officers in one of the United States military services, and the university regards this training as the foundation for possible careers in the military. The Air Force and the Navy require a period of active duty service upon completion of the ROTC program. Graduates from Army ROTC serve in either active Army, the Army Reserve, or the National Guard.

All students enrolled in advanced ROTC programs receive financial allowances, which are described under Student Financial Aid. Scholarships are also available for all services as outlined in the section on financial aid.

For specific courses and programs see also Air Force Aerospace Studies, Military Science, and Naval Science.

U.S. Latino/a Studies Program

U.S. Latino/a Studies is devoted to the study of Mexican Americans, Puerto Ricans, Cuban Americans and other groups of people living in the United States who trace their ancestry to the Spanish-speaking countries of Latin America, and who comprise the largest and fastest growing ethnic groups in the United States. U.S. Latino/a Studies is to be distinguished from Latin American Studies; the latter focuses on people living in Latin America. The methodologies of study in U.S. Latino/a Studies are cross-disciplinary, drawing from the methods established in psychology, anthropology, sociology, political science, economics, religion, philosophy, history, literary studies, and other fields.

The minor in U.S. Latino/a Studies is an excellent addition to any major. Virtually any professional, in any field, working throughout the United States, can benefit from a greater understanding of the Latino/a communities in our nation.

Students can also build a major in U.S. Latino/a Studies within the Interdisciplinary Studies major administered by the College of Liberal Arts and Sciences.

Interdisciplinary Studies Major, Track in U.S. Latino/a Studies

Students can work with the US LS program director and the Interdisciplinary Studies adviser to develop an individualized major program. In addition to meeting the general requirements for the Interdisciplinary Studies major, students wishing to complete a track in U.S. Latino/a Studies must complete a minimum of 36 credits in the area of U.S. Latino/a Studies. At least 15 of the 36 credits must be in courses numbered 300 and above and 6 credit hours must be earned at the 400-level. Students must also meet the upper-level communication proficiency requirement by taking English 302 or 314.

Required Courses (36 credits)

Prerequisite for all US LS courses: (3 credit hours):

US LS 211	Introduction to U.S. Latino/a Studies	3
Two of the following Historical Foundations of US LS		6
US LS 240	Latina/o History	
HIST 340	History of Latin America I	
HIST 341	History of Latin America II	
Two of the following Social Science Foundations of US LS		6
US LS 332	The Latino/Latina Experience in U.S. Society	
US LS 347	U.S. Latino/a Psychology	
ANTHR 323	Topics in Latin American Anthropology	
SPAN 322	Latin American Civilization	
SPAN 324	Latin America Today	
Two of the following Political Foundations of US LS		3
US LS 343	Latin American Government and Politics	
US LS 473	Civil Rights and Ethnic Power	
Two of the following Literature and Language in US LS		6
US LS 342	Religion and U.S. Latino/a Literature	
US LS 344	U.S. Latino/a Literature	
SPAN 445	Seminar on the Literatures and Cultures of Latin America	
SPAN 304	Spanish for Global Professionals	
Special Topics in US LS (Optional; maximum of 3 credit hours per semester up to 9 credit hours total)		3-9
US LS 490	Independent Study	
Additional Credits for the Major (if not taken to satisfy areas above; four of the following courses)		12
US LS 240	Latina/o History	
US LS 332	The Latino/Latina Experience in U.S. Society	
US LS 342	Religion and U.S. Latino/a Literature	
US LS 343	Latin American Government and Politics	
US LS 344	U.S. Latino/a Literature	
US LS 347	U.S. Latino/a Psychology	
US LS 473	Civil Rights and Ethnic Power	
US LS 490	Independent Study	
ANTHR 323	Topics in Latin American Anthropology	
HIST 340	History of Latin America I	
HIST 341	History of Latin America II	
SPAN 322	Latin American Civilization	
SPAN 324	Latin America Today	
SPAN 445	Seminar on the Literatures and Cultures of Latin America	

Notes

1. The list of acceptable courses may include courses not currently listed above. Contact the Director of US Latino/a Studies for information on eligible courses.
2. The student must have an average grade of C in the required courses of the major.
3. Fulfillment of the foreign language requirement with Spanish is strongly recommended, but not required. A limit of six (6) credits of approved Spanish courses (304, 322, 324, 445) may be used as supporting courses for the major. Spanish course credits counted toward the major may not be applied to any other degree requirement.

US Latino/a Studies Minor

The minor in US Latino/a Studies requires a minimum of 15 credit hours. University policy indicates that minors must include at least 9 credits that are not applied to any other degree requirement.

Required course work in core courses (9 credits total):

US LS 211	Introduction to U.S. Latino/a Studies	3
And six credits from the following:		6
US LS 240	Latina/o History	
US LS 332	The Latino/Latina Experience in U.S. Society	
US LS 342	Religion and U.S. Latino/a Literature	
US LS 343	Latin American Government and Politics	
US LS 344	U.S. Latino/a Literature	
US LS 347	U.S. Latino/a Psychology	
US LS 473	Civil Rights and Ethnic Power	
US LS 490	Independent Study	
Total Credits		9

Six (6) additional credits from the following list (if not taken to satisfy area above):

US LS 240	Latina/o History	3
US LS 332	The Latino/Latina Experience in U.S. Society	3

US LS 342	Religion and U.S. Latino/a Literature	3
US LS 343	Latin American Government and Politics	3
US LS 344	U.S. Latino/a Literature	3
US LS 347	U.S. Latino/a Psychology	3
US LS 473	Civil Rights and Ethnic Power	3
US LS 490	Independent Study	1-3
ANTHR 323	Topics in Latin American Anthropology	3
HIST 340	History of Latin America I	3
HIST 341	History of Latin America II	3
SPAN 304	Spanish for Global Professionals	3
SPAN 322	Latin American Civilization	3
SPAN 324	Latin America Today	3
SPAN 445	Seminar on the Literatures and Cultures of Latin America	3

Notes:

1. The list of acceptable courses may include courses not currently listed above. Contact the Director of US Latino/a Studies for information on eligible courses.
2. A limit of six (6) credits of approved Spanish courses (304, 322, 324, 445) may be used as supporting courses for the minor. Spanish course credits counted toward the minor may not be applied to any other degree requirement.
3. A maximum of 3 credit hours of US LS 490 (Independent Study) may applied toward the minor.

Courses primarily for undergraduates:

US LS 211: Introduction to U.S. Latino/a Studies
(3-0) Cr. 3. F.S.
History and current lives of the Latino/a peoples in the United States, including Mexican, Cuban, Puerto Rican, Dominican, and South and Central Americans, as well as information specific to Iowa Latino/as, will be covered. Through readings, class discussions, writing assignments, and guest speakers, students will acquire accurate information and a solid understanding of the US Latino/a population and cultural perspectives. Elements of Latino/a culture to be covered include historical, sociological, educational, psychological, economic, and political facets.
Meets U.S. Diversity Requirement

US LS 240: Latina/o History
(Cross-listed with HIST). (3-0) Cr. 3.
Historical and cultural heritage of Latinas/os in the United States. The histories of Mexican, Puerto Rican, Cuban, and other Latin American peoples in the U.S. emphasizing political and cultural convergence and congruencies.
Meets U.S. Diversity Requirement

US LS 332: The Latino/Latina Experience in U.S. Society
(Cross-listed with SOC). (3-0) Cr. 3. F.
Prereq: SOC 134
Examination of the social, historical, economic and political experience of varied Latino ethnic groups in the U.S. - primarily focusing on Mexican, Puerto Ricans, and Cubans.
Meets U.S. Diversity Requirement

US LS 342: Religion and U.S. Latino/a Literature
(Cross-listed with RELIG). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
A study of the religious behavior and attitudes expressed in the literature of Mexican Americans, Puerto Ricans, Cuban Americans and other groups of people living in the U.S. who trace their ancestry to the Spanish-speaking countries of Latin America.
Meets U.S. Diversity Requirement

US LS 343: Latin American Government and Politics
(Cross-listed with POL S). (3-0) Cr. 3.
Political institutions, processes, and contemporary issues. Selected countries examined intensively to illustrate generalizations. Role of parties, military, church, human rights, women, environmental issues, interest groups, ideology, and globalization.

US LS 344: U.S. Latino/a Literature
(Cross-listed with ENGL). (3-0) Cr. 3. S.
Prereq: ENGL 250
An introduction to the literature of Mexican Americans, Puerto Ricans, Cuban Americans and other Latino/a sub-groups. Special emphasis on themes such as ethnic relations and comparisons with EuroAmerican literary traditions.
Meets U.S. Diversity Requirement

US LS 347: U.S. Latino/a Psychology
(Cross-listed with PSYCH). (3-0) Cr. 3. S.
Prereq: Two courses in Psychology including PSYCH 101
Historical, political, and social contexts of psychological and mental health constructs in terms of their validity and utility for use with Latino/a people in the U.S. Unique aspects of psychological functioning particular to Latino/a people in the U.S.
Meets U.S. Diversity Requirement

US LS 371: Mexican American History
(Cross-listed with HIST). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 3 credits of 200-level HIST at Iowa State and sophomore classification.
History of the Mexican American community in the U.S. from the 1820s to the present. Topics include community development, employment, social marginalization, racism/discrimination, depression and world wars, civil rights, ethnic power and politics.
Meets U.S. Diversity Requirement

US LS 473: Civil Rights and Ethnic Power
(Cross-listed with AF AM, HIST). (3-0) Cr. 3.
Prereq: Sophomore classification
Comparative history of the civil rights and ethnic power movements (African American, Chicano, American Indian, Puerto Rican, among others) in the U.S. from World War II to the present. Topics include institutional foundations, leadership, gender and racial dynamics, and the convergences and divergences of these differing ethnic struggles for rights.
Meets U.S. Diversity Requirement

US LS 490: Independent Study
Cr. 1-3. Repeatable, maximum of 9 credits.
Prereq: permission of instructor
Independent study under supervision of instructor. No more than 3 credits may count towards the U.S. Latino/a Studies certificate.

College of Veterinary Medicine

Pat Halbur, Interim Dean

Jared A. Danielson, Associate Dean of Academic and Student Affairs

vetmed.iastate.edu/ (http://vetmed.iastate.edu)

Departments of the College

- Biomedical Sciences
- Veterinary Clinical Sciences
- Veterinary Diagnostic and Production Animal Medicine
- Veterinary Microbiology and Preventive Medicine
- Veterinary Pathology

Other units of the college include the Lloyd Veterinary Medical Center, Veterinary Diagnostic Laboratory, Veterinary Medical Research Institute, Veterinary Education and Technology Services and Office of Curricular and Student Assessment. The college participates in interdisciplinary graduate programs in genetics; molecular, cellular and developmental biology; toxicology; immunobiology; and neuroscience.

Objectives of the Curriculum

The instructional objective of the College of Veterinary Medicine is to enable students to assume vital roles in society as productive health care providers and biomedical scientists. Such an education provides students with general learning, communication, and problem solving abilities; veterinary medical practice and research skills; and professional and ethical values.

The curriculum incorporates basic biomedical and clinical principles, clinical decision making skills, and exceptional clinical experience in small animal medicine and surgery, equine medicine and surgery, food animal medicine and surgery, and production animal medicine. Companion animal medicine and surgery are provided within the regionally recognized referral hospital through the community practice unit and equine field services. The college is located in one of the most intensive livestock producing areas in the United States. Because of this, students engage in extensive food supply veterinary medicine experiences and numerous diagnostic cases.

The professional curriculum is a four-year course of study leading to the doctor of veterinary medicine degree. Each of the first three years of the curriculum consists of two semesters while the fourth year has three semesters. Students are admitted into the professional curriculum after completing a minimum of 60 semester credits of required undergraduate coursework.

A strong and reputable basic science education during the first two years of the professional curriculum prepares veterinary students for a wide range of clinical experience during the last two years of the educational program. Fourth year students may choose to enhance their education by earning clinical elective credits at approved government agencies, research laboratories, veterinary practices and other university hospitals. Outstanding research programs in infectious diseases, food safety, neuroscience, immunoparasitology, evidence-based medicine, and many other areas provide opportunities for qualified students to participate in research.

Concurrent DVM/MS, DVM/PhD, DVM/MPH and DVM/MBA programs are available for qualified students who wish to obtain both veterinary and graduate degrees. Students must have a bachelor's degree or a minimum of 128 semester credits in undergraduate and professional curricula in order to participate in the concurrent DVM/graduate degree program. Admission to the concurrent degree program is subject to the approval of the deans of the College of Veterinary Medicine and the Graduate College.

The college is an important recruiting center for employers seeking veterinarians for private practice; industry; educational institutions; international agencies; federal, state and local governments; the armed forces; departments of public health; zoological gardens; and other related fields of professional activity. Graduates are highly sought after

and typically have multiple employment offers upon graduation. Career services and an online job board are available for students.

Pre-veterinary Medicine Preparation

Admission Requirements

The College of Veterinary Medicine seeks students with diverse backgrounds and encourages students to enroll in baccalaureate programs in the college of their choice.

Undergraduate students are strongly encouraged to complete a bachelor's degree before applying to the College of Veterinary Medicine. Because veterinarians have varied career options, when deciding on an undergraduate major, the student should consider the area of veterinary medicine which interests them. For example, those who desire a career in clinical practice may wish to pursue a degree in biological science, animal science, agricultural economics, business, social science or humanities. Students with an interest in zoo or wildlife veterinary medicine may want to look at animal ecology, environmental studies or zoology. Future researchers may wish to consider genetics, molecular biology, microbiology, or biochemistry. Students who desire a career in public health (USDA, FDA, etc) or government (legislative/policy) may find benefit in any of the biological sciences or in political science. A degree in education may be valuable to those who envision themselves as educators in a College of Veterinary Medicine. These examples are only suggestions and are but a few of the many possibilities.

For the most current information regarding applications and admission to the College of Veterinary Medicine, please refer to the College web site at www.vetmed.iastate.edu/ (http://www.vetmed.iastate.edu).

Applicants for admission to the College of Veterinary Medicine must have attended an accredited college or university, have completed 40 semester credits prior to the deadline for filing an application for admission, and have completed 60 semester credits prior to the end of the spring term of the year in which the applicant seeks to be admitted to the College of Veterinary Medicine.

All science requirements should be fulfilled by the time of application or scheduled for completion by the end of the fall term in which the applicant applies. However, if necessary, the applicant may complete up to two required science courses after the fall term providing a transcript with the courses and grades listed is postmarked by July 1 of the year the applicant would enter. There is no maximum number of non-science required courses that may be completed but the deadline of having a transcript with these course grades posted by July 1 also applies. The July 1 deadline for transcripts and grades is firm.

Required courses must be completed with a grade of C (2.00) or better. A grade of C- (1.67) does not fulfill the requirement.

Credits earned must include the following Iowa State semester course offerings or their equivalents:

English Composition 6 cr.
One year of composition or writing emphasis courses. May include business or technical writing. Two of the following courses would fulfill the requirement.

ENGL 150	Critical Thinking and Communication	3
ENGL 250	Written, Oral, Visual, and Electronic Composition	3
ENGL 302	Business Communication	3
ENGL 309	Proposal and Report Writing	3
ENGL 314	Technical Communication	3

Oral Communications 3 cr.
May include public speaking, interpersonal communication, group or organizational communication or speaking emphasis courses. One of the courses below will fulfill the requirement.

SP CM 212	Fundamentals of Public Speaking	3
AGEDS 311	Presentation and Sales Strategies for Agricultural Audiences	3
SP CM 312	Business and Professional Speaking	3
COMST 214	Professional Communication	3

General Chemistry with Laboratory* 7 cr.
One year series for science majors with one semester lab.

CHEM 177 & 177L	General Chemistry I and Laboratory in General Chemistry I	5
CHEM 178	General Chemistry II	3
Total Credits		8

Organic Chemistry with Laboratory* 7 cr.
One year series with one semester lab.

CHEM 331	Organic Chemistry I	3
CHEM 331L	Laboratory in Organic Chemistry I	1
CHEM 332	Organic Chemistry II	3
Total Credits		7

Biochemistry* 3 cr.
One semester (no lab required). One of the courses below will fulfill the requirement.

BBMB 301	Survey of Biochemistry	3
BBMB 316	Principles of Biochemistry	3
BBMB 420	Mammalian Biochemistry	3

General Physics with Laboratory* 4 cr.
First semester of a two-semester series with lab. Must include mechanics, fluids, heat and thermodynamics, vibrations, waves and sound.

PHYS 111 General Physics

General Biology with Laboratory* 8 cr.
Two semester series with lab each semester. A Bachelor's degree in Biology fulfills this requirement.

BIOL 211	Principles of Biology I	3
BIOL 211L	Principles of Biology Laboratory I	1
BIOL 212	Principles of Biology II	3
BIOL 212L	Principles of Biology Laboratory II	1
Total Credits		8

Genetics * 3 cr.
Must include Mendelian and molecular genetics. One of the courses below will fulfill the requirement.

BIOL 313	Principles of Genetics	3
GEN 320	Genetics, Agriculture and Biotechnology	3
Total Credits		6

Mammalian Anatomy or Physiology* 3 cr.
Human anatomy or physiology will also fulfill this requirement (no lab required). One of the courses below will fulfill the requirement

B M S 329	Anatomy and Physiology of Domestic Animals	3
AN S 214	Domestic Animal Physiology	3
BIOL 155	Human Biology	3
BIOL 255	Fundamentals of Human Anatomy	3
BIOL 335	Principles of Human and Other Animal Physiology	4

Humanities or Social Sciences 8 cr.
Electives 8 cr.
Total Credits Required 60 cr.
Courses above marked with an asterisk (*) are the required science courses. The required science course GPA is calculated from these courses.

Credits in the previously specified courses will normally be earned on the traditional four-letter grading system with A as the highest grade and D as the lowest passing grade. All required courses must be completed with a grade of C (2.0) or better. It is generally expected that required courses have been completed within the past eight (8) years. AP or CLEP credits must be documented by original scores submitted to the College of Veterinary Medicine. CLEP credits may be accepted only for arts, humanities and social sciences. Credits in the preceding specified courses will not be accepted if earned under the pass-not pass grading system or similar options.

Application and Admission

Applicants must apply using the Veterinary Medical College Application Service (VMCAS). The VMCAS application may be found online at the VMCAS website (www.aavmc.org (http://www.aavmc.org) under VMCAS). Those applying through VMCAS also need to complete the ISU Supplemental Application found at the College of Veterinary Medicine website. The Iowa resident deadline for filing the VMCAS application, supplemental application, processing fee, GRE scores, evaluations and transcripts is September 1. The deadline for all other applicants is October 1.

Any student wishing to use international coursework (including study abroad) to fulfill a preveterinary requirement must provide a transcript from the foreign institution.

A list of courses in progress at the time of submission and/or scheduled for completion by the end of spring term should accompany the supplemental application. Undergraduate college credits must average at least 2.50 on a 4.00 marking system for the application to be eligible for review. The preceding scholastic requirements are minimum and do not assure admission even though these requirements have been fulfilled.

Admission to the College of Veterinary Medicine is on a competitive and selective basis. GPA, Graduate Record Exam (GRE) general test score (the GRE for Iowa residents must be received by September 1, for all other applicants, it must be received by October 1), animal and veterinary experience, essays, recommendations and personal development (leadership, citizenship, etc.) are given consideration in the selection of candidates. Final selection of candidates is made after an on-campus interview.

Approximately one-half of the positions available are reserved for residents of Iowa. The College of Veterinary Medicine has implemented a Professional Program in Veterinary Medicine with the University of Nebraska-Lincoln for Nebraska residents and contracts with the states of North Dakota, South Dakota and Connecticut. A number of positions are also available to residents of other states. A few highly qualified international students may be accepted and are considered in the non-resident/non-contract applicant pool. Consideration is given equally to all applicants without regard to race, color, national origin, gender, religion, disability, or age, political beliefs, or marital or familial status.

For further information on these programs and contracts, please visit the College of Veterinary Medicine at www.vetmed.iastate.edu (http://www.vetmed.iastate.edu) and click on APPLY VET MED.

Curriculum in Veterinary Medicine

Graduation Requirements

To be awarded the degree doctor of veterinary medicine, candidates must have passed all required courses in the curriculum in veterinary medicine,

have earned at least 4 elective credits on a graded basis of A, B, C, D while enrolled in the College of Veterinary Medicine, and have at least a 2.0 grade-point average in the veterinary medicine curriculum.

Required Courses in the Professional Program

B M S 330	Principles of Morphology I	6
B M S 331	Principles of Morphology II	4
B M S 333	Biomedical Sciences I	6
B M S 334	Biomedical Sciences II	6
B M S 335	Molecular and Cellular Basis of Disease	1
B M S 336	Veterinary Nutrition	2
B M S 337	Neuroanatomy	3
B M S 339	Clinical Foundations I	1
B M S 345	Case Study I	1
B M S 346	Case Study II	1
B M S 354	General Pharmacology	3
B M S 443	Pharmacology and Therapeutics	3
V C S 311	Veterinarian in Society I	R
V C S 313	Veterinarian in Society III	1
V C S 314	Veterinarian in Society IV	1
V C S 315	Veterinarian in Society V	1
V C S 339	Clinical Foundations I	1
V C S 385	Grand Rounds	R
V C S 391	Clinical Imaging	1
V C S 393	Principles of Surgery	3
V C S 394	Principles of Surgery Laboratory	1
V C S 395	Small Animal Surgery	2
V C S 398	Anesthesiology	2
V C S 399	Ophthalmology	1
V C S 436	Small Animal Internal Medicine	3
V C S 440	Introduction to Clinics	R
V C S 444	Small Animal Medicine	4
V C S 445	Equine Medicine	2
V C S 448	Diagnostic Imaging and Radiobiology	3
V C S 449	Junior Surgery Laboratory	3
VDPAM 312	Introduction to Animal Welfare	1
VDPAM 426	Veterinary Toxicology	3
VDPAM 445	Production Animal Clinical Medicine	3
VDPAM 450	Disturbances of Reproduction	4
V MPM 378	Case Study IV	2
V MPM 380	Veterinary Immunology	2
V MPM 386	Veterinary Microbiology	5
V MPM 387	Veterinary Virology	3
V MPM 388	Public Health and the Role of the Veterinary Profession	3
V MPM 437	Infectious Diseases and Preventive Medicine	3
V PTH 342	Anatomic Pathology I	3
V PTH 372	Anatomic Pathology II	4
V PTH 376	Veterinary Parasitology	4
V PTH 377	Case Study III	2
V PTH 409	Introduction to Veterinary Cytology and Laboratory Techniques	1
V PTH 425	Clinical Pathology	4

Fourth Year

The fourth year of the veterinary medical curriculum is designed to be flexible yet provide a broad based clinical education involving all domestic species of animals. All students participate in rotations that are considered fundamental to any species orientation that the student might choose. In addition, students choose one of four options for additional study, including the Small Animal, Equine, Mixed Animal, or Food Animal Options. Students may obtain clinical elective credits by repeating on-campus rotations or participating in approved off-campus preceptorships at government, private or public agencies; other universities; or private veterinary practices.

The following rotations are required of all fourth year students in addition to the requirements of the track they choose. A complete listing of track-specific requirements can be found at: http://vetmed.iastate.edu/:

V C S 453	Small Animal Medicine I	2
V C S 457	Equine Medicine	2
or V C S 464	Equine Field Services	
V C S 460	Radiology	2
V C S 463	Primary Care	2
V C S 466	Anesthesiology	2
V C S 468	Intensive Care	4
2 credits of V C S 473 Small Animal Surgery:		2
V C S 473O	Small Animal Surgery: Orthopedic	
V C S 473S	Small Animal Surgery: Soft Tissue	
V C S 495	Grand Rounds Presentations	R
VDPAM 477	Food Animal and Camelid Medicine and Surgery	2
V PTH 456	Necropsy Laboratory Practicum	1
V PTH 457	Clinical Pathology Laboratory Practicum	1

Reinstatement

Any student who voluntarily withdraws from the College of Veterinary Medicine or who is dismissed from the College of Veterinary Medicine, after having successfully completed one or more semesters forfeits his/

her standing and must make written application for reinstatement to this college a minimum of 60 days prior to the opening of the semester for which they seek to re-enter. Any student who voluntarily withdraws from the College of Veterinary Medicine prior to completion of one semester must re-apply for admission to the college in the general applicant pool.

Biomedical Sciences

Professional Program of Study

For professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see Veterinary Medicine, Curriculum.

A good foundation in anatomy, physiology, and pharmacology of animals is necessary to understand the mechanisms of animal disease processes and their treatment. Study of mammalian anatomy and physiology prepares students with a background in the structural and functional activities of cells, tissues, organs, and body systems relevant to veterinary medicine.

An understanding of drug action is essential for rational drug therapy. The general pharmacology courses provide students with a background in basic pharmacology to include pharmacodynamics, toxicology, and the clinical application of drugs. Special emphasis is placed on chemical agents and therapeutic practices specific to veterinary medicine.

Graduate Programs

The department offers Master of Science and Doctor of Philosophy degrees with a major in Biomedical Sciences and specializations in Anatomy, Physiology, Pharmacology, and Cell Biology. Up to 10 credits of dual-listed veterinary courses may be applied for major graduate credit. Departmental research facilities allow for training in experimental anatomy, pharmacology, and physiology. Graduate studies are supervised by faculty members recognized in their areas of expertise. Current areas of research include: Alzheimer's disease, aquatic animal health, calcium and mineral homeostasis, diabetes mellitus, glia-neuron signaling, neurophysiology of pain, neurotoxicology, physiology and pharmacology of nematode ion-channels, Parkinson's disease, pharmacology of schistosomiasis, pharmacology of salmonellosis, physiology and pharmacology of thalamic neurons, physiology of the retina, Spinal Muscular Atrophy, and study of neural stem cells. The objective of the department is to prepare graduate students for successful careers in biomedical research and professional service. The department is part of interdepartmental programs in neuroscience, toxicology, and molecular, cellular, and developmental biology. The combined Ph.D./DVM program is an option offered by the department.

Courses primarily for professional curriculum students:

B M S 329: Anatomy and Physiology of Domestic Animals
(3-0) Cr. 3. S.
Prereq: BIOL 212, BIOL 212L
Survey of body systems of domestic animals. Provides a medical science orientation particularly useful to students in a preveterinary medicine curriculum.

B M S 330: Principles of Morphology I
(Dual-listed with B M S 530). (4-6) Cr. 6. F.
Prereq: 10 credits in biological science and permission of the instructor
Anatomy of the dog and cat: from basics to clinical application.

B M S 331: Principles of Morphology II
(Dual-listed with B M S 531). (2-6) Cr. 4. S.
Prereq: First-year classification in veterinary medicine. B M S 330
Comparative and topographic anatomy of horse, ruminants, pig, and chicken.

B M S 333: Biomedical Sciences I
(Dual-listed with B M S 533). (5-3) Cr. 6. F.
Prereq: First-year classification in veterinary medicine
Microscopic anatomy and physiology of cells, tissues, cardiovascular system, respiratory system, and urinary system.

B M S 334: Biomedical Sciences II
(Dual-listed with B M S 534). (5-3) Cr. 6. S.
Prereq: First-year classification in veterinary medicine
Microscopic anatomy of the immune system and integument. Microscopic anatomy and physiology of the digestive system, endocrine system, and reproductive system.

B M S 335: Molecular and Cellular Basis of Disease
(1-0) Cr. 1. F.
Descriptions of molecular and cellular biology especially as it pertains to veterinary medicine. Discussions of cellular components, cellular functions and anomalies thereof. Emphasis placed on divergences relevant to companion animals and livestock.

B M S 336: Veterinary Nutrition
(2-0) Cr. 2. F.
Introduce basic biochemical aspects of metabolism and function of energy, protein, fat, minerals and vitamins in the diet. Determine nutrient requirements of food animals, pets, and horses under various physiological states. Understand fate of various nutrients in simple stomached animals, ruminants, and cecal fermenters. Discuss clinical nutrition problems specific to each species.

B M S 337: Neuroanatomy
(Dual-listed with B M S 537). (2-2) Cr. 3. S.
Prereq: First-year classification in veterinary medicine
Neuroanatomy of domestic animals.

B M S 339: Clinical Foundations I
(Cross-listed with V C S). (0-2) Cr. 1. F.
Prereq: First-year classification in veterinary medicine
Canine physical examination; basic behavior, animal handling and restraint; medical record keeping.

B M S 345: Case Study I
(0-2) Cr. 1. F.
Prereq: First-year classification in veterinary medicine
Clinical applications of basic sciences taught concurrently in the fall semester of the first year curriculum in veterinary medicine.

B M S 346: Case Study II
(0-1) Cr. 1. S.
Prereq: First-year classification in veterinary medicine
Clinical applications of basic sciences taught concurrently in the spring semester of the first year curriculum in veterinary medicine.

B M S 354: General Pharmacology
(Dual-listed with B M S 554). (Cross-listed with TOX). (3-0) Cr. 3. S.
Prereq: B M S 549 and B M S 552; BBMB 404, BBMB 405
General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems.

B M S 401: Intro to Aquatic Animal Medicine
(Cross-listed with A ECL). (1-2) Cr. 1. S.
8 week course. Introductory course with focus on fin fish production, health and medicine. Course content will help define future roles for veterinarians, producers, and service providers. Emphasis will be placed on anatomy, pathology, infectious diseases, nutrition, regulatory constraints in production, food safety, and current research. Field trip to aquaculture facility.

B M S 403: Behavior of Domestic Animals
(1-0) Cr. 1. Alt. S., offered even-numbered years.
Prereq: Classification in veterinary medicine
Normal and abnormal behavior of domestic animals.

B M S 443: Pharmacology and Therapeutics
(Dual-listed with B M S 543). (3-0) Cr. 3. F.
Prereq: B M S 354
Pharmacology and therapeutic uses of fluids, antimicrobial and antiparasitic drugs, clinical use of veterinary drugs, and adverse drug reactions.

B M S 447: Principles of Anatomy
(Dual-listed with B M S 547). (2.5-6) Cr. 4. F.
Prereq: Instructor permission required for undergraduate students.
Examination of gross anatomy and neuroanatomy of human and dog. Laboratories will include cadaveric and virtual dissection, clinical case studies, and problem based learning.

B M S 490: Independent Study
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 490H: Independent Study, Honors
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 496: International Preceptorship
(0-40) Cr. 1-12. Repeatable. S.
Prereq: Second-year classification in veterinary medicine
International Preceptorships and Study Abroad Group programs. This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities.

Courses primarily for graduate students, open to qualified undergraduates:

B M S 501: Selected Research Methods in Biomedical Sciences
(0-8) Cr. 3. F.S.SS.
Prereq: Graduate classification, permission of a BMS faculty member
Experience in biomedical techniques in selected BMS laboratories that include but is not limited to cytochemical methods, molecular biological techniques, extracellular and intracellular unit recording, microiontophoresis, microinjection, spectrophoto-fluorometric analysis of chemicals, use of radioisotopes, radioimmunoassay, Ca2+ imaging, confocal microscopy, fluorescence microscopy, and immunocytochemistry.

B M S 502: Methods in Biomedical Sciences
(0-6) Cr. 3. S.
Provides laboratory experience in the application of methods in biomedical sciences, including animal physiology and pharmacology laboratory techniques; human physiology recordings and urinalysis; pharmacokinetics; basic techniques in analytical laboratory; basic pathology, immunology, bacteriology, and virology laboratory techniques.

B M S 530: Principles of Morphology I
(Dual-listed with B M S 330). (4-6) Cr. 6. F.
Prereq: 10 credits in biological science and permission of the instructor
Anatomy of the dog and cat: from basics to clinical application.

B M S 531: Principles of Morphology II
(Dual-listed with B M S 331). (2-6) Cr. 4. S.
Prereq: First-year classification in veterinary medicine. B M S 330
Comparative and topographic anatomy of horse, ruminants, pig, and chicken.

B M S 533: Biomedical Sciences I
(Dual-listed with B M S 333). (5-3) Cr. 6. F.
Prereq: First-year classification in veterinary medicine or graduate student status
Microscopic anatomy and physiology of cells, tissues, cardiovascular system, respiratory system, and urinary system.

B M S 534: Biomedical Sciences II
(Dual-listed with B M S 334). (5-3) Cr. 6. S.
Prereq: First-year classification in veterinary medicine or graduate student status
Microscopic anatomy of the immune system and integument.
Microscopic anatomy and physiology of the digestive system, endocrine system, and reproductive system.

B M S 537: Neuroanatomy
(Dual-listed with B M S 337). (2-2) Cr. 3. S.
Prereq: 10 credits in biological science and permission of the instructor
Neuroanatomy of domestic animals.

B M S 538: Principles of Physiology
(4-0) Cr. 4. F.
Principles of neurophysiology, endocrine and reproductive physiology, muscle physiology, cardiovascular, respiratory, renal, and digestive physiology, and regulation of body fluid.

B M S 539: Principles of Pharmacology
(4-0) Cr. 4. S.
General principles of drug actions; drug disposition; drug acting or, cardiovascular, respiratory, renal, gastrointestinal, and endocrine systems; anti-inflammatory and antibiotic drug; anti-cancer drugs; anesthetics CNS stimulants; lifestyle drugs; drug addiction, abuse and dependence; drugs in sport; drugs for obesity; biopharmaceuticals and gene therapy; drug development.

B M S 542: Introduction to Molecular Biology Techniques
(Cross-listed with EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

B M S 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

B M S 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

B M S 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

B M S 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

B M S 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

B M S 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

B M S 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

B M S 543: Pharmacology and Therapeutics
(Dual-listed with B M S 443). (3-0) Cr. 3. F.
Prereq: B M S 354
Pharmacology and therapeutic uses of fluids, antimicrobial and antiparasitic drugs, clinical use of veterinary drugs, and adverse drug reactions.

B M S 547: Principles of Anatomy
(Dual-listed with B M S 447). (2.5-6) Cr. 4. F.
Prereq: Instructor permission required for undergraduate students.
Examination of gross anatomy and neuroanatomy of human and dog. Laboratories will include cadaveric and virtual dissection, clinical case studies, and problem based learning.

B M S 554: General Pharmacology
(Dual-listed with B M S 354). (Cross-listed with TOX). (3-0) Cr. 3. S.
Prereq: B M S 549 and B M S 552; BBMB 404, BBMB 405
General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems.

B M S 556: Cellular, Molecular and Developmental Neuroscience
(Cross-listed with GDCB, NEURO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 335 or BIOL 436; physics recommended
Fundamental principles of neuroscience including cellular and molecular neuroscience, nervous system development, sensory, motor and regulatory systems.

B M S 575: Cell Biology
(Cross-listed with TOX). (3-0) Cr. 3. F.
Prereq: 10 credits in biological science and permission of instructor
A multi-instructor course covering major topics in cell structure and function, including: universal features of prokaryotic and eukaryotic cells, types of utilization and conversion of energy, genetic control of cell shape and functionality, internal organization of cells, communication between cells and their environment, development of multicellular systems. Students have to write a term paper.

B M S 590: Special Topics
Cr. 1-7. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 590A: Anatomy
Cr. 1-7. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 590B: Physiology
Cr. 1-7. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 590C: Pharmacology
Cr. 1-7. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 590D: Cell biology
Cr. 1-7. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 599: Creative Component
Cr. 1-3. F.S.SS.
Prereq: Enrollment in BMS graduate program, and permission of instructor.
Creative component for non-thesis Master of Science degree.

Courses for graduate students:

B M S 688: Research Review
Cr. 1. Repeatable. F.S.
Prereq: Enrollment in BMS graduate program.
A forum for B M S students to gain experience in the critical exchange of ideas through oral presentation and discussion of scientific information.

B M S 690: Advanced Topics
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 690A: Anatomy
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 690B: Physiology
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 690C: Pharmacology
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 690D: Cell biology
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

B M S 698: Seminar
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in BMS graduate program.

B M S 698A: Seminar: Attendance
Cr. R. Repeatable. F.S.
Prereq: Enrollment in BMS graduate program.

B M S 698B: Seminar: Attendance and Presentation
(1-0) Cr. 1. Repeatable. F.S.SS.
Prereq: Enrollment in B M S graduate program.
Attendance and presentation required. Offered on a satisfactory-fail basis only.

B M S 698C: Seminar: Attendance and Report
Cr. 1. Repeatable. F.S.
Prereq: Enrollment in BMS graduate program.
Attendance to all B M S seminars and written reports are required.

B M S 699: Research
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in BMS graduate program.

B M S 699A: Research: Anatomy
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in BMS graduate program.

B M S 699B: Research: Physiology
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in BMS graduate program.

B M S 699C: Research: Pharmacology
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in BMS graduate program.

B M S 699D: Research: Cell biology
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in BMS graduate program.

Veterinary Clinical Sciences

Professional Program of Study

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see Veterinary Medicine, Curriculum.

The curriculum of veterinary clinical sciences explores the preventive health care, and diagnosis and treatment of diseases of companion and competitive athletic animals. Veterinary specialists lead didactic and laboratory based learning in the clinical sciences. Experiential based courses conducted through the Veterinary Medical Center during the fourth year provide the student an opportunity to participate in the application of clinical skills and knowledge.

Graduate Study

The department offers work for the degree master of science with major in veterinary clinical science, and minor work for students majoring in other departments. Within the veterinary clinical sciences major, the student may specialize in veterinary medicine, surgery, or theriogenology. The D.V.M. degree or equivalent is prerequisite to a major graduate work.

Both thesis and nonthesis options are available and require the completion of a minimum of 30 graduate credits and a final examination.

World languages and cultures requirements may be established by the student's program of study committee.

Courses primarily for professional curriculum students:

V C S 305: Shelter Medicine
Cr. 1. S.
Prereq: First year classification in Veterinary Medicine or with permission of instructor
An elective course designed to educate the veterinary student about issues of relevance to companion animal population and shelter medicine and welfare.

V C S 311: Veterinarian in Society I
Cr. R. F.
Prereq: First-year classification in veterinary medicine
Introduction to the veterinary profession and the various career opportunities available.

V C S 313: Veterinarian in Society III
(1-1) Cr. 1. F.
Prereq: Second-year classification in veterinary medicine
A continuation of the Veterinarian in Society series. The course covers selected topics on moral and ethical issues affecting the practice of veterinary medicine.

V C S 314: Veterinarian in Society IV
(1-0) Cr. 1. F.
Prereq: Third-year classification in veterinary medicine
A continuation of the Veterinarian in Society series. This course will focus on helping students develop their communication, leadership, team building and conflict resolution skills.

V C S 315: Veterinarian in Society V
(1-0) Cr. 1. S.
Prereq: Third-year classification in veterinary medicine
A continuation of the Veterinarian in Society series. This course will emphasize veterinary law.

V C S 339: Clinical Foundations I
(Cross-listed with B M S). (0-2) Cr. 1. F.
Prereq: First-year classification in veterinary medicine
Canine physical examination; basic behavior, animal handling and restraint; medical record keeping.

V C S 385: Grand Rounds
Cr. R. Repeatable. F.S.
Prereq: Classification in veterinary medicine
Seminars and case presentations on selected clinical subjects by fourth-year students of the College of Veterinary Medicine. Attendance is required for a passing grade. Offered on a satisfactory-fail basis only.

V C S 391: Clinical Imaging
(1-0) Cr. 1. F.
Prereq: First-year classification in veterinary medicine
Evaluation of morphologic anatomy of the dog and cat utilizing clinical imaging methods - radiography, ultrasonography, computed tomography, magnetic resonance imaging and nuclear imaging. Emphasis will be placed on normal radiographic anatomy.

V C S 393: Principles of Surgery
(2-2) Cr. 3. F.
Prereq: Second year classification in veterinary medicine
General principles of surgery of companion animals.

V C S 394: Principles of Surgery Laboratory
(0-3) Cr. 1. S.
Prereq: Second year classification in veterinary medicine
General principles of surgery of companion animals.

V C S 395: Small Animal Surgery
(2-0) Cr. 2. S.
Prereq: V C S 394
Small animal surgery.

V C S 396: Equine Surgery
(2-0) Cr. 2. S.
Prereq: V C S 394
Elective course in equine surgery.

V C S 398: Anesthesiology
(2-0) Cr. 2. S.
Prereq: Second-year classification in veterinary medicine
Anesthetic equipment, agents and procedures, including pain management for core species.

V C S 399: Ophthalmology
(1-0) Cr. 1. S.
Prereq: Third year classification in veterinary medicine
Principles and techniques of medical and surgical ophthalmology.

V C S 402: Clinical Cardiology I
(1-0) Cr. 1. F.
Prereq: Third or fourth-year classification in veterinary medicine; V CS 444 or concurrent enrollment in V C S 444
Elective course in diagnosis and management of cardiac diseases. Emphasis on interpretation of electrocardiography.

V C S 405: Pet Bird and Exotic Species Medicine
(1-3) Cr. 2. S.
Prereq: third classification in veterinary medicine
Elective course in management and diseases of pet birds and exotic species.

V C S 407: Feline Internal Medicine
(1-0) Cr. 1. F.
Prereq: Third-year classification in veterinary medicine
Elective course in feline internal medicine.

V C S 409: Oncology
Cr. 2-4. Repeatable, maximum of 4 credits.
Prereq: Fourth-year classification in veterinary medicine
Elective clinical assignment in oncology.

V C S 414: Companion Animal Nutrition
(1-0) Cr. 1. S.
Prereq: Third or fourth -year classification in veterinary medicine
Elective course in small animal and equine nutrition.

V C S 415: Advanced Small Animal Dermatology
(1-2) Cr. 2. F.
Prereq: Third or Fourth-year classification in veterinary medicine
Elective course in dermatology.

V C S 419: Preceptorship in Companion Animal/Equine Veterinary Medical Practice
Cr. 2-6. Repeatable, maximum of 6 credits.
Prereq: Fourth-year classification in veterinary medicine, permission of department curriculum committee
Elective course in veterinary practice under the guidance of veterinarians in approved practice settings. Maximum of 6 credits in 2 credit increments.

V C S 420: Practicum
Cr. R. Repeatable.
Prereq: VM4 classification, permission of instructor
External practical experiences in the fourth year curriculum for additional professional development of the veterinary student. Offered on a satisfactory-fail basis only.

V C S 422: Rotation at Blank Park Zoo
Cr. 4. F.S.SS.
Prereq: Fourth-year classification in veterinary medicine and completion of V C S 405. Enrollment by permission of instructor.
Clinical experience in husbandry, nutrition and training of exotic animals in a zoo environment. Students will get instruction and learn the application of the clinical skills required when dealing with exotic animals, including the hands-off visual examination obtaining historical and clinical information from zookeepers, and the use of immobilization drugs for patient exams. Students will learn the common medical disorders of exotic species and treatment techniques.

V C S 436: Small Animal Internal Medicine
(3-0) Cr. 3. F.
Prereq: Third year classification in veterinary medicine
Clinical diagnosis and treatment of diseases of small animals.

V C S 437: Small Animal Shelter Medicine
(2-0) Cr. 2. Repeatable.
Prereq: Fourth year classification in Veterinary Medicine
A 2-week elective rotation at an animal shelter/humane society that works with the public to place pets in homes. This rotation will encompass population medicine (medicine, surgery, intake, adoption, behavior and temperament, neglect and cruelty) that animal shelters deal with on a daily basis. The selected animal shelter/humane society must have a veterinarian(s) on staff and be approved by the course coordinator. More than one VCS 437 may be taken upon approval of the course coordinator.

V C S 440: Introduction to Clinics
Cr. R. S.
Prereq: Third-year classification in veterinary medicine
Rotating assignments through multiple sections within the Veterinary Medical Center.

V C S 441: Canine Rehabilitation
Cr. 2.
Prereq: Fourth-year classification in veterinary medicine.
Elective clinical assignment in rehabilitation.

V C S 443: Equine Lameness
(1-2) Cr. 2. S.
Prereq: Second or third-year classification in veterinary medicine
Orthopedic diseases of the equine.

V C S 444: Small Animal Medicine
(4-0) Cr. 4. F.S.
Prereq: Third-year classification in veterinary medicine
Clinical diagnosis and treatment of diseases of small animals.

V C S 445: Equine Medicine
(2-0) Cr. 2. F.
Prereq: Third-year classification in veterinary medicine
Clinical diagnosis and treatment of diseases of equine.

V C S 446: Clinical Neurology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical rotation in neurology with an emphasis on neurolocalization, disease processes, use of diagnostics in medical and surgical neurology and treatment options. Exposure to neurosurgical techniques.

V C S 447: Equine Veterinary Diagnostic Skills
(3-0) Cr. 2. S.
Prereq: Fourth-year classification in veterinary medicine - preference to equine track student. Limited to 16 students.
Hands on experience with equine veterinary diagnostic skills related to theriogenology, medicine, surgery, radiology, and ophthalmology.

V C S 448: Diagnostic Imaging and Radiobiology
(2-2) Cr. 3. F.S.
Prereq: Third-year classification in veterinary medicine
Essentials of diagnostic image interpretation. Essentials of radiobiology, radiation therapy and protection from radiation.

V C S 449: Junior Surgery Laboratory
(1-6) Cr. 3. F.
Prereq: Third-year classification in veterinary medicine
Pre-laboratory presentations and laboratories introduce the student to anesthetic and surgical principles and techniques that can be applied to all animal species.

V C S 449A: Junior Surgery Laboratory: Alternative Curriculum
(1-6) Cr. 3. F.
Prereq: Third-year classification in veterinary medicine
This laboratory introduces the student to anesthetic and surgical principles - and techniques that can be applied to all animal species. Consists of only neutering humane society animals throughout the laboratory.

V C S 449B: Junior Surgery Laboratory: Traditional Curriculum
(1-6) Cr. 3. F.
Prereq: Third-year classification in veterinary medicine
This laboratory introduces the student to anesthetic and surgical principles and techniques that can be applied to all animal species. Provides a broader range of surgical experiences throughout the laboratory.

V C S 451: Advanced Junior Surgery Laboratory
(1-6) Cr. 2. S.
Prereq: V C S 449
8 weeks. Continuation of surgical laboratory experience. Techniques and advanced principles learned are applicable to all animal species.

V C S 451A: Advanced Junior Surgery Laboratory: Alternative Curriculum
(1-6) Cr. 2. S.
Prereq: V C S 449
8 weeks. Continuation of surgical laboratory experience. Techniques and advanced principles learned are applicable to all animal species. Consists of only neutering humane society animals throughout the laboratory.

V C S 451B: Advanced Junior Surgery Laboratory: Traditional Curriculum
(1-6) Cr. 2. S.
Prereq: V C S 449
8 weeks. Continuation of surgical laboratory experience. Techniques and advanced principles learned are applicable to all animal species. Exposure to more advanced surgical techniques with most surgical principles.

V C S 451C: Advanced Junior Surgery Laboratory: Traditional Curriculum
(1-6) Cr. 2. S.
Prereq: V C S 449
8 weeks. Continuation of surgical laboratory experience. Techniques and advanced principles learned are applicable to all animal species. A second repeat for students with a special interest in small animal surgery.

V C S 452: Clinical Dermatology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine. Must have instructor permission to repeat this course.
Study of clinical dermatological problems via computer-aided instruction, case simulations, and/or lectures. Clinical management of cases presented to Veterinary Medical Center.

V C S 453: Small Animal Medicine I
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in small animal medicine.

V C S 455: Small Animal Soft Tissue Surgery
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in soft tissue surgery.

V C S 456: Small Animal Orthopedic Surgery
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in orthopedic surgery.

V C S 457: Equine Medicine
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in equine medicine.

V C S 458: Equine Surgery
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in equine surgery.

V C S 459: Small Animal Overpopulation Medicine and Surgery
Cr. 2.
Prereq: Fourth year classification in Veterinary Medicine
A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues. Each section can be taken for credit once.

V C S 459A: Small Animal Overpopulation Medicine and Surgery :Nebraska Humane Society, Omaha NE
Cr. 2.
Prereq: Fourth year classification in Veterinary Medicine
A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues. Each section can be taken for credit once.

V C S 459B: Small Animal Overpopulation Medicine and Surgery: Animal Rescue League of Iowa, Des Moines IA
Cr. 2.
Prereq: Fourth year classification in Veterinary Medicine
A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues. Each section can be taken for credit once.

V C S 459C: Small Animal Overpopulation Medicine and Surgery: WaySide Waifs, Kansas City MO
Cr. 2.
Prereq: Fourth year classification in Veterinary Medicine
A 2-week surgical emphasis, elective rotation at a humane society that addresses the issues facing veterinarians and non-veterinary humane society personnel who deal with small animal overpopulation issues. Each section can be taken for credit once.

V C S 460: Radiology
Cr. 2.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in veterinary radiology.

V C S 461: Advanced Small Animal Internal Medicine
Cr. 1. S.
Prereq: V C S 444 and V C S 436
A discussion of advanced topics in small animal internal medicine.

V C S 463: Primary Care
Cr. 2. Repeatable, maximum of 4 credits.
Prereq: Fourth-year classification in veterinary medicine
Clinical experience in hospital based general practice.

V C S 464: Equine Field Services
Cr. 2.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in equine ambulatory practice.

V C S 465: Farrier
Cr. 2.
Prereq: Fourth-year classification in veterinary medicine.
Elective clinical assignment on the principles and practices of normal and therapeutic horseshoeing and equine foot care.

V C S 466: Anesthesiology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in small animal and large animal anesthesiology.

V C S 467: Pain Management
Cr. 1-2. Repeatable, maximum of 2 credits.
Prereq: Fourth year classification in veterinary medicine
Elective clinical assignment with emphasis on pain management.

V C S 468: Intensive Care
Cr. 4. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment to provide supervision of hospital cases requiring intensive care and including emergency cases.

V C S 469: Ophthalmology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment in ophthalmology.

V C S 470: Radiology
Cr. 2. Repeatable, maximum of 4 credits.
Prereq: Fourth-year classification in veterinary medicine. Completion of V C S 460 Radiology is required. Enrollment by permission of instructor.
Elective clinical assignment in veterinary radiology.

V C S 471: Animal Reproduction
Cr. 2.
Prereq: Fourth-year classification in veterinary medicine
Elective clinical assignment in animal reproduction. Equine, Small Animal, Comparative, and Food Animal reproduction only.

V C S 471A: Animal Reproduction: Equine and Small Animal Reproduction
Cr. 2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Fourth-year classification in veterinary medicine
Elective clinical assignment in equine and small animal Theriogenology involving breeding management, cool-shipped semen preparation and semen cryopreservation, embryo transfer.

V C S 471C: Animal Reproduction: Comparative
Cr. 2. Repeatable, maximum of 4 credits. SS.
Prereq: Fourth-year classification in veterinary medicine.
Elective comparative clinical assignment in Theriogenology with caseload management in Food Animal, Equine, Small Animal and Small Ruminants sections. Rotation through these different sections will depend on the caseload (by species)and include routine breeding management, semen collection and cryopreservation in different species, advanced laparoscopic and non-surgical procedures for insemination and embryo flushing/transfer, pregnancy diagnosis as well as management of reproductive emergencies.

V C S 471E: Animal Reproduction: Equine Reproduction
Cr. 2.
Prereq: Fourth-year classification in veterinary medicine
Elective clinical assignment in Equine Theriogenology involving both mare and stallion breeding management, cool-shipped semen preparation and semen cryopreservation, embryo transfer, foaling of high-risk pregnant mares as well as normal mares, breeding soundness exams of the mare and stallion, treatment of retained fetal membranes and neonatal care.

V C S 473: Small Animal Surgery
Cr. 1.
Prereq: fourth-year classification in veterinary medicine
Clinical assignment in small animal surgery split between soft tissue surgery (one week) and orthopedic surgery (one week).

V C S 473O: Small Animal Surgery: Orthopedic
Cr. 1.
Prereq: fourth-year classification in veterinary medicine
Clinical assignment in small animal surgery split between soft tissue surgery (one week) and orthopedic surgery (one week).

V C S 473S: Small Animal Surgery: Soft Tissue
Cr. 1.
Prereq: fourth-year classification in veterinary medicine
Clinical assignment in small animal surgery split between soft tissue surgery (one week) and orthopedic surgery (one week).

V C S 475: Cardiology Rotation
Cr. 2. Repeatable.
Prereq: Fourth year classification in veterinary medicine
Elective clinical assignment in cardiology.

V C S 476: Veterinary Anesthesiology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Assignments in equine, small animal, and large animal anesthesiology. Experience includes case work-up, management and recovery. Understanding of the unique physiology and potential complications of anesthetized patients. Pharmacology of commonly used drugs. Specific protocols and management for both field and general anesthesia.

V C S 476E: Equine Anesthesiology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Assignments in equine, small animal, and large animal anesthesiology. Experience includes case work-up, management and recovery. Understanding of the unique physiology and potential complications of anesthetized patients. Pharmacology of commonly used drugs. Specific protocols and management for both field and general anesthesia.

V C S 476S: Small Animal Anesthesiology
Cr. 2. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Assignments in equine, small animal, and large animal anesthesiology. Experience includes case work-up, management and recovery. Understanding of the unique physiology and potential complications of anesthetized patients. Pharmacology of commonly used drugs. Specific protocols and management for both field and general anesthesia.

V C S 478: Intensive and Critical Care
(2-0) Cr. 2. Repeatable, maximum of 4 credits. F.S.SS.
Prereq: Fourth-year classification in veterinary medicine
Elective clinical assignment in intensive care.

V C S 480: Veterinary Dentistry
Cr. 1. F.
Prereq: Third or Fourth-year classification in veterinary medicine
All aspects of veterinary dentistry, prophylaxis, endodontics, and orthodontics. This course is an on-line course.

V C S 481: Advanced Equine Dentistry
Cr. 2. S.
Prereq: Fourth year classification in veterinary medicine
Clinical rotation in equine dentistry with an emphasis on routine equine dental examinations, specialized equipment, and corrective procedures. Offered only offered for one 2-week rotation. Enrollment is limited.

V C S 490: Independent Study
Cr. arr. Repeatable.
Prereq: Permission of instructor and the VCS Associate Chair for Academic Affairs.
Independent Study in veterinary medicine focusing on basic / translational research or learning issues. Enrollment in this course is not appropriate for clinical experiences in the Veterinary Medical Center or extramural experiences in clinical veterinary practice (i.e., preceptorships).

V C S 492: Orientation for International Experience
(2-0) Cr. 1. Repeatable. S.
Prereq: Classification in veterinary medicine
8 weeks. Predeparture orientation for group study abroad. Cultural considerations for the study abroad experience and a conversational language introduction. Out of class work may be assigned.

V C S 495: Grand Rounds Presentations
Cr. R. S.
Prereq: Fourth-year classification in veterinary medicine
Seminars and case presentations on selected subjects by fourth year students of the College of Veterinary Medicine. Completion of a seminar presentation is required for graduation. Offered on a satisfactory-fail basis only.

V C S 496: International Preceptorship
Cr. 1-12. Repeatable.
Prereq: Second-year classification in veterinary medicine.
International Preceptorships and Study Abroad Group programs. Provides opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

V C S 590: Special Topics
Cr. 1-3. Repeatable.

V C S 590A: Special Topics: Medicine
Cr. 1-3. Repeatable.

V C S 590B: Special Topics: Surgery
Cr. 1-3. Repeatable.

V C S 590C: Special Topics: Theriogenology
Cr. 1-3. Repeatable.

V C S 590D: Special Topics: Radiology
Cr. 1-3. Repeatable.

V C S 590E: Special Topics: Anesthesiology
Cr. 1-3. Repeatable.

V C S 590F: Special Topics - Ophthalmology
Cr. 1-3. Repeatable, maximum of 3 credits. F.S.
Special topics in Ophthalmology.

V C S 596: International Preceptorship
(0-40) Cr. 1-12. Repeatable. F.S.SS.
Prereq: Admission to graduate college
International Preceptorships and Study Abroad Group programs. Provides opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities.

V C S 599: Creative Component
Cr. arr.
Prereq: Enrollment in nonthesis master's degree program

Courses for graduate students:

V C S 604: Seminar
Cr. 1. Repeatable. F.S.

V C S 640: Advanced Radiology
(2-0) Cr. 2.
Prereq: V C S 448
Detailed principles of clinical radiology with particular reference to radiographic interpretation.

V C S 671: Advanced General Surgery
(1-3) Cr. 2.
Prereq: Permission of instructor
Course designed to discuss and perform advanced surgical procedures in soft tissue, orthopedic and neurological surgery. Minimally invasive surgical procedures and organ transplantation will be included.

V C S 672: Advanced Special Surgery
(1-3) Cr. 2.
Prereq: Permission of instructor
Innovative techniques in microvascular, thoracic, gastrointestinal, neurological and reconstructive surgery will be investigated.

V C S 676: Advanced Medicine
(2-0) Cr. 2.
Prereq: V C S 445
Principles of general medicine. A study in depth of factors that contribute to the development of clinical signs as related to the pathogenesis of disease.

V C S 677: Advanced Medicine
(2-0) Cr. 2.
Prereq: V C S 445
An advanced study of metabolic diseases.

V C S 699: Research
Cr. arr. Repeatable.

V C S 699A: Research: Medicine
Cr. arr. Repeatable.

V C S 699B: Research: Surgery
Cr. arr. Repeatable.

V C S 699C: Research: Theriogenology
Cr. arr. Repeatable.

V C S 699E: Research: Anesthesiology
Cr. arr. Repeatable.

V C S 699F: Research: Ophthalmology
Cr. arr. Repeatable.
Graduate Level Research.

V C S 699G: Research: Cardiology
Cr. arr. Repeatable.
Graduate Level Research.

Veterinary Diagnostic and Production Animal Medicine

Professional Program of Study

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see Veterinary Medicine, Curriculum.

Courses in veterinary diagnostic and production animal medicine provide students with basic and advanced skills in diagnostics, reproduction, medicine, surgery, production, welfare, and health management of the major livestock species. Students in the fourth year of the curriculum in veterinary medicine may elect to take advanced courses in beef, dairy, swine, poultry or small ruminant production medicine. Elective courses may include preceptorships in private practices, at other veterinary schools, in research and disease control laboratories, or in related agribusinesses.

Production animal medicine emphasizes the integration of veterinary medicine with nutrition, genetics, economics, food safety, and other disciplines, enabling graduates to acquire and use a broad knowledge base to support the health and improve the production and efficiency of the food supply chain.

Graduate Study in Veterinary Preventive Medicine

Veterinary Preventive Medicine is a multidisciplinary program focused on the study of health and disease in populations. The various disciplines represented in the program are unified by a common approach based on the application of epidemiological methods to problem solving in populations. Through their research and course work, students will learn to understand and apply a variety of disciplines, principles, and techniques to population health issues involving environmental, ecological, nutritional, genetic, infectious, or non-infectious diseases.

Graduate study in Veterinary Preventive Medicine will provide valuable skills and experience to persons interested in public health, food safety, emerging infectious diseases, zoo or wildlife health, and livestock health. A degree in Veterinary Preventive Medicine may be valuable for individuals considering a future in the biological or pharmaceutical industries, government regulatory agencies, public veterinary practice, international service agencies responsible for population health or progressive private practice.

Veterinary Preventive Medicine is an interdepartmental major administered by the Department of Veterinary Diagnostic and Production Animal Medicine (VDPAM) with participating faculty from colleges and departments across the University and collaborators from the National Animal Disease Center (USDA:ARS) and the National Veterinary Services Laboratories (USDA:APHIS) located in Ames, Iowa.

Both thesis and non-thesis options are available and require the completion of a minimum of 30 graduate credits for thesis and 36 graduate credits for non-thesis and a final examination.

Program of Study: Master of Science in Veterinary Preventive Medicine (Thesis Option) 30 credits

STAT 401	Statistical Methods for Research Workers	4
VDPAM 527	Applied Statistical Methods in Population Studies	3
VDPAM 528	Principles of Epidemiology and Population Health	3
VDPAM 529	Epidemiological Methods in Population Research	3
VDPAM 699	Research	arr †
Research or Electives to total at least 17 additional credits		

† Arranged with instructor.

Program of Study: Master of Science in Veterinary Preventive Medicine (Non-Thesis Option) 36 Credits

STAT 401	Statistical Methods for Research Workers	4
VDPAM 527	Applied Statistical Methods in Population Studies	3
VDPAM 528	Principles of Epidemiology and Population Health	3
VDPAM 529	Epidemiological Methods in Population Research	3
VDPAM 590	Special Topics	3
One Additional STAT course from the following		3
STAT 402	Statistical Design and the Analysis of Experiments	
STAT 407	Methods of Multivariate Analysis	
STAT 415	Advanced Statistical Methods for Research Workers	
STAT 421	Survey Sampling Techniques	
VDPAM 599	Creative Component	arr †
Creative Component and Electives to total 18 additional credits		

† Arranged with instructor.

Graduate Certificate in Veterinary Preventive Medicine

Veterinary Diagnostic and Production Animal Medicine offers a graduate certificate for DVMs, concurrent DVM students and non-DVMs in allied animal industries in Veterinary Preventive Medicine.

Students in this program are able to select courses that focus in areas of animal welfare, diagnostics, food safety, evidence-based medicine, surgery, pathology, microbiology, epidemiology, public heatlh, statistics and production medicine.

The purpose of the graduate certificate in Veterinary Preventive Medicine for industry professionals is to address the continued and advanced needs of animal health professionals. The certificate enables professionals to gain recognition for a skill set that includes epidemiology, risk assessment, production medicine and animal welfare. A graduate certificate may be used to increase knowledge in a new or emerging area of interest to the candidate. As such, it may be used to formally gain recognition for retraining to meet the needs of today's food production systems.

The graduate certificate for concurrent DVM students is designed to give additional skills to students planning on working with populations of animals. Using a combination of on-line and dual listed graduate level courses, the program is designed to enable DVM students to complete the certificate while studying for their DVM degree. Students enrolled in any US-based DVM program are able to complete a graduate certificate at ISU using a combination of on-line and transfer graduate level courses.

The graduate certificate is an additional qualification awarded by Iowa State University after successful completion of 15 graduate level credits. A graduate certificate is different from continuing education as the certificate includes an academic transcript from Iowa State University. Students complete the same courses graduate students do with the the same expectations for all assignments and exams.

The program is available as a strictly on-line (off campus) delivery method or as a combination of classroom-based and on-line course offerings providing maximum flexibility in scheduling.

Program of Study: Graduate Certificate in Veterinary Preventive Medicine (15 credits)

Certificate required core courses		7
STAT 401	Statistical Methods for Research Workers	
VDPAM 528	Principles of Epidemiology and Population Health	
Remaining 3 core credits can be selected from		3
VDPAM 527	Applied Statistical Methods in Population Studies	
VDPAM 529	Epidemiological Methods in Population Research	
VDPAM 570	Risk Assessment for Food, Agriculture and Veterinary Medicine	
5 elective credits from any approved ISU graduate course		5
Total Credits		15

Courses primarily for professional curriculum students:

VDPAM 308: Spanish for Veterinarians
(2-0) Cr. 2. S.
Prereq: Classification in veterinary medicine and basic knowledge of Spanish
This course is designed to meet the needs of veterinary students who will practice in an environment in which the use of Spanish for accurate client communication is essential which includes much of our food animal industry in the state of Iowa. This is not a traditional Spanish language course. To be successful, students taking the course should have a basic knowledge of Spanish pronunciation, grammar and syntax.

VDPAM 309: Introduction to Production Animal Informatics
(1-0) Cr. 1. S.
The fundamentals of how clinical, diagnostic, production and financial information is obtained and used by production animal operations will be presented. Students will acquire skills to create and use spreadsheets for manipulating and summarizing data. They will also acquire knowledge of where to find inexpensive and readily available resources with information on how to use spreadsheets and other software. Students will also have the opportunity to work with different record keeping programs used by swine, beef and dairy operations.

VDPAM 310: Introduction to Production Medicine
Cr. 2. S.
Prereq: Second or third year classification in veterinary medicine or permission of instructor
The role of the veterinarian in the management of animal health and production in populations including evaluation tools in dairy and beef cattle herds, beef feedlots and swine herds will be described. Provides veterinary students with a starting point to understand the principles and techniques that are the basis of food-animal population health diagnosis management programs. Course available on-line, attendance is not required.

VDPAM 312: Introduction to Animal Welfare
(1-0) Cr. 1. S.
Prereq: First-year classification in veterinary medicine
A continuation of the Veterinarian in Society series. The objective of this course is to develop knowledge of the fundamental principles of animal welfare, in terms of science, ethics and cultural components.

VDPAM 340: Clinical Foundations
(0-30) Cr. 1. S.
Prereq: Classification in veterinary medicine
One week course at Iowa State University; introduction to food supply veterinary medicine covering overviews of major animal agriculture species (beef, dairy, pork, sheep and camelid), production systems, behavior, welfare, handling and restraint, examination techniques, biosecurity, epidemiology and food safety. Visits to production units are utilized to introduce the application of clinical skills. Biosecurity: All students must follow current college policies regarding animal contact following foreign travel. Required equipment includes coveralls and rubber boots.

VDPAM 351: Bovine Embryo Transfer and Related Technology
(2-0) Cr. 2. S.
Prereq: Second or third year classification in veterinary medicine
This course will meet for two hours once each week of the Spring Semester. The first hour will be traditional lecture and the second hour will be a combination of student projects, labs and demonstrations of applied clinical procedures. Bovine embryo transfer and closely related topics such as: female reproductive physiology, estrus synchronization, semen sexing and reproductive disease will be emphasized. In addition, several class periods will be devoted to the use of ultrasound for diagnosis of reproductive and non-reproductive conditions.

VDPAM 365: Animal Welfare Judging and Assessment
Cr. 1. Repeatable. F.
Preparation for competition in the Intercollegiate Animal Welfare Judging Contest. Development of critical appraisal and oral communication skills in regard to animal welfare. Animal behavior, physiology, health and performance parameters, basic husbandry, housing and preventive care will be explored for select farmed, companion and exotic species. Optional field trips.

VDPAM 402: Advanced Dairy Production Informatics
(1-1) Cr. 2. Repeatable. F.S.
Prereq: VDPAM 309 or permission of instructor
Advanced coverage of concepts related to collection, manipulation, analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 305 and PCDart as well as other dairy management and information software.

VDPAM 402A: Advanced Dairy Production Informatics: Lecture Series
(1-1) Cr. 2. S.
Prereq: Classification in veterinary medicine
Advanced coverage of concepts related to collection, manipulation, analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 305 and PCDart as well as other dairy management and information software.

VDPAM 402B: Advanced Dairy Production Informatics: Experience I
(1-1) Cr. 2. F.S.
Prereq: VDPAM 402A
Independent records analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 305 and PCDart.

VDPAM 402C: Advanced Dairy Production Informatics: Experience II
(1-1) Cr. 2. F.S.
Prereq: VDPAM 402A, VDPAM 402B
Independent records analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 305 and PCDart.

VDPAM 402D: Advanced Dairy Production Informatics: Experience III
(1-1) Cr. 2. F.S.
Prereq: VDPAM 402A, VDPAM 402B, VDPAM 402C
Independent records analysis and reporting of information used by dairy farms and their consultants. Hands on experience with Dairy Comp 305 and PCDart.

VDPAM 407: Evidence Based Clinical Decision Making
(Dual-listed with VDPAM 507). (1-0) Cr. 1. S.
Prereq: Permission of instructor
Discussion, lectures and laboratories to assess the quality and significance of medical evidence in making informed decisions about the treatment of individual animals and animal populations.

VDPAM 408: Poultry Diseases
(Dual-listed with VDPAM 508). Cr. 2. Alt. S., offered even-numbered years.
Prereq: Second or third year classification in veterinary medicine or permission of instructor
Bacterial, viral, parasitic, and nutritional diseases of domestic poultry and gamebirds; biosecurity, immunization, and management procedures to prevent poultry diseases.

VDPAM 409: Veterinary Practice Management and Organization
(2-0) Cr. 2. F.
An A to Z introduction to proven veterinary practice management methods and strategies. The student will follow a detailed hands-on workbook describing most of the processes and procedures of day to day veterinary practice. The class content will be composed of class room discussions, didactic presentations, a practical workbook, ancillary handouts, and both in and out of class assignments.

VDPAM 410: Llama Medicine
(1-0) Cr. 1. F.
Prereq: Second or third year classification in veterinary medicine
Introduction to basic camelid medicine, including anatomy, behavior, restraint, handling, husbandry, herd health, common diseases, surgical conditions, and anesthesia protocols.

VDPAM 414: Veterinary Practice Entrepreneurship
(Dual-listed with VDPAM 514). Cr. 2-3. S.
Prereq: Classification in veterinary medicine
Formal exposure to the entrepreneurial and business skills necessary to own and operate a successful veterinary practice or other small business opportunity. Personal finance, marketing, human resource management, general accounting, site assessment, location demographics, practice valuation, and a host of other issues which must be considered when purchasing or starting a new business are covered. Class instruction will be delivered by successful practice and business owners with examples from real world experience.

VDPAM 416: Bovine Reproduction Evaluation Laboratory
(0-4) Cr. 1. F.S.
Prereq: Third year classification in veterinary medicine. 10 students per section.
Bovine rectal palpation techniques will be repetitively taught in 7 four-hour sessions. Students will also learn techniques of epidural anesthesia, artificial insemination, pregnancy staging and ultrasonic imaging. University-owned cattle will be used. No Wednesday section in Spring semester. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 419: Advanced Swine Production Informatics
(1-0) Cr. 1. F.
Prereq: VDPAM 309 or permission of instructor
Advanced coverage of concepts related to collection, manipulation, analysis and reporting of information used by swine production companies. Production, financial, diagnostic and clinical data will be covered in the course. Hands-on experience with computer software and information systems used in swine production will be provided. Students will learn to objectively evaluate the validity of information that is presented to them and also be able to make practical and useful recommendations regarding the types of information tools that can/should be used. The students will learn what software and information systems are available and be able to critically evaluate them.

VDPAM 420: Applied Production Animal Medicine Preceptorship
(0-30) Cr. 1-6. Repeatable. F.S.SS.
Prereq: Fourth year classification in veterinary medicine
Advanced course in production animal medicine with emphasis on government, industry or veterinary practice settings. Requires 40 hours clinical experience per week. Assignments will be preceptorships with a practicing veterinarian, governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 420A: Applied Production Animal Medicine Preceptorship: Mixed Animal Practice with Food Animal Emphasis
(0-30) Cr. 1-6. Repeatable. F.S.SS.
Prereq: Fourth year classification in veterinary medicine
Advanced course in mixed animal production medicine with a food animal emphasis in veterinary practice settings. Requires 40 hours of clinical experience per week. Assignments will be preceptorships with a practicing veterinarian, governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 420B: Applied Production Animal Medicine Preceptorship: General Mixed Animal Practice
(0-30) Cr. 1-6. Repeatable. F.S.SS.
Prereq: Fourth year classification in veterinary medicine
Advanced course in production animal medicine with an emphasis on general mixed animal veterinary practice settings. Requires forty hours clinical experience per week. Assignments will be preceptorships with a practicing veterinarian, governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 420C: Applied Production Animal Medicine Preceptorship: Government Agency or Food Processing Company
(0-30) Cr. 1-6. Repeatable. F.S.SS.
Prereq: Fourth year classification in veterinary medicine
Advanced course in production animal medicine with emphasis on government agency or food processing company in veterinary practice settings. Forty hours clinical experience per week. Assignments will be preceptorships with a governmental agency and/or production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 421: Great Plains Veterinary Educational Center
Cr. 1. F.S.SS.
Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.
The Great Plains Veterinary Education Center (GPVEC), located on the US Meat Animal Research Center (USMARAC) near Clay Center, Nebraska offers one week clinical training in production animal medicine species. All sections will be held at GPVEC. Students need to provide their own transportation to the site and overnight stays at or near GPVEC are required.

VDPAM 421A: Great Plains Veterinary Educational Center: Calving
Cr. 1. F.S.SS.
Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.
The Calving Elective provides an opportunity to expand knowledge and experience in all phases of calving management. The program is structured around normal calving operations at USMARC including night calving at the polesheds. The GPVEC and USMARC veterinary staff will make an effort to involve students in veterinary activities that take place during the Calving Elective including the diagnosis, treatment, and management of many commonly encountered conditions in the dam and calf. However, participation in a caesarian section is not guaranteed.

VDPAM 421B: Great Plains Veterinary Educational Center: Bull Breeding Soundness

Cr. 1. S.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Bull Breeding Soundness Examination Elective involves training in all phases of the examination, collection, and semen evaluation for up to 350 bulls as recommended by the Society for Theriogenology. Chuteside training and hand-on experience are the primary training techniques for this elective with informal discussions held during the performance of the breeding soundness examinations.

VDPAM 421D: Great Plains Veterinary Educational Center: Feedlot Management

Cr. 1. F.S.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

Evaluation of production techniques and production efficiency including ration and feeding management, health management program development and evaluation, environmental management, quality assurance, feedlot necropsy and microbiology techniques, and break even analysis. Approaches to solve seasonal health problems within the management objectives for different feed yards are the strong emphasis of this elective. Students may have the opportunity to follow cattle to a packing plant to learn the methods for tracking animals into the food chain, identifying production problems that are not diagnosable at the feedlot level, and monitoring beef quality assurance. Biosecurity activities will be emphasized and practiced.

VDPAM 421E: Great Plains Veterinary Educational Center: Weaning Management

Cr. 1. F.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

This is a hands-on elective in which students participate in the weaning management at the USMARC. Students will be involved with processing, feeding, finding, and treating sick calves. Additionally, students will be introduced to developing weaning rations and managing feed delivery. Students will also learn how to develop vaccination and treatment protocols and each student will have as an objective the development of their own vaccination and treatment protocol template. As time allows, students will visit commercial feed yards and cover production management topics.

VDPAM 421F: Great Plains Veterinary Educational Center: Pregnancy Examination

Cr. 1. F.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Pregnancy Examination Elective involves students, the GPVEC faculty, and USMARC personnel during pregnancy examination. Activities involve rectal examinations for pregnancy, collecting data and entry into the CowCalf5 computer software program to evaluate the reproductive performance of the herd. This elective is designed for students who have some palpation experience and are interested in honing their skills. Pregnancy Examination occurs during yearly fall herd work at the USMARC, therefore, speed and accuracy will be stressed, rather than basic technique.

VDPAM 421J: Great Plains Veterinary Educational Center: Lambing

Cr. 1. S.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Lambing Elective involves students working with the USMARC lambing crew and GPVEC faculty in observations, assistance with delivery when necessary, and routine lambing duties. Students will work with veterinary personnel in sheep necropsy and health surveillance. Self-study material will be provided covering topics such as pre-breeding and breeding, pregnancy diagnosis, pregnant ewe management, pre-lambing ewe/lambing management, feeder lamb health and nutrition management, and replacement ewe and ram management.

VDPAM 421K: Great Plains Veterinary Educational Center: Equine Dentistry

(20-20) Cr. 1. S.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site

The Equine Dentistry Elective provides the opportunity for students to expand their knowledge and experience related to equine dentistry. The rotation consists of lectures on topics relevant to equine dental care and hands-on laboratories during which students practice routine dental care procedures on USMARC horses. Equine Dentistry will involve both lecture and lab time at about equal shares.

VDPAM 421M: Great Plains Veterinary Educational Center: Preconditioning

Cr. 1. F.SS.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Preconditioning Elective provides the opportunity for students to expand their knowledge and experience in the development and implementation of calf preweaning programs. Students will assist GPVEC and USMARC personnel during routine processing of USMARC spring-born calves prior to weaning. GPVEC faculty will also lead discussions related to vaccine and dewormer protocols, preweaning nutrition, and other topics related to preparing beef calves for weaning.

VDPAM 421P: Great Plains Veterinary Educational Center: Gomer Bull Surgery

Cr. 1. F.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Gomer Bull Surgery Elective is designed to give students interested in food animal surgery an opportunity to practice their surgical skills by performing penile translocations and epididymectomies on USMARC teaser bull candidates. Lectures specific to gomer bull surgery as well as other topics related to food animal surgery will be presented during this elective.

VDPAM 421Q: Great Plains Veterinary Educational Center: Swine Husbandry

Cr. 1. F.S.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

This elective provides students the opportunity to gain hands-on experience related to the daily activities of an intensively managed confinement swine unit. Rotation participants will work closely with USMARC Swine Unit personnel as they complete their daily routines in the farrowing and breeding areas of the USMARC Swine Unit and will participate in piglet delivery, neonatal pig processing, artificial and natural breeding, necropsies, and other activities as they arise.

VDPAM 421R: Great Plains Veterinary Educational Center: Sheep Weaning Management

Cr. 1. SS.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

This elective provides the opportunity for students to develop their skills in the area of health and nutritional management of sheep immediately before and after weaning. The rotation consists of lectures on pre- and post-weaning nutrition, clinical parasitology, and prevention and control of common ovine infectious diseases. Hands-on experience during the week will take place at the USMARC Sheep Unit and will consist of walk-through and hand-on examinations of recently weaned lambs, treatment of sick lambs, inspection of weaning pen environment, investigation of herd outbreaks, and post mortem examination of all sheep mortalities.

VDPAM 421S: Great Plains Veterinary Educational Center: Ultrasound Pregnancy Examination

Cr. 1. SS.

Prereq: Fourth year classification in veterinary medicine; ability to provide own transportation to each site.

The Ultrasound Pregnancy Examination Elective involves students, the GPVEC faculty, and USMARC personnel during pregnancy examination of USMARC yearling heifers. Activities involve transrectal ultrasonographic examinations for pregnancy, collecting data and entry into the CowHerd/CowCalf computer software program to evaluate the reproductive performance of the herd. This elective is designed for students who have some ultrasound experience and are interested in honing their skills. This elective occurs during yearly fall herd work at the USMARC, therefore, speed and accuracy will be stressed, rather than basic technique. Didactic instruction may include several topics in cow herd health, nutrition, management and reproductive decision making.

VDPAM 422: Beef Cattle Calving

Cr. 2. Repeatable. F.S.SS.

Prereq: VDPAM 310; fourth year classification in veterinary medicine

This elective provides students opportunity to assist cow-calf operations with calving in Nebraska, South Dakota or other locations. These operations typically calve 300-1,000 head each spring. Calving experience is not required, but a good understanding of working around cattle is necessary. Students will be actively participating in the day to day, normal calving routine including detecting and sorting off “springers”, calf “watch”, detecting when intervention is needed and assisting delivery, caring for and monitoring newborns and dams for good health and early disease detection, tagging/processing new calves, treating calves needing intervention and performing other routine calving chores. Students need to provide their own transportation to the site and overnight stays at or near the production sites are required. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 426: Veterinary Toxicology
(Dual-listed with VDPAM 526). (Cross-listed with TOX). (3-0) Cr. 3. S.
Prereq: Third year classification in veterinary medicine
Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials.

VDPAM 428: Principles of Epidemiology and Population Health
(Dual-listed with VDPAM 528). (Cross-listed with V MPM). (3-0) Cr. 3. S.
Epidemiology of disease in populations. Disease causality and epidemiologic investigations. Issues in disease prevention, control, and eradication. This course is available on campus and by distance.

VDPAM 436: Beef Records Analysis
(0-30) Cr. 1. F.S.
Prereq: First, second or third year classification in veterinary medicine, or permission of instructor
Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Lab activities will allow students an opportunity to work with individual beef cattle producers to identify areas for improving profitability, health, and sustainability. Each semester's content builds on the material from the previous semester. Enrolling in the class for multiple semesters will be encouraged.

VDPAM 436A: Beef Records Analysis: Introduction
(0-30) Cr. 1. F.
Prereq: First, second or third year classification in veterinary medicine, or special permission of instructor
Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Lab activities will allow students an opportunity to work with individual beef cattle producers to identify areas for improving profitability, health, and sustainability.

VDPAM 436B: Beef Records Analysis: Herd Management
(0-30) Cr. 1. S.
Prereq: First, second or third year classification in veterinary medicine, or special permission of instructor, VDPAM 436A
Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Lab activities will allow students an opportunity to work with individual beef cattle producers to identify areas for improving profitability, health, and sustainability.

VDPAM 436C: Beef Records Analysis: Cow/Calf Preventive Medicine
(0-30) Cr. 1. F.
Prereq: Second or third year classification in veterinary medicine, or special permission of instructor, VDPAM 436A, VDPAM 436B
Lectures will emphasize current production and evaluation techniques for beef cow/calf operations and students will learn to conduct and critically assess production and financial data using a standardized approach. Lab activities will allow students an opportunity to work with individual beef cattle producers to identify areas for improving profitability, health, and sustainability.

VDPAM 436D: Beef Records Analysis: Feedlot Production Medicine
(0-30) Cr. 1. S.
Prereq: Second or third year classification in veterinary medicine, or special permission of instructor, VDPAM 436A, VDPAM 436B, VDPAM 436C
Lectures will emphasize current production and evaluation techniques for feedlot production and students will develop a standard treatment protocol book. Topics include respiratory disease, receiving programs, nutrition, cattle handling and environmental issues.

VDPAM 445: Production Animal Clinical Medicine
(3-0) Cr. 3. S.
Prereq: Third year classification in veterinary medicine
Clinical diagnosis and treatment of diseases of swine, beef and dairy cattle, and small ruminants.

VDPAM 450: Disturbances of Reproduction
(4-0) Cr. 4. F.
Prereq: Third year classification in veterinary medicine
General principles of normal reproductive functions in addition to environment, management and diseases causing disturbances in reproduction. Cattle, Swine, Equine, Small Ruminant, and Small Animal species will be covered.

VDPAM 451: Clinical Embryo Transfer
Cr. 2. F.S.SS.
Prereq: Fourth year classification in veterinary medicine
Elective clinical assignment in techniques of embryo transfer. Primary species studied will be bovine but equine and small ruminant embryo transfer will be covered during appropriate seasons. Enrollment is limited to four students per two week session. Biosecurity policies require documentation of your presence in the USA 5 days immediately prior to the start of class if international travel has occurred.

VDPAM 455: Diagnostic Laboratory Practicum
Cr. 1. Repeatable. F.S.
Prereq: Fourth year classification in veterinary medicine
Practical experience and training in necropsy, recognition of gross lesions, diagnostic sample collection and test selection for the diagnosis of infectious, toxic, nutritional and metabolic diseases of small animal and production livestock species through exposure to diagnostic cases submitted to the ISU Veterinary Diagnostic Laboratory.

VDPAM 456: Veterinary Diagnostic Lab Methods & Applications
(16-0) Cr. 1. F.
Prereq: Second or third year classification in veterinary medicine
Case materials are used to develop diagnostic questions and to better understand the value of diagnostic tests. Testing methods and interpretation of diagnostic tests are coupled with sampling strategy and objective assessment of available evidence to provide accurate diagnosis.

VDPAM 465: Animal Welfare Clinical Rotation
Cr. 2. F.SS.
Prereq: Fourth year classification in veterinary medicine
Two-week course for senior veterinary students to gain skills for collecting and interpreting animal welfare data, aid clients with identifying and achieving welfare goals, and assisting law enforcement with animal cruelty response. Field trips to food animal and companion animal facilities are mandatory.

VDPAM 471: Theriogenology: Food Animal
Cr. 2. Repeatable.
Prereq: Fourth year classification in veterinary medicine.
Elective clinical assignment in Food Animal Theriogenology involving male and female breeding soundness exams, dystocia management, advanced diagnostic and surgical procedures, surgical and nonsurgical insemination programs in small ruminants, and semen cryopreservation. Medical and surgical correction of reproductive disorders in cattle, swine and small ruminants. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 476: Food Animal and Camelid Field Service
Cr. 1-2. Repeatable. F.S.SS.
Prereq: VDPAM 310; Fourth year classification in Veterinary Medicine
Elective course in food animal and camelid field services. Students will assist university veterinarians in delivering health care and production management services to the ISU livestock farms and other livestock farms in the local area. Focus will be on delivery of individual animal care and herd health. Focus on the establishment of best practices for herd management of production systems at the university and in the region. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 477: Food Animal and Camelid Medicine and Surgery
Cr. 2. Repeatable. F.S.SS.
Prereq: Fourth-year classification in veterinary medicine
Clinical assignment focused on the management of food animal and camelid medicine and surgery cases. Specific instruction in clinical evaluation of cases coupled with appropriate diagnostic testing and therapeutic intervention will be emphasized. Additional instruction will be provided in disease prevention, intensive care and management of food animal and camelid species. Particular emphasis will be placed on appropriate on-label and extra-label drug usage in food animal species. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 479: Applied Swine Production Medicine Preceptorship
(0-30) Cr. 1-6. Repeatable. F.S.SS.
Prereq: VDPAM 310; Fourth year classification in Veterinary Medicine
Preceptorship course in swine production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will be preceptorships with a practicing veterinarian and/or a production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 480: Swine Production Medicine
(15-25) Cr. 2. Repeatable. F.S.SS.
Prereq: VDPAM 310; Fourth year classification in Veterinary Medicine or permission of instructor
Two week clinical rotation in swine production medicine. Students will be assigned to take the lead in investigating field based client cases with supervision of the instructors. Development of critical thinking skills that will allow students to apply concepts of herd management, production analysis, economic analysis, and disease prevention in addressing client cases. Variable amounts of travel to farm sites will be required with the potential for rare overnight stays. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 481: Advanced Cow/Calf Production Medicine
(Dual-listed with VDPAM 581). (20-20) Cr. 2. S.
Prereq: Completion of two semesters of VDPAM 436 or UNL equivalent (V MED 596 Cattle Production), fourth year classification in veterinary medicine
Two-week senior elective that will focus on the economics of animal disease in cow/calf operations. Evidence based medicine and epidemiological principles will be used in investigation of disease outbreaks. Extensive partial budgeting used. Students will complete at least two disease investigations involving outbreaks in commercial cow/calf operations and communicate their findings to the class, the herd owner, and local practitioner. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 482: Applied Beef Production Medicine Preceptorship
Cr. 1-6. Repeatable. F.S.SS.
Prereq: VDPAM 310; Fourth year classification in veterinary medicine
Advanced course in beef production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will include preceptorships with a practicing veterinarian and/or a production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 483: Beef Production Medicine
(15-20) Cr. 2. F.
Prereq: VDPAM 310; fourth year classification in veterinary medicine
Two week advanced clinical rotation in beef production medicine. Fifteen hours recitation/discussion and 20 hours clinical experience per week. This course is designed to expose students to cow-calf and feedlot production concepts. The activities scheduled for the rotation depend greatly on the time of year. Whenever possible, the class incorporates field trips. Students should anticipate that travel, including overnight stays, may be required. These field trips can vary in length from several hours to several days and may include weekends. Typically, 3-4 days of the rotation are spent at the Great Plains Veterinary Education Center, Clay Center, NE. Students should, therefore, plan accordingly and contact the instructor, immediately, if they anticipate a conflict. Students should not schedule Grand Rounds during this rotation. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 484: Dairy Production Medicine
(15-20) Cr. 2. F.SS.
Prereq: VDPAM 310; fourth year classification in veterinary medicine
Two week course in dairy production medicine combining class time with multiple on-farm visits to learn various management aspects (DHIA, DC305 & PC Dart record analysis, calf rearing through lactating cows, reproduction programs, udder health and milk quality, biosecurity, welfare, nutrition and cow comfort) for a wide variety of dairy operations. Students will learn the latest in dairy management by reviewing current topic articles and gain experience in farm evaluation through a group project. Fifteen hours recitation/discussion and 20 hours clinical experience per week. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 485: Applied Dairy Production Medicine Preceptorship
(0-30) Cr. 1-6. Repeatable. F.S.SS.
Prereq: VDPAM 310; fourth year classification in veterinary medicine
Advanced course in dairy production medicine with emphasis on herd management, production analysis, and problem solving. Forty hours clinical experience per week. Assignments will include preceptorships with a practicing veterinarian and/or a production unit. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 486: Introduction to Small Ruminant Production Medicine
(15-0) Cr. 1. S.
Prereq: Third year classification in veterinary medicine or permission of instructor.
Survey of small ruminant production systems, common management practices, and disease processes of small ruminants. This course is intended to give the student a background in small ruminant medicine. Herd health, disease monitoring and prevention, and typical management systems will be emphasized in lecture.

VDPAM 487: Livestock Disease Prevention
(3-0) Cr. 3. F.
The course is designed for both the pre-veterinary and animal science majors who have an interest in production animal health, disease prevention methods, epidemiology of economically important agents, and the ecology of currently important pathogens found in North American livestock industries. It will focus on disease prevention principles for individuals and large production population systems.

VDPAM 488: Laboratory in Clinical Microbiology
Cr. 1. Repeatable. F.S.
Prereq: Fourth year classification in veterinary medicine
Application of microbiological procedures to the diagnosis of infectious diseases.

VDPAM 489: Issues in Food Safety
(Cross-listed with AN S, FS HN, HSP M). (1-0) Cr. 1. S.
Prereq: Credit or enrollment in FS HN 101 or FS HN 272 or HSP M 233; FS HN 419 or FS HN 420; FS HN 403
Capstone seminar for the food safety minor. Case discussions and independent projects about safety issues in the food system from a multidisciplinary perspective.

VDPAM 490: Independent Study
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of department chair

VDPAM 491: Advanced Ruminant Nutrition
(30-10) Cr. 2. F.
Focus on dairy nutrition and balancing rations from the calf to the adult, lactating cow. Introduction to different feedstuffs and forage varieties to determine those that are best suited to bovine diets. This course is held the week immediately prior to the start of the fall semester. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 494: Advanced Dairy Production Medicine
(20-20) Cr. 2. S.
Prereq: VDPAM 484 or permission of instructor
Advanced course in investigating dairy herd problems relating to milk quality or nutrition. Milk quality and nutrition troubleshooting will be taught through the combination of lecture and on-farm investigations. Students will combine lecture knowledge, data acquired from on-farm investigations and record analysis to generate management plans. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 495: Advanced Small Ruminant Production Medicine
(15-20) Cr. 2. F.S.
Prereq: VDPAM 486, fourth year classification in veterinary medicine, or permission of instructor
Two week clinical rotation in small ruminant production medicine. Field trips (including overnight stays) will be incorporated when possible. Topics to be covered include small ruminant industries (milk, meat, and fiber), milk quality, nutrition, reproduction, and disease management of small ruminants. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 496: International Preceptorship
(Dual-listed with VDPAM 596). Cr. 1-12. Repeatable. F.S.SS.
Prereq: Second, third or fourth year classification in veterinary medicine
International Preceptorships and Study Abroad Group programs.
This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

VDPAM 507: Evidence Based Clinical Decision Making
(Dual-listed with VDPAM 407). (1-0) Cr. 1. S.
Prereq: Permission of instructor
Discussion, lectures and laboratories to assess the quality and significance of medical evidence in making informed decisions about the treatment of individual animals and animal populations.

VDPAM 508: Poultry Diseases
(Dual-listed with VDPAM 408). Cr. 2. Alt. S., offered even-numbered years.
Prereq: Second or third year classification in veterinary medicine or permission of instructor
Bacterial, viral, parasitic, and nutritional diseases of domestic poultry and gamebirds; biosecurity, immunization, and management procedures to prevent poultry diseases.

VDPAM 514: Veterinary Practice Entrepreneurship
(Dual-listed with VDPAM 414). Cr. 2-3. S.
Prereq: Classification in veterinary medicine
Formal exposure to the entrepreneurial and business skills necessary to own and operate a successful veterinary practice or other small business opportunity. Personal finance, marketing, human resource management, general accounting, site assessment, location demographics, practice valuation, and a host of other issues which must be considered when purchasing or starting a new business are covered. Class instruction will be delivered by successful practice and business owners with examples from real world experience.

VDPAM 526: Veterinary Toxicology
(Dual-listed with VDPAM 426). (Cross-listed with TOX). (3-0) Cr. 3. S.
Prereq: Third year classification in veterinary medicine
Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials.

VDPAM 527: Applied Statistical Methods in Population Studies
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 401
ANOVA, Linear Regression, Model Selection, Mixed Models, ANCOVA, Repeated Measurement Analysis, MANOVA, Nonparametric Methods, Diagnostic Test Evaluation, ROC Curve Analysis, Generalized Linear Models, Logistic Regression, Survival Analysis, Cox Proportional Hazards Regression. This course is available on campus and by distance.

VDPAM 528: Principles of Epidemiology and Population Health
(Dual-listed with VDPAM 428). (Cross-listed with V MPM). (3-0) Cr. 3. S.
Epidemiology of disease in populations. Disease causality and epidemiologic investigations. Issues in disease prevention, control, and eradication. This course is available on campus and by distance.

VDPAM 529: Epidemiological Methods in Population Research
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: STAT 401
Designing, conducting, and analyzing outcomes from field-based studies, including cross-sectional, case-control, cohort, and clinical trials with categorical outcomes. This course is available on campus and by distance.

VDPAM 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

VDPAM 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

VDPAM 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

VDPAM 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

VDPAM 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

VDPAM 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

VDPAM 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

VDPAM 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, V MPM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

VDPAM 546: Clinical and Diagnostic Toxicology
(Cross-listed with TOX). (0-3) Cr. 1-3. Repeatable. F.S.SS.
Prereq: D.V.M. degree or VDPAM 526
Advanced study of current problems and issues in toxicology. Emphasis on problem solving utilizing clinical, epidemiological, and laboratory resources.

VDPAM 551: Advanced Veterinary Diagnostic Medicine
(0-3) Cr. 1-3. Repeatable. F.S.SS.
Prereq: VDPAM 455
Laboratory diagnosis of animal diseases with emphasis on gross and microscopic lesion description. Caseload is focused heavily on infectious diseases of food animals.

VDPAM 570: Risk Assessment for Food, Agriculture and Veterinary Medicine
(Cross-listed with AGRON, TOX). (3-0) Cr. 3. F.
Prereq: Statistics 300-level or higher.
Risk assessment principles as applied to biological systems. Exposure and effects characterization in human and animal health and ecological risk assessment. Risk analysis frameworks and regulatory decision-making. Introduction to quantitative methods for risk assessment using epidemiological and distributional analysis. Uncertainty analysis. This course is available only by distance.

VDPAM 581: Advanced Cow/Calf Production Medicine
(Dual-listed with VDPAM 481). (20-20) Cr. 2. S.
Prereq: Completion of two semesters of VDPAM 436 or UNL equivalent (V MED 596 Cattle Production), fourth year classification in veterinary medicine
Two-week senior elective that will focus on the economics of animal disease in cow/calf operations. Evidence based medicine and epidemiological principles will be used in investigation of disease outbreaks. Extensive partial budgeting used. Students will complete at least two disease investigations involving outbreaks in commercial cow/calf operations and communicate their findings to the class, the herd owner, and local practitioner. Biosecurity: All students must follow current College policies regarding animal contact following foreign travel.

VDPAM 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Topics in medicine, surgery, theriogenology; beef, swine, dairy, or sheep production medicine.

VDPAM 596: International Preceptorship
(Dual-listed with VDPAM 496). Cr. 1-12. Repeatable. F.S.SS.
Prereq: Second, third or fourth year classification in veterinary medicine
International Preceptorships and Study Abroad Group programs.
This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

VDPAM 599: Creative Component
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in nonthesis master's degree program

Courses for graduate students:

VDPAM 650: Swine Diagnostic Medicine
Cr. 4. Alt. S., offered even-numbered years.
Prereq: Permission of instructor
A detailed study of swine diseases emphasizing the pathogenesis and diagnosis of swine respiratory, enteric, reproduction, metabolic, and septicemic diseases. Course activities include interpretation of diagnostic case reports and development of diagnostic plans for specific disease objectives.

VDPAM 654: Comparative Antimicrobial Clinical Pharmacology
Cr. 2. S.
Prereq: Graduate student, resident, or intern in College of Veterinary Medicine
Initial antimicrobial selection for infectious diseases of domestic animals. The antimicrobial drug groups will be examined, stressing pharmacokinetics, minimal inhibitory concentrations, and the use of these parameters to select appropriate compounds and dosages for maximum efficacy.

VDPAM 655: Advanced Swine Production Medicine
Cr. 4. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Detailed overview of applied techniques used in swine production medicine; production modeling and record analysis, facility design and management, analysis of competing intervention options, design and evaluation of therapeutic and vaccination strategies, quality control procedures and food safety. Course activities include interpretation of diagnostic case reports and development of diagnostic plans for specific disease objectives.

VDPAM 699: Research
Cr. arr. Repeatable.

Veterinary Microbiology and Preventive Medicine

Professional Program of Study

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see Veterinary Medicine, Curriculum.

The Department of Veterinary Microbiology and Preventive Medicine provides instruction on pathogenic bacteria, fungi, and viruses and their interaction with host animal species. Principles and applications of infectious diseases, immunity to disease, diagnostic methods for infectious diseases, and vaccinology are covered. Principles and applications of epidemiology, public health, preventive veterinary medicine, regulatory veterinary medicine and food safety are also emphasized.

Graduate Study

The department offers opportunities for the degree doctor of philosophy with a major in veterinary microbiology. A specialization in preventive medicine is an option for this degree. Graduates in the Veterinary Microbiology and Preventive Medicine programs have a broad understanding of the fundamental processes involved in infectious diseases, pathogenesis and immunology. They are able to effectively establish research programs, which involve complex biological systems and disease syndromes. They are also prepared to address microbial-based social, ethical and environmental problems. Graduates acquire

effective written and oral communication skills which lead to successful research and teaching careers in the medical and veterinary sciences. The department also offers work towards the master of science with majors in veterinary microbiology or veterinary preventive medicine. A non-thesis master's option is available for majors in preventive medicine. Courses are open for students majoring in other graduate programs.

Prerequisite to graduate study is completion of coursework in general microbiology, biology, biochemistry, mathematical sciences, and physics. Candidates for the majors in veterinary microbiology should possess an undergraduate degree in biomedical science with emphasis in medical microbiology or the D.V.M. degree. Candidates for the major in preventive medicine should possess the D.V.M. degree.

The department also participates in the interdepartmental majors and programs in genetics, immunobiology, and MCDB (molecular, cellular, and developmental biology; see Index).

Each graduate student must demonstrate proficiency in English composition within two semesters in residence.

Courses primarily for professional curriculum students:

V MPM 378: Case Study IV
(2-0) Cr. 2. S.
Prereq: Second-year classification in veterinary medicine
Case-based applied learning that relates to the basic science courses. Emphasis on early integration of basic and clinical science concepts.

V MPM 380: Veterinary Immunology
(2-0) Cr. 2. S.
Prereq: First-year classification in veterinary medicine
Structure and function of the immune system in animals.

V MPM 386: Veterinary Microbiology
(3-5) Cr. 5. F.
Prereq: Second-year classification in veterinary medicine
Bacteria and fungi of veterinary importance with emphasis on mechanisms of disease production and laboratory diagnostic procedures.

V MPM 387: Veterinary Virology
(3-0) Cr. 3. S.
Prereq: Second-year classification in veterinary medicine
Basic principles of animal virology. Pathogenesis of viral infections. The nature and ecology of viruses of veterinary and zoonotic importance.

V MPM 388: Public Health and the Role of the Veterinary Profession
(3-0) Cr. 3. S.
Prereq: Second-year classification in veterinary medicine
Fundamental epidemiology, zoonotic diseases, occupational health, food safety, other public health topics.

V MPM 390: Topics in Veterinary History
(1-0) Cr. 1. F.S.
An overview of the history of veterinary medicine focused primarily on disease-specific events. A review of the historical aspects of the veterinary profession's accomplishments in the discovery of the etiological origins of disease and their subsequent control will provide students with insights that are applicable to understanding and solving today's animal and human health challenges.

V MPM 409: Infectious Diseases of Wild Animals
(0-2) Cr. 1. F.S.
Prereq: Second year classification in veterinary medicine
Infectious diseases (bacterial, viral, and mycotic) of non-human primates, birds, ruminants, cold-blooded animals, marine mammals, and carnivores.*Spring only offered to UNL students.

V MPM 428: Principles of Epidemiology and Population Health
(Dual-listed with V MPM 528). (Cross-listed with VDPAM). (3-0) Cr. 3. S.
Epidemiology of disease in populations. Disease causality and epidemiologic investigations. Issues in disease prevention, control, and eradication. This course is available on campus and by distance.

V MPM 437: Infectious Diseases and Preventive Medicine
(3-0) Cr. 3. S.
Prereq: Third-year classification in veterinary medicine
Etiology, epidemiology, laboratory diagnosis, regulatory control and preventive medicine aspects of the infectious diseases of swine, sheep, goats, cattle and horses.

V MPM 486: Laboratory in Public Health
Cr. 2. Repeatable. F.S.SS.
Prereq: Fourth-year classification in veterinary medicine
Discussions, lectures, exercises and field trips related to veterinary public health.

V MPM 490: Independent Study
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of instructor and department chair

V MPM 491: CDC Epidemiology Elective Preceptorship
Cr. 6. F.S.SS.
Prereq: Written permission of instructor
Introduction to preventive medicine, public health and the principles of applied epidemiology within the working atmosphere of the Centers for Disease Control and Prevention.

V MPM 494: Zoo Preceptorship
Cr. 1-8. Repeatable. F.S.SS.
Prereq: Fourth year classification in veterinary medicine
Elective course in zoo veterinary practice under guidance of approved veterinarians.

V MPM 496: International Preceptorship
(0-40) Cr. 1-12. Repeatable. F.S.SS.
Prereq: Second-year classification in veterinary medicine
International Preceptorships and Study Abroad group programs. This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

V MPM 501: Basic Principles of Microbiology
Cr. 3. F.
The general principles of bacteriology, immunology and virology will be discussed. The structure and function of bacteria and viruses, the mechanisms of pathogenesis, and the host response to infectious agents will be reviewed. Vaccines, their failures, and new developments in vaccine development will be explored.

V MPM 502: Microbial Genetics and Genomics
(Cross-listed with MICRO). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: MICRO 302, BIOL 313
The fundamental concepts of bacterial and bacteriophage genetics including mutagenesis, mechanisms of both vertical and horizontal genetic information transfer, gene regulation, and genetic approaches to study complex cellular processes. Review and discussion of research literature to examine experimental design, methodology, and interpretation of both historical and contemporary relevance to microbial genetics.

V MPM 520: Medical Immunology I
(4-0) Cr. 4. F.
Prereq: MICRO 310 or V MPM 386, 3 credits in biochemistry
Nature of the immune system and its role in health and disease. Credit for either V MPM 520 or 575, but not both may be applied toward graduation.

V MPM 525: Intestinal Microbiology
(Cross-listed with MICRO). Cr. 3. Alt. S., offered even-numbered years.
Prereq: Micro 302, BIOL 313
Overview of commensal microbiota in the health and well-being of vertebrates. Topics include diversity of intestinal structure, microbial diversity/function, innate immune development, community interactions and metabolic diseases associated with alterations of the intestinal microbiome.

V MPM 528: Principles of Epidemiology and Population Health
(Dual-listed with V MPM 428). (Cross-listed with VDPAM). (3-0) Cr. 3. S.
Epidemiology of disease in populations. Disease causality and epidemiologic investigations. Issues in disease prevention, control, and eradication. This course is available on campus and by distance.

V MPM 536: Zoonoses and Environmental Health
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: V MPM 386, VMPM 387 and V MPM 388 or equivalent or permission of instructor
Pathogensis and control of zoonotic diseases. Factors influencing transmission and survival of pathogenic microorganisms in the environment.

V MPM 540: Livestock Immunogenetics
(Cross-listed with AN S, MICRO). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: AN S 561 or MICRO 575 or V MPM 520
Basic concepts and contemporary topics in genetic regulation of livestock immune response and disease resistance.

V MPM 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

V MPM 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

V MPM 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

V MPM 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

V MPM 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

V MPM 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

V MPM 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, NUTRS, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

V MPM 575: Immunology
(3-0) Cr. 3. S.
Prereq: MICRO 310
An examination of humoral and cellular immune function as well as the interaction of the cells and factors of the immune system that result in health and disease. Micro 475L optional. Credit for either Micro 575 or V MPM 520, but not both, may be applied toward graduation.

V MPM 586: Medical Bacteriology
(Cross-listed with MICRO). (4-0) Cr. 4. F.
Prereq: Permission of instructor
Bacteria associated with diseases of vertebrates, including virulence factors and interaction of host responses.

V MPM 586L: Medical Bacteriology Laboratory
(0-6) Cr. 2. F.
Prereq: credit or enrollment in V MPM 586 or V MPM 625
Procedures used in isolation and identification of pathogenic bacteria, including molecular and genetic techniques used in research.

V MPM 587: Animal Virology
(4-0) Cr. 4.
Prereq: Permission of instructor
Principles of animal virology. Biology of viruses associated with diseases of veterinary importance, including mechanisms of pathogenesis.

V MPM 590: Special Topics
Cr. 1-5. Repeatable. F.S.SS.
Prereq: Permission of instructor

V MPM 596: International Preceptorship
(0-40) Cr. 1-12. Repeatable. F.S.SS.
Prereq: Admission to graduate college
International Preceptorships and Study Abroad Group programs. This course will provide opportunties for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunties. Offered on a satisfactory-fail basis only.

V MPM 599: Creative Component
Cr. arr.
Prereq: Nonthesis M.S. Option only
A written report based on laboratory research, library reading, or topics related to the student's area of specialization and approved by the student's advisory committee.

Courses for graduate students:

V MPM 604: Seminar
(1-0) Cr. 1. Repeatable. F.
Offered on a satisfactory-fail basis only.

V MPM 608: Molecular Virology
(Cross-listed with MICRO, PL P). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: BBMB 405 or GDCB 511
Advanced study of virus host-cell interactions. Molecular mechanisms of viral replication and pathogenesis.

V MPM 615: Molecular Immunology
(Cross-listed with BBMB, MICRO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BBMB 405 or BBMB 506 and BBMB 507
Current topics in molecular aspects of immunology: T and B cell receptors; major histocompatibility complex; antibody structure; immunosuppressive drugs and viruses; and intracellular signaling pathways leading to expression of genes that control and activate immune function.

V MPM 625: Mechanisms of Bacterial Pathogenesis
(Cross-listed with MICRO). (4-0) Cr. 4. Alt. S., offered odd-numbered years.
Prereq: Credit in Biochemistry and Microbiology
Review of current concepts in specific areas of microbial pathogenesis including the genetic basis for bacterial disease, genetic regulation and control of virulence factors and their mechanisms of action, and host-pathogen interactions at the cellular and molecular levels. The application of microbial genetics to understanding pathogenesis will be included.

V MPM 629: Advanced Topics in Cellular Immunology
(2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: V MPM 520 or V MPM 575
Current topics and literature in cellular immunology. Topics include thymocyte development and selection, T cell interactions with antigen presenting cells, and lymphocyte effector functions.

V MPM 660: Pathogenesis of Persistent Infections
(Cross-listed with V PTH). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Study of current knowledge related to host pathogen interactions during persistent and chronic infections by bacteria, viruses and parasites.

V MPM 690: Current Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

V MPM 690A: Current Topics: Immunology
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

V MPM 690B: Current Topics: Infectious Diseases
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Colloquia or advanced study of specific topics in a specialized field.

V MPM 698: Seminar in Molecular, Cellular, and Developmental Biology
(Cross-listed with BBMB, GDCB, MCDB, MICRO). (2-0) Cr. 1-2. Repeatable. F.S.
Student and faculty presentations.

V MPM 699: Research
Cr. arr. Repeatable.

Veterinary Pathology

Professional Program of Study

For the professional curriculum in veterinary medicine leading to the degree doctor of veterinary medicine, see Veterinary Medicine, Curriculum.

The Department of Veterinary Pathology offers a systematic study of basic disease mechanisms with emphasis on the changes in gene expression, cells, tissues, organs, and body fluids associated with disease. The theory and practice of veterinary pathology, veterinary clinical pathology, veterinary parasitology, veterinary toxicology, and related disciplines provide the basis for accurate diagnosis and a rational approach to the treatment and prevention of animal diseases.

Graduate Study

The department offers work for the degree master of science and doctor of philosophy with a major in veterinary pathology. The majority of students choose an area of specialization in veterinary anatomic pathology, veterinary clinical pathology, or veterinary parasitology (http://vetmed.iastate.edu/vpath/academics/graduate-program). The master of science degree is available on a thesis or nonthesis basis in the veterinary pathology major with or without an area of specialization.

For the ACVP training track (residency) of the anatomic or clinical pathology graduate program designed to train veterinary pathologists, the student must have a funded position within the Department of Veterinary Pathology. If the student does not have a funded position or is not enrolled in the departmental degree program, enrollment in courses pertaining to the residency program and activities that support the residency program must have the approval of the Department Chair of Veterinary Pathology and the head of the departmental residency training program.

Graduates have a broad understanding of the mechanistic basis of disease pathogenesis. They are able to communicate with clinicians, other scientists, and other colleagues on scientific matters, and with the general public on related science policy matters. Graduates are able to address complex problems facing the agricultural and biomedical sciences, and comparative medicine, and are able to make appropriate diagnoses and investigations of animal diseases. They consider ethical, social, legal and environmental issues, and are skilled at carrying out research, communicating research results, and writing concise and competitive grant proposals.

Collaborative work is recommended in other departments in the College of Veterinary Medicine or departments or programs in other colleges. The department participates in the interdepartmental programs in Immunobiology (www.immunobiology.iastate.edu/ (http://www.immunobiology.iastate.edu)), Toxicology (www.toxicology.iastate.edu/ (http://www.toxicology.iastate.edu)), Genetics (www.genetics.iastate.edu/ (http://www.genetics.iastate.edu)), and Molecular, Cellular, and Developmental Biology (www.mcdb.iastate.edu/ (http://www.mcdb.iastate.edu)).

A veterinary degree (doctor of veterinary medicine or equivalent) is required for training in Veterinary Anatomic Pathology and Veterinary Clinical Pathology. Other specializations do not require the veterinary degree. A minimum score of 550 paper-based (213 computer-based; 79 internet based) is required on the TOEFL examination for students whose native language is not English. Scores on the standardized Graduate Record Examination (GRE) General Test are required of students not having a veterinary degree from the United States or Canada. The GRE General Test is strongly recommended for all other applicants. A foreign language requirement will be determined by the student's program

of study committee with the approval of the departmental chair. The Graduate English Examination is a graduate college requirement for native English speakers.

The M.S. thesis degree in veterinary pathology, with or without an area of specialization, requires a minimum of 30 graduate credits. Following completion of all other requirements, a comprehensive final examination is administered covering all graduate work including the thesis. The examination is typically oral, but a written component may be specified by the program of study committee. The degree candidate must submit a thesis, including at least one manuscript suitable for publication, to the committee members and departmental chair at least two weeks prior to the final examination. The departmental requirement for graduate courses includes:

3 credits of basic biological sciences (biochemistry, genetics, cell biology)		3
STAT 401	Statistical Methods for Research Workers	4
V PTH 570	Systemic Pathology I	4
or V PTH 571	Systemic Pathology II	
V PTH 551	Postmortem Pathology Laboratory	1
V PTH 605	Current Topics Seminar	1
V PTH 699	Research	arr †

† Arranged with instructor.

The M.S. nonthesis degree in veterinary pathology, with or without an area of specialization, requires a minimum of 40 graduate credits including at least 10 graduate credits earned outside the department. Every nonthesis master's degree program requires evidence of individual accomplishment demonstrated by completion of a creative component, special report, or scientific study. A minimum of 3 credits of such independent work (V PTH 599 Creative Component Research) and a practical diagnostic examination (V PTH 606 Diagnostic Interpretation) corresponding to the area of specialization are required on every program of study. The final examination is comprehensive and consists of written and oral questions. The departmental requirement for graduate courses includes those for the M.S. thesis degree plus additional courses corresponding to the area of degree emphasis of specialization. Contact the department for a more complete list of requirements and information on areas of specialization.

The Ph.D. degree in veterinary pathology, with or without an area of specialization, requires a minimum of 72 graduate credits including at least 12 graduate credits earned outside the department. The preliminary examination, consisting of written and oral components, is comprehensive and not restricted to the content of graduate courses. The degree candidate must submit a dissertation, including at least two manuscripts suitable for publication, to the committee members and departmental chair at least two weeks prior to the final examination. The final examination is primarily a defense of the dissertation, but it may include questions on other areas of specialized knowledge. The department also offers a combined DVM/Ph.D. program designed for completion of courses for the Ph.D. degree in Veterinary Pathology simultaneously with study in the professional curriculum in the College of Veterinary Medicine. Contact the department for a more complete list of requirements for the Ph.D. degree and information on areas of specialization.

Courses primarily for professional curriculum students:

V PTH 342: Anatomic Pathology I
(Dual-listed with V PTH 542). (2-2) Cr. 3. S.
Prereq: for V PTH 342, prereq: First-year classification in veterinary medicine. For V PTH 542, prereq: Graduate classification and BIOL 352 or equivalent for graduate credit, permission of instructor.
Basic pathology with emphasis on disease in animals and introduction to diseases by system.

V PTH 353: Introductory Parasitology
(Cross-listed with BIOL, MICRO). (3-0) Cr. 3. S.
Prereq: BIOL 212
Biology and host-parasite relationships of major groups of animal parasites, and techniques of diagnosing and studying parasites.

V PTH 372: Anatomic Pathology II
(Dual-listed with V PTH 572). (3-3) Cr. 4. F.
Prereq: for V PTH 372, prereq: V PTH 342. For V PTH 572, prereq: Graduate classification and V PTH 542.
Response to injury by each body system.

V PTH 376: Veterinary Parasitology
(Dual-listed with V PTH 576). (3-3) Cr. 4. F.
Prereq: For V PTH 376, prereq: Second-year classification in veterinary medicine. For V PTH 576, prereq: Graduate classification and V PTH 542.
Parasitic diseases of domestic animals and their control.

V PTH 377: Case Study III
(0-4) Cr. 2. F.
Prereq: Second-year classification in veterinary medicine
Clinical applications of the basic sciences taught concurrently in the fall semester of the second year curriculum in veterinary medicine.

V PTH 401: Basics of Medical Terminology
(1-0) Cr. 1. F.
Discussion of prefixes, suffixes, and roots (mostly from Latin and Greek) that comprise medical terms.

V PTH 402: Introduction to Pathology
(Cross-listed with BIOL). (3-0) Cr. 3. S.
Prereq: BIOL 211 and BIOL 212 with labs
Introductory exploration of pathology as a medical discipline. This includes study of disease mechanisms via an introduction to general pathology topics (cell degeneration, necrosis, disturbances of growth, disturbances of blood flow, inflammation, neoplasia) and organ system-specific response to injury.

V PTH 409: Introduction to Veterinary Cytology and Laboratory Techniques
(0-2) Cr. 1. S.
Prereq: Third-year classification in veterinary medicine
Description, interpretation, and techniques for cellular preparations from tissues and body fluids.

V PTH 425: Clinical Pathology
(2-4) Cr. 4. S.
Prereq: V PTH 372
Principles of clinical hematology, clinical chemistry, and urinalysis in domestic animals.

V PTH 456: Necropsy Laboratory Practicum
Cr. 1. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Practicum in postmortem examination and diagnosis.

V PTH 457: Clinical Pathology Laboratory Practicum
Cr. 1. Repeatable.
Prereq: Fourth-year classification in veterinary medicine
Methodology in clinical chemistry, hematology and cytology; practice in interpretation of laboratory data.

V PTH 490: Independent Study
Cr. arr. Repeatable.
Prereq: Permission of instructor and department chair

V PTH 492: Orientation for International Experience
(2-0) Cr. 1. Repeatable. S.
Prereq: Classification in veterinary medicine
8 weeks. Predeparture orientation for group study abroad. Cultural considerations for the study abroad experience and a conversational language introduction. Out of class work will be assigned. Offered on a satisfactory-fail basis only.

V PTH 495: Clinical Competency Skills Checklist/Remediation
Cr. R. S.
Prereq: 4th year classification in Veterinary Medicine
In order to graduate, all 4th year veterinary students are required to complete a checklist of clinical procedures and complete any assigned remediation (based on evaluation in core clinical rotations). These requirements are tied to the college's AVMA COE accreditation, and this course is used to document completion of those requirements. Offered on a satisfactory-fail basis only.

V PTH 496: International Preceptorship
(0-40) Cr. 1-12. Repeatable. F.S.SS.
Prereq: Second-year classification in veterinary medicine
International Preceptorships and Study Abroad Group programs. This course will provide opportunities for students to be involved in applied clinical, production, and/or research experience in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

Courses primarily for graduate students, open to qualified undergraduates:

V PTH 503: Principles of Pathology
(3-0) Cr. 3. S.
Prereq: Graduate classification; permission of instructor
Introductory exploration of pathology as a medical discipline. This includes study of disease mechanisms via an introduction to general pathology topics (cell degeneration, necrosis, disturbances of growth, disturbances of blood flow, inflammation, neoplasia) and organ system-specific response to injury.

V PTH 530: Teaching and Learning in Veterinary Medical Education
(3-0) Cr. 3. Alt. F., offered even-numbered years.
Study of principles of teaching and learning as they relate to veterinary medical education. These include: theories of learning, analyzing content/learners/context, identifying goals, identifying appropriate instructional strategies (specific to medical education), matching assessment processes to goals and strategies, common curricular approaches and decision-making processes in medical education, and the scholarship of teaching and learning for veterinary medical educators.

V PTH 542: Anatomic Pathology I
(Dual-listed with V PTH 342). (2-2) Cr. 3. S.
Prereq: for V PTH 342, prereq: First-year classification in veterinary medicine. For V PTH 542, prereq: Graduate classification and BIOL 352 or equivalent for graduate credit, permission of instructor.
Basic pathology with emphasis on disease in animals and introduction to diseases by system.

V PTH 548: Diagnostic Parasitology Laboratory
Cr. 1-3. Repeatable. F.S.SS.
Prereq: V PTH 376 or V PTH 576
Contact hours are (0-3 to 0-9). A laboratory experience in the technical and applied aspects of veterinary parasitology.

V PTH 549: Clinical Pathology Laboratory
(0-3) Cr. 1. Repeatable. F.S.SS.
Prereq: V PTH 457; permission of instructor
Laboratory procedures and clinical interpretations with emphasis on hematology, cytology, and clinical chemistry. Offered on a satisfactory-fail basis only.

V PTH 550: Surgical Pathology Laboratory
Cr. 1-3. Repeatable. F.S.SS.
Prereq: V PTH 570 or V PTH 571; permission of instructor
Contact hours are (0-3 to 0-9). Diagnosis of lesions in biopsy specimens; classification of neoplasms. Course includes rotation through departmental biopsy service and review of selected cases from departmental archives. Offered on a satisfactory-fail basis only.

V PTH 551: Postmortem Pathology Laboratory
Cr. 1-3. Repeatable. F.S.SS.
Prereq: V PTH 542; permission of instructor
Contact hours are (0-3 to 0-9). Necropsy techniques of animals with emphasis on gross and microscopic lesions and diagnosis. Offered on a satisfactory-fail basis only.

V PTH 554: Ethics in Scientific Research and Writing
(1-0) Cr. 1. Alt. S., offered even-numbered years.
Prereq: Graduate classification
Ethical conduct in biomedical research, criticism, writing, and adherence to regulations. Offered on a satisfactory-fail basis only.

V PTH 570: Systemic Pathology I
(4-0) Cr. 4. Alt. F., offered even-numbered years.
Prereq: V PTH 342 or V PTH 542; permission of instructor
Pathology of the respiratory, reproductive, endocrine, musculoskeletal, and cardiovascular systems. Emphasis on pathogenesis and anatomic pathology correlated with interpretive clinical pathology where appropriate.

V PTH 571: Systemic Pathology II
(4-0) Cr. 4. Alt. F., offered odd-numbered years.
Prereq: V PTH 342 or V PTH 542; permission of instructor
Pathology of the integumentary, urinary, digestive, lymphoid, and nervous systems and special senses. Emphasis on pathogenesis and anatomic pathology correlated with interpretive clinical pathology where appropriate.

V PTH 572: Anatomic Pathology II
(Dual-listed with V PTH 372). (3-3) Cr. 4. F.
Prereq: for V PTH 372, prereq: V PTH 342. For V PTH 572, prereq: Graduate classification and V PTH 542.
Response to injury by each body system.

V PTH 576: Veterinary Parasitology
(Dual-listed with V PTH 376). (3-3) Cr. 4. F.
Prereq: For V PTH 376, prereq: Second-year classification in veterinary medicine. For V PTH 576, prereq: Graduate classification and V PTH 542.
Parasitic diseases of domestic animals and their control.

V PTH 590: Special Topics
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor

V PTH 590A: Special Topics: Veterinary Pathology
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor

V PTH 590B: Special Topics: Veterinary Parasitology
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor

V PTH 590C: Special Topics: Veterinary Toxicology
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor

V PTH 590D: Special Topics: Veterinary Clinical Pathology
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor

V PTH 590E: Special Topics: Other
Cr. 1-4. Repeatable. F.S.SS.
Prereq: Permission of instructor

V PTH 596: International Preceptorship
(0-40) Cr. 1-12. Repeatable. F.S.SS.
Prereq: Admission to graduate college
International Preceptorships and Study Abroad Group programs. This course will provide opportunities for students to be involved in applied clinical, production, and/or research experiences in international locations. The course consists of 40 hour per week experiential learning opportunities. Offered on a satisfactory-fail basis only.

V PTH 599: Creative Component Research
Cr. arr. Repeatable.
Course for departmental graduate research.

V PTH 599A: Creative Component Research: Veterinary Pathology
Cr. arr. Repeatable.
Course for departmental graduate research.

V PTH 599B: Creative Component Research: Veterinary Parasitology
Cr. arr. Repeatable.
Course for departmental graduate research.

V PTH 599C: Creative Component Research: Veterinary Toxicology
Cr. arr. Repeatable.
Course for departmental graduate research.

V PTH 599D: Creative Component Research: Veterinary Clinical Pathology
Cr. arr. Repeatable.
Course for departmental graduate research.

Courses for graduate students:

V PTH 604: Pathology Case Seminar
Cr. 1-2. Repeatable. F.S.
Prereq: permission of instructor
Description and interpretation of microscopic lesions and clinical pathology data collected from cases of natural and experimental disease. Offered on a satisfactory-fail basis only.

V PTH 605: Current Topics Seminar
Cr. 1. Repeatable. F.S.SS.
A seminar of graduate research at the time of thesis or dissertation defense.

V PTH 606: Diagnostic Interpretation
Cr. R. F.S.SS.
Prereq: permission of instructor
A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination.

V PTH 606A: Diagnostic Interpretation: Veterinary Pathology
Cr. R. F.S.SS.
Prereq: permission of instructor
A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination.

V PTH 606B: Diagnostic Interpretation: Veterinary Parasitology
Cr. R. F.S.SS.
Prereq: permission of instructor
A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination.

V PTH 606C: Diagnostic Interpretation: Veterinary Toxicology
Cr. R. F.S.SS.
Prereq: permission of instructor
A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination.

V PTH 606D: Diagnostic Interpretation: Veterinary Clinical Pathology
Cr. R. F.S.SS.
Prereq: permission of instructor
A comprehensive examination in the diagnostic description and interpretation of case materials relevant to veterinary pathology and areas of specialization for the graduate degree preliminary examination.

V PTH 652: Pathologic Hematology
(2-2) Cr. 3.
Prereq: V PTH 425; permission of instructor
Pathologic changes in blood constituents of domestic animals.

V PTH 655: Cellular and Molecular Pathology I
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Graduate course in biochemistry, genetics, or cell biology
Cellular and molecular mechanisms of cell injury, cellular responses to injury, and inflammation.

V PTH 656: Cellular and Molecular Pathology II
(Cross-listed with TOX). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Graduate course in biochemistry, genetics, or cell biology
Cellular and molecular mechanisms of carcinogenesis.

V PTH 660: Pathogenesis of Persistent Infections
(Cross-listed with V MPM). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Permission of instructor
Study of current knowledge related to host pathogen interactions during persistent and chronic infections by bacteria, viruses and parasites.

V PTH 661: Comparative Immunology and Infectious Disease
(Cross-listed with IMBIO). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Graduate level Immunology or permission of instructor.
Discuss and define similarities and differences of varied host responses to infectious challenge. Learning will focus on comparative aspects of the host response and the unique aspects of immunity from different organisms, while highlighting molecular and mechanistic similarities of pathogen recognition, response and resolution.

V PTH 663: Clinical Chemistry
(2-2) Cr. 3.
Prereq: V PTH 425; permission of instructor
The pathophysiology, methodology, and clinical application of laboratory medicine.

V PTH 679: Histopathology of Laboratory Animals
(1-2) Cr. 2.
Prereq: V PTH 570 or V PTH 571; permission of instructor
Study of microscopic lesions in laboratory animals with emphasis on description, etiology, pathogenesis, and diagnosis.

V PTH 699: Research
Cr. arr. Repeatable.
Course restricted to graduate program within the department.

V PTH 699A: Research: Veterinary Pathology
Cr. arr. Repeatable.
Course restricted to graduate program within the department.

V PTH 699B: Research: Veterinary Parasitology
Cr. arr. Repeatable.
Course restricted to graduate program within the department.

V PTH 699C: Research: Veterinary Toxicology
Cr. arr. Repeatable.
Course restricted to graduate program within the department.

V PTH 699D: Research: Veterinary Clinical Pathology
Cr. arr. Repeatable.
Course restricted to graduate program within the department.

Graduate College

www.grad-college.iastate.edu/ (http://www.grad-college.iastate.edu)

David K. Holger, Dean
William R. Graves, Associate Dean
Craig Ogilvie, Assistant Dean

The Graduate College and graduate faculty at Iowa State University are responsible for the quality of graduate education, for administering students' graduate programs, and for promoting research support from various governmental, industrial, and private agencies.

The graduate faculty in various programs handle admission and classification of graduate students, establish requirements for advanced degrees, and have charge of instruction and research at the graduate level. Graduate faculty members also teach graduate courses, serve on program of study (POS) committees, and direct work of master's and doctoral students. All graduate courses offered for major or nonmajor credit are taught by graduate faculty members or graduate lecturers.

Graduate study was offered soon after the university was founded, and the first graduate degree was conferred in 1877. Experimentation and research also started early, first in agriculture and shortly thereafter in home economics, engineering, science, and veterinary medicine. In 1913, the graduate faculty was organized formally and an executive graduate committee was appointed. In 1915, the graduate faculty held its first meeting, and in 1916, it granted the first doctor of philosophy degree.

Graduate education is vital to the quality of university teaching. The creative efforts of graduate faculty members and graduate students result in knowledge necessary to help society solve problems in educational, scientific, technological, and socio-economic areas. The Graduate College encourages educational exchange and contact with undergraduate areas of the university to promote improved teaching on both the undergraduate and graduate levels. A part of this exchange is accomplished by the publication of books and technical articles which are made possible by graduate research.

The degrees master of arts, master of science, and doctor of philosophy are research oriented. In many fields master's degrees are also awarded without a thesis, but a written report of independent study, called a creative component, is generally required. Coursework only degrees are available for those individuals interested in advanced study directed toward meeting vocational or professional objectives. Information on other types of Master's degrees can be found in the Graduate College Handbook, Appendix E, (www.grad-college.iastate.edu/publications/gchandbook/homepage.html (http://www.grad-college.iastate.edu/publications/gchandbook/homepage.html))

The Graduate College Handbook lists policies and procedures of the Graduate College. It is available at the Graduate College's Web site: www.grad-college.iastate.edu/ (http://www.grad-college.iastate.edu).

Graduate Appointments

Graduate assistantships, fellowships, and research grants have been established at Iowa State University to encourage graduate work and to promote research. Such appointments and research opportunities are available through the various departments of instruction and the research centers on campus.

Graduate assistantships, the most common form of graduate student support, are available in three categories: the research assistantship, the teaching assistantship, or the administrative assistantship. A half-time graduate assistantship (20 hours per week) permits the holder to enroll for a maximum of 12 semester credits. Recipients of these assistantships are assessed fees at full Iowa resident rates regardless of the number of credits for which they register. These students may also be eligible for tuition scholarship awards (50% of in-state tuition for most master's students and 100% of in-state tuition for most Ph.D. students and certain terminal masters students). Students who are graduates of a regionally accredited college or university in the United States or of a recognized institution in another country whose requirements for the bachelor's degree are substantially equivalent to those of Iowa State University, who are admitted in the full or provisional admissions status,

and who present the requisite undergraduate or graduate preparation, may apply for these appointments.

Students registered on a restricted basis or those placed on academic probation are eligible for assistantship appointment only on a term by term basis but are not normally eligible for a graduate tuition scholarship. Students admitted as nondegree students are not eligible for assistantship appointments. Further information may be obtained by contacting the appropriate graduate program.

The satisfactory completion of one appointment, plus satisfactory academic performance, will ordinarily make a student eligible for reappointment. After a period of three years of full time study for the master's degree or five years for the doctorate, the student will not normally be continued on assistantship support (shorter periods may be stipulated by the student's program or department).

Postdoctoral Study

Opportunities are provided for postdoctoral study through the extensive research programs of the university. Inquiries should be directed to the appropriate program, institute, or to the Dean of the Graduate College.

Graduate Study by Staff Members

Any full-time member of the research, instructional, or extension staff at the rank of instructor, research associate, or assistant scientist may carry up to six course credits per semester and three credits per summer session, subject to the approval of the head of the program or section, and provided it does not interfere with other duties. This privilege may be extended to members of the research, instructional, or extension staffs at the rank of assistant professor with approval of the college dean and the Dean of the Graduate College. Staff members at the rank of professor or associate professor cannot become candidates for graduate degrees from ISU.

Distance Education

Iowa State offers many graduate degree and certificate programs off-campus. For a listing of the degree programs, registrations for courses, and more information about distance education, consult the Iowa State University Web site at http://www.distance.iastate.edu.

Other information about graduate requirements is available in the Graduate College Handbook at http://www.grad-college.iastate.edu/publications/gchandbook/homepage.html.

Doctoral Post Prelim (Continuous Registration)

Even when Ph.D. graduate students have completed course work and residency requirements, they are required to register and pay tuition and fees, whether or not university facilities and equipment are used or staff is consulted—either in person or in absentia.

After the preliminary oral examination is passed (with either full or conditional pass) and if university facilities, equipment, and staff time are used, the Ph.D. candidate must register for the appropriate number of credits in the major department or program and pay the appropriate graduate tuition and fees.

After the preliminary oral examination is passed (with either full or conditional pass) and if university facilities, equipment, and staff time are not used, the Ph.D. candidate may register for GR ST 680 Doctoral Post Prelim (Continuous) Registration and pay the Doctoral Post Prelim Registration fee.

The Ph.D. candidate must be aware that registration for Gr St 680 is allowed only after the Ph.D. candidate passes the preliminary oral examination; is required only in the fall and spring semesters, and not during the summer term; is not allowed after the completion of the final oral examination; and is not sufficient registration for the term the preliminary or final oral examination is taken; and does not defer student loans.

If students take the final examination during the interim between terms (including the first day of classes), registration can be for the term either before or after the examination is held.

Auditing

Audit registration means taking courses without receiving formal credit. Audit provisions are as follows: Instructors must approve ALL audits; students must register for audits by day 10 of the semester; changes to or from an audit must be made in the first 10 days of the semester; students are assessed tuition and fees as though they were taking the course for credit; and the course DOES NOT count in determining full-time student status.

Audited courses do not appear on the student's permanent record unless the "Request for Audit(s) to Appear on Transcript" form is completed and signed by the student, course instructor, and major professor. Copies of this form, which are available from the Graduate College or from the Graduate College's web site at www.grad-college.iastate.edu/forms/forms.html (http://www.grad-college.iastate.edu/forms/forms.html), must be filed with the Graduate College, 1137 Pearson Hall.

After the fifth class day, if a student changes a regular course to an audit, that course will appear on the student's permanent record as a drop. Audits are not acceptable as registration for loan deferments or meeting visa requirements.

Graduate Courses Taken by Undergraduates

Certain graduate level courses listed in the ISU Catalog may be used in the program of study even though they were taken for graduate credit by the student as an undergraduate at Iowa State University.

The following conditions must be met:

1. The POS committee can request approval from the Dean of the Graduate College that up to nine hours of such credit be applied toward meeting advanced degree requirements (these courses must be clearly marked on the POS).
2. Credits earned in these courses must be in addition to those used to meet requirements for the bachelor's degree and must have grades of B or better.
3. The student must be classified as an undergraduate and not a nondegree undergraduate (credits taken as a nondegree undergraduate student are not allowed).
4. The Graduation Office (10A Enrollment Services Center) should be contacted to determine that the courses were not taken as a nondegree undergraduate student, were not used toward fulfillment of the undergraduate degree program and were graded B or better.

Courses Taken as a Nondegree Undergraduate Student

A person classified as a "nondegree undergraduate" student may not use courses taken under that status in a graduate degree program. A student who has received the baccalaureate degree must register as a graduate student if he/she is to receive graduate credit for courses.

Graduate Majors

A complete list of all graduate majors can be found on the Graduate College website, http://www.grad-college.iastate.edu/academics/gradprograms/phd.php, with links to admission requirements and program websites.

Admission

All degree-seeking graduate students must have graduated with a bachelor's or master's degree from a regionally accredited U.S. institution or from a recognized foreign institution where the requirements for the bachelor's degree or its equivalent are similar to those at ISU. Additionally, each applicant must be accepted at ISU by the major program, the Office of Admissions, and the Graduate College. For information concerning graduate study in a particular academic discipline, prospective students should correspond with the chair of the major program in which they wish to study.

Iowa State University has a shared application process, which means certain items are sent (electronically or in print form) to the Office of Admissions and other items are sent to the graduate program to which the prospective student is applying. Detailed instructions are available at http://www.admissions.iastate.edu/graduate/index.php. Students are also encouraged to check the Program Requirements Web page on the Graduate College Web site at http://www.grad-college.iastate.edu/programs/APprograms.php for mailing instructions and deadlines for each program.

The nonrefundable application fee is $40 ($90 for international applicants). An electronic application is required to apply to ISU's graduate programs; the form and necessary instructions are available at https://www.admissions.iastate.edu/apply/index.php. The application fee is required of all applicants except those who have attended Iowa State as undergraduates. Iowa State requires official academic records and statements of all degrees earned from all institutions attended since secondary school. Faxed, scanned, and notarized copies are not considered official.

Many programs have very early application deadlines. For more details, check program deadlines at www.grad-college.iastate.edu/programs/APprograms.php (http://www.grad-college.iastate.edu/programs/APprograms.php).

Categories of Graduate Admission

An applicant pursuing an advanced degree must be recommended by the program in which he/she will be pursuing an advanced degree and must be approved by the Dean of the Graduate College. There are three admission categories for students who wish to pursue an advanced degree:

Full Admission status may be granted to an applicant who either has achieved a grade point average (GPA) of 3.0 or greater (on a 4.0 scale).

Provisional admission status may be granted to applicants who meet the requirements for full admission but have academic or prerequisite deficiencies to remedy. Transfer from provisional admission to full admission status requires the completion of the graduate English requirement, completion of the coursework prescribed to remedy the background deficiencies with a grade average of B or better, and the written recommendation of the major professor and approval by the Dean of the Graduate College.

Restricted admission status may be granted to an applicant who does not satisfy the formal university requirements for full admission status and/or lacks undergraduate preparation in a field related to the graduate field of study. Restricted admission may also be granted to graduates of non-English-speaking foreign institutions, even if the student meets the university requirements for full admission status. Advancement from restricted to full admission status requires completion of 9 semester credits of graduate level course work as a graduate student with a cumulative grade average of B or better and satisfaction of the Graduate

College English requirement. A recommendation is submitted in writing to the Graduate College by the major professor and must be approved by the Dean of the Graduate College.

Nondegree Graduate Admission

Well-qualified applicants who do not intend to seek an advanced degree from Iowa State University may be considered for nondegree graduate admission. Such students usually include:

1. Those who intend to transfer graduate credit earned at Iowa State University to other institutions.
2. Those who intend to use graduate credits earned for professional certification.
3. Those who enroll for personal satisfaction.
4. Those who enroll occasionally in off-campus graduate courses. The nondegree application form is available from www.admissions.iastate.edu/nondegree/ (http://www.admissions.iastate.edu/nondegree).

Applications and schedules for nondegree students are processed directly by the Office of Admissions and the Graduate College office; no program approvals are generally required, unless the non degree applicant has a very low GPA, then departments are contacted about what courses would be appropriate for the student to take.

A nondegree student who subsequently seeks full, provisional, or restricted admission must apply to and be accepted by a graduate program and by the Graduate College for degree study. A new application, the regular application fee, and transcripts from all colleges attended are required.

For those students originally admitted to the Graduate College on a nondegree basis, no more than 9 semester hours of graduate credit earned under the nondegree option may be applied if the student later chooses to undertake a graduate degree program. The student's program of study committee will recommend to the Graduate College which courses (if any) taken on a nondegree basis may be included in the degree program.

Graduate Admission of International Students

An applicant who is a graduate of a recognized foreign institution is subject to the same criteria for admission as a graduate from an institution in the United States and may be recommended for the same admission categories described above except that of the nondegree option. International applicants for nondegree status may be considered for admission at the discretion of the Graduate College dean. Application and admission deadlines for international students can be obtained from the Admissions web site at www.admissions.iastate.edu/apply/ (http://www.admissions.iastate.edu/apply).

International students are required to show evidence of financial support and to carry adequate health and accident insurance while in residence.

Admission Examinations

Graduate Record Examination. The Graduate Record Examination (GRE) is not a university-wide requirement for all applicants. However, many programs require or recommend submission of GRE scores; individual program statements at www.grad-college.iastate.edu/programs/APprograms.php (http://www.grad-college.iastate.edu/programs/APprograms.php) should be consulted for this information.

Registration

Graduate students are encouraged to register for courses on the ISU web site (www.iastate.edu (http://www.iastate.edu)) via AccessPlus. Students who are unable or who choose not to register through this system may use a walk-through registration procedure. Students who do not register by the published deadline for initiation of a schedule through the AccessPlus systems must use the walk-through procedure. For complete information on registration, see the ISU Schedule of Classes or the Registration Web site at http://www.registrar.iastate.edu/students.

Credit Limits

Registration is limited to a maximum of 15 credits per semester. Schedules for graduate assistants on one-half time appointments are limited to a maximum of 12 credits. For full-time staff members, the limit is 6 credits. (Different credit limits apply during the summer session; see the Graduate College Handbook at www.grad-college.iastate.edu/common/ (http://www.grad-college.iastate.edu/common/handbook)handbook for more details.)

Interim Registration

Registration for special work between semesters and during certain vacation periods cannot exceed one credit for each week that the student is in residence. For more information, consult the Graduate College Handbook.

Grading

Grades are the permanent official record of a student's academic performance. Iowa State uses A through F grading for most courses. S, P, and NP grades are given in some courses. The standard four-point scale is used to calculate a grade point average.

Grade Point Average (GPA)

All courses (even if they are undergraduate courses) taken as a graduate student will be calculated into the graduate GPA. The GPA is determined by dividing the number of grade points earned by the total number of ISU

cumulative hours. The grade given when an incomplete (I) is resolved is figured into the cumulative grade point average, but not into a particular semester's average. Marks of I, S, P, NP, T, and X are not counted in the grade point average; a mark of F (even if taken S/F) is counted in the grade point average. Creative Component/Research (599 and 699) credits are not used in the calculation of the GPA. In the case of repeated courses, only the grade achieved the last time the course is taken is used in computing the grade point average. (However, grades in courses that are noted as repeatable courses in the catalog, such as certain repeatable seminars, will all be used in calculating the grade point average.)

Grading Research and Creative Component Credits

Creative Component/Research credits may be graded as A, B, C, D, I, S, or F. Plus and minus grades are optional. These credits are not calculated in a student's GPA.

Pass (P)/Not Pass (NP) Course Credit

Pass/Not Pass courses are those that a student, with the approval of the major professor, may take for personal enrichment, but not for satisfying prerequisites or deficiencies in the undergraduate background. P/NP marks may not be used in a POS, nor do P/NP marks contribute to the student's GPA. Full credit for P/NP courses is used in calculating tuition assessment and credit load limitations. For more information, see the Graduate College Handbook.

Satisfactory/Fail (S/F) Grading

S/F grading is not the same as P/NP grading. S/F grading is by instructor option; all students in a particular course receive S/F grading. P/NP grading is generally a student option. A P mark is equivalent to at least a D- grade whereas an S mark is equivalent to at least a B grade at the graduate level. No special registration procedures are required for S/F grading. An S mark in a course taken S/F is not counted in the grade point average, but an F mark in a course taken S/F is counted in the grade point average and is equivalent to an F in a regularly graded (A-F) course. No more than 20 percent of the total credits (excluding creative component, thesis or dissertation research) in the program of study may be earned on an S/F basis.

S/F grading may be used only for approved courses offered as seminars, symposia, workshops, special topics, and research. Programs must submit requests for S/F grading to the Dean of the Graduate College. The Graduate College Curriculum and Catalog Committee reviews and approves or rejects all S/F courses.

Grievances about Grades

A graduate student who feels that a course grade has been unjustly assigned, and whose attempts to resolve the matter with the instructor have failed, may appeal through the grievance procedures described in the Graduate College Handbook.

Probation

If a graduate student does not maintain a cumulative 3.0 grade point average on all course work taken, exclusive of research credit, he or she may be placed on academic probation by the Dean of the Graduate College. Grades earned by graduate students in undergraduate courses are included in the calculation of the grade point average. Academic probation judgments are made on the basis of grades in course work only. New, first-term, degree seeking graduate students who fall below a 3.0 GPA at the end of their first semester will be given a one term grace period to bring their grades back to a 3.0 GPA. These students will receive a warning letter from the Graduate College.

While on academic probation a student will not be admitted to candidacy for a degree and if appointed to a graduate assistantship, the student will not receive a Graduate tuition scholarship unless approval is given by the student's academic college. If a student is to qualify for a tuition scholarship, he/she must be removed from probation by the tenth class day of the term.

To insure that registration does not take place without a review by the program, the Graduate College places a hold on future registrations by a student on probation. Before the student registers for each term, the program must review his or her record and recommend in writing if the Graduate College should permit further registration. Before graduation is approved, the student must complete all courses listed on the program of study with a minimum grade of C and have achieved a 3.0 GPA or greater.

English Requirements for Non-native Speakers

Applicants whose native language is not English and who have not earned a bachelor's or master's in a country where the only official language is English are required to submit Test of English as a Foreign Language (TOEFL) scores as part of the admission process. A minimum score of at least 79 on the TOEFL internet-based test or 550 on the paper-based test is required by the Graduate College. International students may also submit IELTS (International English Language Testing System) scores in lieu of the TOEFL. The ISU Graduate College minimum is 6.5. Because many programs require higher TOEFL and/or IELTS scores, applicants should check directly with the program to which they desire admission or browse the Graduate College Web site at www.grad-college.iastate.edu/programs/APprograms.php (http://www.grad-college.iastate.edu/programs/APprograms.php).

Graduate students whose native language is not English and who did not graduate from a U.S. institution must take an English Placement Test at the beginning of their first semester of enrollment. This test is administered by the Department of English. A student who does not pass this examination is assigned to one or more courses in the English 99 and 101 series. This course work must be completed during the first year of

study . (There is a developmental course fee for the English 99 course.). Non-native English speaking ISU graduate students who meet or exceed the TOEFL scores (640 or above on the paper-based test or 105 on the internet-based test) are exempted from taking the Enlish Placement Test. (Self-enrollment in English 099 or 101 courses remains possible.

A graduate student whose native language is not English but did graduate from a U.S. institution, may bring to the Graduate College the "Request for the Graduate College to Approve the Graduate English Requirement for a Student Whose Native Language is NOT English" form, available from the Graduate College or on the Graduate College's Web site at www.grad-college.iastate.edu/common/forms/student_forms. (http://www.grad-college.iastate.edu/common/forms/student_forms.php)php. Two conditions must be met: the student must have received a bachelor's, master's, or Ph.D degree from a U.S. college or university and the language of instruction at that college or university must have been in English.

New teaching assistants whose native language is not English are evaluated for their ability to communicate effectively in English before their assistantship assignments are made. The Oral English Certification Tests (OECT) are given before the beginning of each semester. The testing dates are announced on the International Teaching Assistants (ITA) program website. Registration for the test is held on line through links posted on the ITA program homepage, http://www.grad-college.iastate./speakteach/, two to three weeks before the test is administered. TAs and faculty with questions about OECT testing should call 515-294-1958 or 515-294-7996. A prospective teaching assistant who does not pass these tests is required to successfully complete course work and be retested. English 180 is a series of communication courses designed to help new teaching assistants. Students focus upon pronunciation, listening, question-handling, teaching and lecturing skills, and analyze the culture of U.S. university life. Because enrollment is restricted, TAs cannot register for the courses online through AccessPlus. TAs must go to the ITA Office,1137 Pearson immediately after they receive the test scores to obtain permission to enter the course by completing a course add slip.

Department/Program Change

Transferring from One Major/Program/Department to Another

Students who have been admitted to a graduate program and to the Graduate College may request to transfer at a later date to another department or program. Because graduate students are admitted to particular programs, transfers require the approval of both the receiving program and the Graduate College.

Students seeking transfer to another program or department should first discuss their wishes with the new program DOGE (Director of Graduate Education) to determine requirements and interest by the new program.

When a student receives a favorable preliminary response from the new program, he or she should fill out the student portion of the form entitled "Request to Transfer from One/Major/Program/Department to Another" and submit this form to his or her current DOGE. The current DOGE will fill out the Current Program Information adding any comments he or she believes the new program should consider and forward the form to the proposed new program. This form is available from the department, the Graduate College, or the Graduate College web page.

The receiving program will generally give the student the same consideration and employ the same admissions standards that are used for original applications for admission and will expect the same application materials (transcripts, letters of recommendation, test scores, etc). During the process, the new and old programs and the Graduate College are authorized and encouraged to seek and disclose information related to the student's overall fitness for studies in the receiving program. Programs are authorized to inquire into the student's prior conduct at the university, both with the prior department and with the Dean of Students.

Upon departmental action (acceptance or denial), the request to transfer form must be sent to the Graduate College for approval. All parties will receive a copy of the completed form from the Graduate College.

Students desiring to transfer from a degree-seeking status to a nondegree-seeking status need to fill out the "Request to Transfer from One Major/Program/Department to Nondegree" form and bring it to the Graduate College.

Students desiring to transfer from nondegree-seeking status to a degree-seeking status must be admitted by a program through the regular graduate admission process.

Curriculum Change from Active Graduate to Active Undergraduate Status

Individuals who are in good standing in the Graduate College and who wish to transfer to an undergraduate curriculum must contact the graduate classification officer (1137 Pearson Hall). The classification officer will consult with the student and determine the proper course of action.

Curriculum Change from Inactive Graduate to Active Undergraduate Status

Individuals who were admitted to the Graduate College more than one year previous and who do not have active graduate status but who wish to change their status from inactive graduate to active undergraduate, must follow the same procedures required of reentering undergraduate students and must begin the process by filing a completed "Undergraduate Reentry" form with the Office of the Registrar. When considering reinstatement, the undergraduate college may consider

the student's overall fitness for continued studies including information about the student's conduct, employment and education since the student's last enrollment.

Individuals who do not have active graduate status and who first enrolled less than one year previous should first see the classification officer in the Graduate College.

Time Limits. It is expected that work for the master's degree shall be completed within five years. In special circumstances the student's POS committee may recommend that the Dean of the Graduate College extend these degree time limits. Cases in which the student leaves Iowa State during his or her graduate career and later returns are dealt with individually by the student's POS committee and the Graduate College. The inclusion in the student's program of study of course work that is beyond the time limits ("over-age" courses) must be justified by the POS committee in a statement accompanying the submission of the program of study.

Application for Graduation. Students planning to graduate must complete an "Application for Graduation" form through their online AccessPlus system by the end of the third week of the semester (fall or spring) in which he/she expects to receive the degree, or by the last day of spring semester when wishing to graduate during summer.

Before completing this form, a student must have submitted and had approved by the Graduate College a "Recommendation for Committee Appointment" form and a "Program of Study" form. Also the student must have been fully admitted to a program and have met the Graduate English requirement if he/she is a non-native English speaker. Graduation may be delayed if the "Application for Graduation" form filing deadline is not met. If it becomes apparent that a student cannot graduate during the indicated term, he/she can go online through AccessPlus and cancel the previously submitted "Application for Graduation" form by the designated deadline. The student must then complete a new form for the next planned term of graduation.

Thesis. A master's thesis is a scholarly composition that demonstrates the ability of the author to do independent and creative work. A thesis is required in all fields in which a master's degree is awarded, except where specific provision is made for a nonthesis degree program. A minimum of three research credits is required on every program of study for a thesis master's degree.

Responsibility for writing and editing of the thesis rests with the student, under the supervision of the major professor, and not with the Graduate College. The Graduate College does not permit joint authorship of theses. It is the responsibility of the major professor to supervise the preparation of preliminary and final drafts of the thesis to assure the highest level of quality when the student presents the thesis to the committee for final approval.

Copies of the thesis must be submitted to the members of the POS committee at least two weeks before the final oral examination.

All theses and dissertations will be submitted electronically after the final oral examination is held. Please browse the Graduate College's web site (http://www.grad-college.iastate.edu/current/thesis (http://www.grad-college.iastate.edu/current/thesis) for requirements, revised fees, and other pertinent information.

Shortly after the submission of the "Application for Graduation" form, a one-time, nonrefundable thesis fee is billed by the university accounting system. In addition, a graduation fee will be assessed by the Registrar's Office. This fee is nonrefundable if a student does not cancel his/her graduation by the Graduate College's cancellation deadline.

Creative Component. Most nonthesis students must present substantial evidence of individual accomplishment (e.g., a special report, capstone course, integrated field experience, annotated bibliography, research project, design, or other creative endeavor). A minimum of two credits of such independent work is required on those programs of study for a nonthesis master's degree. Some programs require more credits. (For more information, contact the individual program or consult the Specific Master's Degrees section in this catalog.) The element of creative independent study must be explicitly identified on the program of study. The format of the creative component is determined in cooperation with the POS committee. As with a thesis, a creative component should be submitted to members of the POS committee two weeks before the final oral examination. However, no final submission of a creative component is turned in to the Graduate College for review and approval.

Final Oral Examination. Most master's candidates must pass final oral examinations. The final oral examination must be held by the final examination deadline date for the semester in which the degree is granted. All coursework in the program of study must either be completed or in progress before the final examination can be scheduled. This examination is oral; it may also include a written component if specified by the student's (POS) committee.

Graduate students must register at Iowa State for the equivalent of two credits, or for the R-credit course if no course work is needed, during the semester in which the final examination is taken. (Graduate students who are not required to take a final oral examination should complete all required coursework on the POS prior to or during the term of graduation. Any transfer credits must be completed the term before the graduation term and follow normal transfer rules.) Taking only an R-credit course where the fee is not equivalent to the 2-credit minimum charge is not acceptable for the term of the final oral examination. If the examination is taken during the interim between terms (including the first day of

classes), registration can be for either the term before or the term after the examination is held.

The candidate is responsible for initiating the "Request for Final Oral Examination" form, which must be submitted to the Graduate College at least three weeks before the examination. This form can be obtained only from the student's program/department. The entire POS committee must be convened for the final oral examination. For more information on the final oral examination, see the Graduate College Handbook.

Graduate Student Approval Slip for Graduation. Every candidate for an advanced degree is required to complete a "Graduate Student Approval Slip for Graduation" form. It is sent to the major professor or program to give to the student after the "Request for Final Examination" form is received and approved by the Graduate College. Signatures are required by the major program, the Graduate College Thesis specialist (for those completing a thesis), and the Graduate College. Final clearance of academic requirements will be made when current term grades have been submitted and evaluated by the Graduate College.

All incompletes from previous terms must be completed by the deadline for completion of the Graduate Student Approval Slip. An incomplete or non-report grade that a student receives for the term of graduation will result in removal from that term's graduation list. The student will need to complete a new Application for Graduation and Graduate Student Approval Slip for the new term of graduation. If a conditional pass was recommended at the final oral examination, the major professor and the committee members, if so specified, must notify the Graduate College in writing no later than the due date for the Graduate Student Approval Slip for the term of graduation that the conditions have been met.

Undergraduate Admission to Concurrent Graduate Degree/Certificate Programs

Several programs provide opportunities for qualified ISU juniors and seniors majoring in those curricula to apply for admission to both a bachelor's and master's degree.

The graduate degree will be awarded only at the same time as, or after, the undergraduate degree is conferred. For a complete listing of the concurrent degree programs, consult the Graduate College Handbook, "Concurrent Degree Programs" on page 27 of the Handbook, http://www.grad-college.iastate.edu/common/handbook/.

Students interested in a research career may apply for graduate research assistantships during their last two years of study. Students should contact the graduate programs about applying early in their undergraduate careers. Undergraduate students seeking admission to concurrent graduate degree programs in field other than these, plus any student with an interdepartmental major, must submit the appropriate concurrent form completed and a written proposal for an individualized program, co-signed by their advisers, to the Graduate College for review and approval. For more information about the application process and transferring credits, consult the Graduate College Handbook.

Veterinary Medicine Students in Concurrent Graduate Degree/Certificate Programs

Students may be concurrently enrolled in the professional curriculum leading to the D.V.M. degree and in a graduate program leading to the M.S. or Ph.D. degree after completion of 90 semester credits. The graduate program may be in the College of Veterinary Medicine or in another college.

Interested students must adhere to the following process:

- Complete a "Concurrent Enrollment for Graduate/Veterinary Medicine Degrees" form available on the web site at www.grad-college.iastate.edu/common/forms/index.php (http://www.grad-college.iastate.edu/common/forms). This is a combination application/concurrent form.
- Submit the "Concurrent Enrollment Request" form to the Graduate College after appropriate signatures are obtained.

Signed approvals on the concurrent form are required from the graduate program, the College of Veterinary Medicine, and the Graduate College. On admittance, the student receives an admission notification from the Office of Admissions. For more information see the Graduate College Handbook.

Graduate Students in Concurrent Undergraduate Programs

Graduate students interested in enrolling in a concurrent undergraduate program should contact the Office of Admissions (100 Enrollment Services Center) to obtain admission information (even if the student has been previously admitted as an undergraduate). An "Application for Graduate Student Wishing to Pursue a Concurrent Undergraduate Degree" form should be obtained from the Graduate College Web site at www.grad-college.iastate.edu/common/forms/index.php (http://www.grad-college.iastate.edu/common/forms) and circulated for the appropriate approvals.

- Official enrollment and fee payment will be as a graduate student.
- The graduate degree or graduate certificate will be awarded only at the same time as, or after, the undergraduate degree is conferred.
- Students interested in a research career may be able to apply for a graduate research assistantship while in a concurrent degree or graduate certificate program.
- Students in concurrent degree programs may, subject ot Program of Study Committee approval, double count up to 6 ISU credits of major

or nonmajor graduate credits courses for both a Bachelor's degree and a certificate or a Master's degree.

- For students pursuing a concurrent undergraduate bachelor's degree and a graduate certificate, at least 12 graduate credits cannot be double counted and a maximum of 6 graduate credits can be double counted for both the bachelor's degree and the graduate certificate (when the graduate certificate requires more than 12 credits.
- A student in a bachelor's and master's concurrent degree program cannot be on a Ph.D. track during the concurrent program.

A complete list of Concurrent Bachelor and Master Programs or Graduate Certificate Programs can be found in the Graduate College Handbook, pages 30-31. http://www.grad-college.iastate.edu/common/handbook

Master's Degrees

General requirements for all master's degrees are as follows:

General Requirements

The Graduate College Handbook outlines the general requirements for completion of a graduate degree at ISU. Faculty in a major field have the responsibility for establishing educational objectives for their graduate program, including specific course requirements and research requirements appropriate to the master's programs in the major. These requirements may place additional responsibilities on the student, the major professor, or the student's program of study (POS) committee beyond those listed in the Graduate College Handbook as deemed appropriate to the goals of the major program.

Faculty and graduate students are active participants in the academic programs of Iowa State University. As active participants, they have a collective impact on the success of those programs and of the university in fulfilling its mission. Each graduate program is encouraged to implement a mechanism for responding to feedback from graduate students as a valuable resource for continuing improvement.

Appointment of the Student's Program of Study (POS) Committee

New graduate students at ISU may be assigned a temporary academic adviser by the major program in the first semester of the student's residence. This faculty member guides the student in selection of a field of study and in development of a graduate program of study until the major professor and POS committee are selected. After the POS committee has been selected, it guides and evaluates the student during the remainder of graduate study.

A thesis master's POS committee consists of at least three members of the graduate faculty. It must include two members, including the major professor, from the major or program. The committee must include member(s) from different fields of emphasis so as to ensure diversity of perspectives. A term member of the graduate faculty may participate in the direction of a student's master's research as a co-major professor if a member of the graduate faculty serves as a co-major professor and jointly accepts responsibility for the direction of a program of study. A non-thesis master's degree needs a minimum of one committee member. Programs may establish requirements for more than one member. For more information on duties and makeup of the committee as well as changes to the committee makeup, see the Graduate College Handbook.

Program of Study. The student and major professor develop the program of study with the consultation and approval of the POS committee. This agreement between the student and the Graduate College should be submitted as early as possible for approval. It is recommended that the committee be formed and the POS form submitted as early as the second semester of graduate study. In no case can the committee and program of study be formed later than the term before the preliminary oral exam for Ph.D students, and the final oral examination for master's students.

Residency. There is no on-campus residency requirement for the master's degree.

Credits. Unless otherwise noted, at least 30 credits of acceptable graduate work must be completed in all master's programs. At least 22 graduate credits must be earned from Iowa State University.

Transfer Credits. At the discretion of the POS committee, and with the approval of the program and the Graduate College, graduate credits earned as a graduate student at another institution or through a distance education program offered by another institution may be transferred if the grade was B or better. Such courses must have been acceptable toward an advanced degree at that institution and must have been taught by individuals having graduate faculty status at the institution. If a student wishes to transfer credits from graduate courses taken at or through another university as an undergraduate student, it is the student's responsibility to provide verification by letter from that institution that these graduate courses were not used to satisfy undergraduate requirements for a degree.

A transcript must accompany the POS in order to transfer credits. The POS committee may ask for other materials, such as a course outline or accreditation of the institution, to evaluate the course. Transfer courses not completed when the POS is submitted must be completed the term before the student graduates. A transcript must then be submitted for review and final approval.

Research credits earned at another institution are generally not transferred. In rare circumstances, the transfer of S or P marks may be accepted for research credits only. It is the responsibility of the POS committee to obtain a letter from the responsible faculty member at the other institution stating that research credits recommended for transfer

with S or P marks are considered to be worthy of a B grade or better. Audits may be listed on the program of study, but do not carry credit.

Major. A major is an approved area of study leading to a graduate degree. The exact number of credits in a major is not prescribed.

Minor. Students may request a minor in any program approved to grant a graduate degree and in programs approved to offer only a minor. A student may not minor and major in the same field. Requirements for declared minors are determined by the minor program and the faculty member representing the minor field on the student's POS committee.

The minor subject area must be tested at the final oral examination and cannot be placed on the transcript after graduation unless it was approved on the program of study, listed on all examination reports, and recorded on the "Application for Graduation" form (diploma slip). A minor cannot be added to a degree that has already been received.

Specific Master's Degrees

The number of credits in a major for a master's degree will vary according to various degrees . General credit requirements for all master's degrees include: a minimum of 30 graduate credits is required for all master's programs at ISU; at least 22 graduate credits must be earned at ISU; any transfer of graduate credits from another institution must be recommended in the program of study by the POS committee; and graduate credit earned as a graduate student will be approved for transfer only if a B grade or better was earned. A transcript must accompany the POS form. A complete listing of specific master's degrees can be found in the Graduate Handbook, section E, page 107, http://www.grad-college.iastate.edu/common/handbook/. A complete listing of all master's degrees can also be found online, http://www.grad-college.iastate.edu/academics/gradprograms/index.php.

Master's Double Degree Programs

A double degree requires fulfillment of the requirements for two graduate majors for which two differently named master's degrees and two diplomas are granted at the same time. For double degrees the final project (thesis or creative component) must integrate subject areas from both departments. One final oral examination must be held covering the combined thesis or creative component. Students planning to pursue double degrees must complete a double degree request form and submit it to the Dean of Graduate College for approval. Just one "Recommendation for Committee Appointment" form and one "Program of Study (POS)" form need to be submitted for the two degrees. However, two "Application for Graduation" forms, one for each degree, will need to be submitted. All forms should show clearly that the student is enrolled in a double-degree program.

Like other master's programs, three graduate faculty members can constitute a POS committee; however, POS committees for double degrees must include co-major professors from each of the majors. Although specific degree programs may require more, the program of study must include at least 44 hours of non-overlapping credit (22 for each major) in the two degrees.

A complete listing of the Double Degree Programs can be found in the Graduate College Handbook, page 35, http://www.xgrad-college.iastate.edu/common/handbook/.

If a student outside one of the named areas is interested in an individually-developed double degree program, a written proposal for a double degree to serve those interests and needs must be submitted to the Dean of the Graduate College for review. See the Graduate College Handbook for more information.

Drake University Law School/Iowa State University Combined Degree

To provide training in the complementary fields of law, political science, and economics with a minimum amount of academic duplication, special arrangements for combined degree programs have been approved with the Drake University Law School. ISU and Drake offer a combined J.D.-M.A. in political science and J.D.-Ph.D. in economics. Drake Law School students are permitted to transfer the equivalent of nine semester credits of specified law courses to ISU for nonmajor graduate credit. Because of the difference in grading systems, the Law School grades are transferred as passes, provided the student has achieved a grade of C or better in those courses at Drake for the political science program or a grade of B or better for the economics program.

Applicants for either of the combined programs must meet the regular entrance requirements of, and be admitted to, both the Drake Law School and the ISU Graduate College.

Doctor of Philosophy

General Requirements

The degree doctor of philosophy is strongly research oriented. The primary requirements for the degree are:

- high attainment and proficiency of the candidate in his or her chosen field
- development of a dissertation which is a significant contribution to knowledge and which shows independent and creative thought and work
- successful passing of detailed examinations over the field of the candidate's major work, with a satisfactory showing of preparation in related courses. General requirements for Ph.D. candidates follow.

The Graduate College Handbook outlines the general requirements for completion of a graduate degree at ISU. Faculty in a major field have the responsibility for establishing educational objectives for their

graduate program, including specific course requirements and research requirements appropriate to the master's or Ph.D. programs in the major. These requirements may place additional responsibilities on the student, the major professor, or the student's program of study (POS) committee beyond those listed in the Graduate College Handbook as deemed appropriate to the goals fo the major program.

Faculty and graduate students are active participants in the academic programs of Iowa State University. As active participants, they have a collective impact on the success of those programs and of the university in fulfilling its mission. Each graduate program is encouraged to implement a mechanism for responding to feedback from graduate students as a valuable resource for continuing improvement.

Appointment of the Student's Program of Study (POS) Committee

The POS committee for a doctoral program consists of at least five members of the graduate faculty. It must include at least three members, including the major professor, from within the student's major or program. The committee must include member(s) from different fields of emphasis so as to ensure diversity of perspectives. A term member of the graduate faculty may participate in the direction of a student's dissertation research as a co-major professor if a member of the graduate faculty serves as a co-major professor and jointly accepts responsibility for direction of the dissertation.

Changes to POS committee

Recommendations for changes in the POS committee must have the approval of the student, major professor, DOGE, and all committee members involved in the change (committee members who are on Faculty Professional Development Assignments, retired, or resigned do not have to sign) before seeking approval of the Graduate College. A form to seek approval is available in program offices or on the web at www.grad-college.iastate.edu/forms/forms.html (http://www.grad-college.iastate.edu/forms/forms.html). These changes must be approved by the Dean of the Graduate College before the preliminary or final oral examination is held. For more information on changes to the committee and to the Program of Study, see the Graduate College Handbook.

Program of Study

The student and the major professor develop the program of study with the consultation and approval of the POS committee. Early selection of a major professor, appointment of a POS committee, and development of a program of study are very important. It is recommended that the committee be formed as early as the second semester of graduate study. In no case can the committee be formed later than the term before the preliminary oral examination.

Credits

A minimum of 72 graduate credits must be earned for a Ph.D. degree. At least 36 graduate credits, including all dissertation research credits, must be earned at Iowa State University. There is no specific university requirement regarding the number of credits to be taken inside or outside the major/program.

Transfer Credits

At the discretion of the POS committee, and with the approval of the program and the Graduate College, graduate credits earned as a graduate student at another institution or through a distance education program offered by another institution may be transferred if the grade was B or better. Such courses must have been acceptable toward an advanced degree at that institution and must have been taught by individuals having graduate faculty status at that institution. If a student wishes to transfer credits from graduate courses taken at or through another university as an undergraduate student, it is that student's responsibility to provide verification by letter from that institution that those graduate courses were not taken to satisfy undergraduate requirements for a degree.

A transcript must accompany the POS in order to transfer credits. The POS committee may ask for other materials, such as a course outline or accreditation of the institution, to evaluate the course. Transfer courses not completed when the POS is submitted must be completed before the term in which the student graduates. A transcript must then be submitted for review and final approval.

Research credits earned at another institution are generally not transferred. In rare circumstances, the transfer of S or P marks may be accepted for research credits only. It is the responsibility of the POS committee to obtain a letter from the responsible faculty member at the other institution stating that research credits recommended for transfer with S or P marks are considered to be worthy of a B grade or better.

Major

A major is the area of study or academic concentration in which a student chooses to qualify for the award of a graduate degree. Majors are listed at the end of this section of the bulletin. Opportunities also exist for majoring in more than one area of study (co-major or joint major programs).

Minor

Students may request a minor in any program approved to grant a graduate degree and in programs approved to offer only a minor. Requirements for declared minors are determined by the minor program and the faculty member representing the minor field on the student's POS committee. The minor subject area must be tested at the preliminary oral and final oral examinations. A minor cannot be added to a program of study after the preliminary oral examination has been taken, nor

can a minor be placed on the transcript after graduation, unless it was approved on the program of study, listed on all examination reports, and recorded on the "Application for Graduation" form (diploma slip). A student may not minor and major in the same field. A minor cannot be added to a degree that has already been awarded.

Time Limits

A student beginning a Ph.D. degree program at Iowa State with a master's degree from another institution is expected to complete the Ph.D. within five years, while a student beginning a Ph.D. degree program without the master's degree is expected to complete the program within seven years. If warranted, the Program of Study (POS) Committee may request by letter that the Dean of the Graduate College extend these time limits. Cases in which the student leaves Iowa State during his or her graduate career and later returns are dealt with individually by the student's program of study committee and the Graduate College. The inclusion in the program of study of coursework that is beyond the time limits ("over-age" courses) must be justified by the POS committee in a statement accompanying the submission of the program of study.

Preliminary Examination

The Graduate College requires a preliminary oral examination of Ph.D. degree students; most programs add a written portion to the preliminary oral examination. The Ph.D. degree preliminary oral examination rigorously tests a graduate student's knowledge of major, minor, and supporting subject areas as well as the student's ability to analyze, organize, and present subject matter relevant to the field. A "Request for Preliminary Examination" form must be submitted to the Graduate College by the major professor at least two weeks before the proposed date of the examination.

The following conditions should be met before the "Request for Preliminary Examination" form is submitted to the Graduate College: admitted to full admission status in a Ph.D. granting program, approved "Recommendation for Committee Appointment" form, approved POS form, English requirement met, not on probation, time limit not exceeded, qualifying examination (if required by program) passed, and registration for at least the equivalent of 2 credits, or for the R-credit course if no course work is needed, during the term in which the preliminary oral examination is taken. (Taking only an R-credit course where the fee is not equivalent to the 2-credit minimum charge is not acceptable for the term of the preliminary oral examination.)

A preliminary oral examination will not be scheduled for a student on provisional or restricted admission or on academic probation. Upon successful completion of the preliminary oral examination, the student is admitted to candidacy for the Ph.D. degree. If the graduate student fails all or part of the preliminary oral examination, the committee provides two options: gives a not pass and allows the student to retake the examination after six months or gives a not pass and does not allow the student to retake the examination. Six months must elapse between the first attempt and the next. The entire POS committee must be convened for the preliminary oral examination. The preliminary oral examination must be passed at least six months prior to the final oral examination. An exception to the rule is allowed if a request signed by the major professor(s) and the program's DOGE is approved by the Dean of the Graduate College.

Application for Graduation

Application for graduation should be made by the end of the third week of the semester (fall or spring) in which the student expects to receive the degree, or by the last day of the spring semester if graduation is planned during summer session. To apply for graduation, the student is required to complete an "Application for Graduation" form, available online through the student's AccessPlus system. Before submitting this form, a student must have submitted and had approved by the Graduate College a "Recommendation for Committee Appointment" form and a "Program of Study" form in the previous semester. Also the student must have been fully admitted to a program and have met the Graduate English requirement. Graduation may be delayed if the "Application for Graduation" filing deadline is not met. If it becomes apparent that a student cannot graduate during the indicated term, he/she can go into AccessPlus and cancel the previously submitted "Application for Graduation" form before the designated deadline. The student must then file a new form for the next planned term of graduation. **Late application.** A student may file a late Application for Graduation during the fourth and fifth weeks of the semester. Students will be charged a non-refundable $20 late fee for a late application.

Dissertation

A doctoral dissertation must demonstrate conclusively the ability of the author to conceive, design, conduct, and interpret independent, original, and creative research. It must attempt to describe significant original contributions to the advancement of knowledge and must demonstrate the ability to organize, analyze, and interpret data. In most instances, a dissertation includes a statement of purpose, a review of pertinent literature, a presentation of methodology and results obtained, and a critical interpretation of conclusions in relation to the findings of others. When appropriate, it involves a defense of objectives, design, and analytical procedures. Dissertation research should be worthy of publication and should appear in appropriate professional journals or in book form.

Responsibility for writing and editing of the dissertation rests with the student, under the supervision of the major professor, and not with the Graduate College. The Graduate College does not permit joint authorship of dissertations. It is the responsibility of the major professor to supervise the preparation of preliminary and final drafts of the dissertation, so as to assure the highest level of quality when the student presents the dissertation to the committee for final approval.

Copies of the dissertation must be submitted to the POS committee at least two weeks before the final oral examination.

All theses and dissertations will be submitted electronically after the final oral examination is held. Please browse the Graduate College's web site (http://www.grad-college.iastate.edu/current/thesis/) (http://www.grad-college.iastate.edu/current/thesis) for new requirements, revised fees, and other pertinent information.

Shortly after the submission of the "Application for Graduation" form, a one-time, nonrefundable thesis fee is billed by the university accounting system. In addition, a graduation fee will be assessed by the Registrar's Office. This fee is nonrefundable if a student does not cancel his/her graduation by the Graduate College's cancellation deadline.

Final Oral Examination

The Ph.D. final oral examination, conducted after the dissertation is finished, is oral and often limited to a defense of the dissertation. To receive the degree at the end of a given semester, the student must hold the final oral examination before the final oral examination deadline for the semester.

The candidate is responsible for initiating the "Request for Final Oral Examination" form, which must be submitted to the Graduate College at least three weeks before the examination. This form can be obtained only from the student's program/department. The entire POS committee must be convened for the final oral examination. For more information on the final oral examination, see the Graduate College Handbook.

Graduate Student Approval Slip for Graduation

Every candidate for an advanced degree is required to complete a "Graduate Student Approval Slip for Graduation" form. It is sent to the major professor or program to give to the student after the "Request for Final Examination" form is received and approved by the Graduate College. Signatures are required by the major program. Final clearance of academic requirements will be made when current term grades have been submitted and evaluated by the Graduate College.

All incompletes from previous terms must be completed by the deadline for completion of the Graduate Student Approval Slip. An incomplete, non-report, or grades lower than a C that a student receives for the term of graduation will result in removal from that term's graduation list. The student will need to complete a new Application for Graduation and Graduate Student Approval Slip for the new term of graduation. If a conditional pass was recommended at the final oral examination, the major professor and the committee members, if so specified, must notify the Graduate College in writing no later than the due date for the Graduate Student Approval Slip for the term of graduation that the conditions have been met.

Interdisciplinary Programs

Interdepartmental programs are available at both graduate and undergraduate levels. An interdepartmental program is an administrative structure usually not functioning as a department, ordinarily headed by a supervisory committee, and offering a degree with major(s) in that subject area. Interdepartmental programs have been officially approved and may offer courses.

See individual programs for information regarding admission and academic requirements.

Undergraduate Interdisciplinary Programs

Locate information for each program from the A-Z catalog index (http://catalog.iastate.edu/azindex).

Interdisciplinary Studies

Interdepartmental Undergraduate Major

Administered by the College of Liberal Arts and Sciences

A major in interdisciplinary studies is offered in the College of Liberal Arts and Sciences for undergraduate students who have unique interdisciplinary educational goals. The student, a faculty review board, and an academic adviser design the major. Leading to either the Bachelor of Arts or the Bachelor of Science degree, the major includes 36 to 48 credits of coursework chosen to provide a coherent, carefully planned program in an area of interest that bridges two or more departments. This specialized area is identified on the diploma. Learning goals are individually crafted for each proposed major.

A degree in Interdisciplinary Studies may be particularly attractive to students who wish to develop an area of interest based upon one of the College's cross-disciplinary programs. Areas of interest in Interdisciplinary Studies have included Classical Studies, International Relations, Ecology Studies, African American Cultural Studies, Asian Studies, and U.S. Latino/a Studies.

A student seeking admission to the program in interdisciplinary studies writes a letter of application that explains how the proposed major meets specific educational and learning goals. A faculty review board screens applications. Since students are expected to earn at least 30 credits after they are admitted into the program, the proposal is ordinarily submitted to the review board in the sophomore or junior year. The proposal will be considered if the area of interest properly falls within the College of Liberal Arts and Sciences and if the student's educational goals cannot be met by a more traditional combination of existing majors, minors, and electives.

The interdisciplinary studies major must satisfy the requirements of the liberal arts and sciences curriculum in the College of Liberal Arts and Sciences. A major emphasizing the humanities or communicative arts normally leads to a B.A.; a major emphasizing the natural or social sciences normally leads to a B.S. Different requirements for the B.A. and B.S. degrees are determined by the nature of the chosen field of study. Courses listed in the individualized major may come from any department of the university with the following restrictions:

1. The selection of courses needs to focus on a single theme and be consistent with the career and educational goals of the student.
2. At least one half of the courses in the major will come from departments within the College of Liberal Arts and Sciences.
3. The courses will be chosen from at least two disciplines.

All courses in the major must be at the 200-level or higher. At least 15 credits must be at the 300-level or higher with at least 6 credits at the 400-level or higher. An average grade of C or better must be earned in 15 credits at the 300-level or higher in the major. To meet the English and communication proficiency requirement, a grade of C or better must be earned in ENGL 250 and in either an advanced English composition course or a course in the major with a significant writing component.

Further information may be obtained from the LAS College Student Academic Services office.

University Studies

Associate Provost for Academic Programs

Certain interdisciplinary courses are offered through university studies, at the discretion of the associate provost for academic programs and upon the advice of the Faculty Senate Curriculum Committee. No major is available in university studies, but credit obtained through university studies offerings may be applied toward a degree in any of the colleges, consistent with the stipulations of the student's curriculum.

Requests to make use of U ST 290 and U ST 490 should be directed to the associate provost for academic programs and should be accompanied by a positive recommendation from the department chairs of the instructor(s) making the request.

Courses primarily for undergraduates:

U ST 101: First Year Seminar I
(1-0) Cr. 1. F.S.
Prereq: Acceptance/participation in appropriate learning community or special program.
Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only.

U ST 101A: First Year Seminar I: Hixson Scholars
(1-0) Cr. 1. F.S.
Prereq: Acceptance/participation in appropriate learning community or special program.
Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only.

U ST 101B: First Year Seminar I: MVP Award
(1-0) Cr. 1. F.S.
Prereq: Acceptance/participation in appropriate learning community or special program.
Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only.

U ST 101C: First Year Seminar I: Science Bound
(1-0) Cr. 1. F.S.
Prereq: Acceptance/participation in appropriate learning community or special program.
Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only.

U ST 101D: First Year Seminar I: Student Athlete Experience
(1-0) Cr. 1. F.S.
Prereq: Acceptance/participation in appropriate learning community or special program.
Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only.

U ST 101E: First Year Seminar I: Student Support Services Program
(1-0) Cr. 1. F.S.
Prereq: Acceptance/participation in appropriate learning community or special program.
Orientation to the university focusing on student transition, acclimation to university, exposure to campus resources, and student success strategies. Exploration of topical issues associated with specific learning community or program focus. Offered on a satisfactory-fail basis only.

U ST 102: First Year Seminar II
(1-0) Cr. 1. S.
Prereq: U St 101 or instructor permission.
Acceptance/participation in appropriate learning community. Continued exploration of university services, strategies for student success, leadership, and acclimation to university. Exploration of issues associated with learning community focus. Offered on a satisfactory-fail basis only.

U ST 102A: First Year Seminar II: MVP Award
(1-0) Cr. 1. S.
Prereq: U St 101 or instructor permission.
Acceptance/participation in appropriate learning community. Continued exploration of university services, strategies for student success, leadership, and acclimation to university. Exploration of issues associated with learning community focus. Offered on a satisfactory-fail basis only.

U ST 102B: First Year Seminar II: Science Bound
(1-0) Cr. 1. S.
Prereq: U St 101 or instructor permission.
Acceptance/participation in appropriate learning community. Continued exploration of university services, strategies for student success, leadership, and acclimation to university. Exploration of issues associated with learning community focus. Offered on a satisfactory-fail basis only.

U ST 104: Personal Career Development
(2-0) Cr. 2. F.S.
Comprehensive approach to personal career development providing students with the skills and structure to make informed choices about their major and career path. Self-exploration of interests, skills, values, and personality as related to the world of work using a variety of techniques; exploration of majors and occupations; model for major and career decision-making and career goal implementation; exposure to effective job search and interviewing skills and resources.

U ST 105: Carver Academy Seminar: Freshmen
(1-0) Cr. 1. F.
Prereq: Acceptance in Carver Academy Program, George Washington Carver scholarship recipient
Orientation to the university for Carver Academy students focusing primarily on transition and acclimation to the university environment. Individual and group identity development. Life and legacy of George Washington Carver. Offered on a satisfactory-fail basis only.
Meets U.S. Diversity Requirement

U ST 106: Carver Academy Seminar: Freshmen
(1-0) Cr. 1. S.
Prereq: Acceptance in Carver Academy Program, George Washington Carver scholarship recipient
Introduction for Carver Academy students to resources at ISU to supplement classroom learning. Exploration of multicultural communities and leadership opportunities at ISU. Offered on a satisfactory-fail basis only.
Meets U.S. Diversity Requirement

U ST 110: International First-Year Experience Seminar
(1-1) Cr. 1. F.S.
Topics to help international students transition to the United States and academic culture, such as culture shock, classroom culture, campus and community resources, learning styles, study skills, basic immigration status and employment benefits, student health and wellness, and research and presentation skills. Offered on a satisfactory-fail basis only.

U ST 201: WiSE Success Seminar
(1-0) Cr. 1. F.S.
Prereq: Participation in Women in Science and Engineering Sophomore or Transfer Learning Community.
Exploration of individual leadership styles, career opportunities, personal values as they relate to career possibilities, and issues facing women in the workplace. Offered on a satisfactory-fail basis only.

U ST 205: Carver Academy Seminar: Peer Mentors
(1-0) Cr. 1. F.
Prereq: U ST 106, intended primarily for sophomores
Leadership and peer mentor training for Carver Academy students who will be serving as peer mentors in Carver Academy. Definitions and analysis of diversity in academia. Academic portfolio preparation and career exploration. Offered on a satisfactory-fail basis only.
Meets U.S. Diversity Requirement

U ST 207: Science Bound Pre-Professional Seminar
(1-0) Cr. 0.5. Repeatable, maximum of 4 times. F.S.
Prereq: 102B or instructor permission
Seminar topics prepare sophomore and upper-class students to pursue research and internship experiences in science, technology, engineering and math fields. Offered on a satisfactory-fail basis only.

U ST 290: Independent Study
Cr. arr.
Prereq: Permission of the associate provost for academic programs
Independent study on topics of an interdisciplinary nature. Intended primarily for freshmen and sophomores.

U ST 301: McNair Program: Introduction to Research I
(2-0) Cr. 2. F.
Prereq: Acceptance to the Iowa State University McNair Program
Introduction to academic research focusing on the initial stages of research with lessons on how to define a research idea, formulate a research question or hypothesis, gather, critique, analyze and synthetize the literature on the subject of inquiry, and understand and be able to apply a number of methodologies to gather data.

U ST 302: McNair Program: Introduction to Research II
(2-0) Cr. 2. S.
Prereq: U ST 301
Continuation of research preparation focusing on methodologies and the relevance to specific research questions, data collection and analysis processes, and scientific research writing and presentation. Lessons on how to determine appropriate methodology and design a scientific protocol, gather and analyze data, and understand findings so as to effectively report and present findings and conclusions.

U ST 311: Leaders Seminar I
(1-0) Cr. 1. Repeatable.
For students serving as peer mentor first-year seminar leaders under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

U ST 311A: Leaders Seminar I: Leaders in Hixson Seminar
(1-0) Cr. 1. Repeatable.
For students serving as peer mentor first-year seminar leaders under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

U ST 311B: Leaders Seminar I: Leaders in MVP Seminar
(1-0) Cr. 1. Repeatable.
For students serving as peer mentor first-year seminar leaders under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

U ST 311C: Leaders Seminar I: Leaders in Strengths Seminar
(1-0) Cr. 1. Repeatable. F.
For students serving as peer mentor learning community leaders under faculty supervision. Development of peer mentor abilities through an understanding of personal strengths and how strengths interact with leadership style. Exploration of connections between strengths and mentor role will be coupled with learning community peer mentor training to interweave identified strengths with those of the students they serve. Offered on a satisfactory-fail basis only.

U ST 312: Leaders Seminar II
(1-0) Cr. 1. Repeatable.
Prereq: U ST 311
For students serving as leaders in Hixson Seminar or MVP Seminar under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

U ST 312A: Leaders Seminar II: Leaders in Hixson Seminar
(1-0) Cr. 1. Repeatable.
Prereq: U ST 311
For students serving as leaders in Hixson Seminar or MVP Seminar under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

U ST 312B: Leaders Seminar II: Leaders in MVP Seminar
(1-0) Cr. 1. Repeatable.
Prereq: U ST 311
For students serving as leaders in Hixson Seminar or MVP Seminar under faculty supervision. Development of course facilitation and peer leadership skills. Offered on a satisfactory-fail basis only.

U ST 315: Cyclone Aide Leaders Seminar
(3-0) Cr. 2. Repeatable, maximum of 4 credits. S.
Prereq: Selection as Cyclone Aide or Cyclone Aide Adviser
Development of public speaking, group facilitation, and peer leadership skills. Exploration of issues associated with student transition to college, university organizational structures, and processes associated with student matriculation. Offered on a satisfactory-fail basis only.

U ST 321: NCORE Scholars: Race and Ethnicity in the U.S
(2-2) Cr. 3. F.
Prereq: Selection as an NCORE Student Scholar and attendance at NCORE.
Exploration of issues of race and ethnicity in the United States.
Meets U.S. Diversity Requirement

U ST 401: McNair Senior Seminar I
(1-0) Cr. 1. F.
Prereq: Intended for second year McNair participants
Comprehensive approach to choosing and applying to graduate school including drafting and finalizing the personal and research essay, understanding graduate funding, preparing for the grad interview, standardized exam preparation, and conversations with faculty and graduate students. Offered on a satisfactory-fail basis only.

U ST 402: McNair Senior Seminar II
(1-0) Cr. 1. S.
Prereq: U ST 401
Continuation of graduate school preparation focusing on transitioning, navigating the critical first year, succeeding in graduate school through to the completion of the PhD, and conversations with faculty and graduate students. Offered on a satisfactory-fail basis only.

U ST 490: Independent Study
Cr. arr. Repeatable.
Prereq: Permission of the associate provost for academic programs
Independent study on topics of an interdisciplinary nature. Intended primarily for juniors and seniors.

Interdisciplinary Graduate Programs

See individual programs for information regarding admission and academic requirements; or see the Graduate College or specific program page for more information.

Biorenewable Chemicals

Administered by the Center for Biorenewable Chemicals (CBiRC)

The core mission of the NSF Engineering Research Center for Biorenewable Chemicals (CBiRC) is to transform the chemical industry by integrating biological and chemical catalysis systems to create a generalized framework for producing biorenewable chemicals. The minor in Biorenewable Chemicals allows students from a variety of allied disciplines to understand the opportunities for developing biorenewable chemicals via a combination of biocatalytic and chemical catalysis steps. In addition to coursework in core technical areas, students in the minor get explicit entrepreneurial training, a background in the general issues related to production and processing of biorenewable resources, exposure to the economic and environmental realities of the chemical industry. Students in the minor are disciplinary experts (in programs such as Chemical Engineering, Chemistry, and Biochemistry, Biophysics, and Molecular Biology) who are interdisciplinary trained to become globally competitive graduates capable of developing integrated chemical/biological processing systems.

Courses primarily for graduate students, open to qualified undergraduates:

BR C 506: The Evolving Chemical Industry
(1-0) Cr. 1.
An overview of the chemical industry including structure and its evolution. Discussion of the dynamics of recent introduction of biorenewable chemicals to the chemical industry.

BR C 507: Technology-Led Entrepreneurship in Biorenewables
(Cross-listed with BRT). (1-0) Cr. 1. S.
Prereq: Graduate Standing or Permission of Instructor.
Develop an understanding of the relationship between discovery research entrepreneurship and innovation in biorenewables. Understand critical techno-commercial analyses and intellectual property. Learn critical skills needed to found a company, including how to define key assets, write a business plan, leverage local resources, and secure funding.

BR C 590: Special Topics
(2-0) Cr. 2.
Special topics in biorenewable chemicals.

BR C 590K: Special Topics: K-12 Science Education.
(2-0) Cr. 2. F.SS.
Understanding of Discovery Research for sixth through 12th grade science teachers. Design, methods and analysis of research associated with biorenewable energy systems. Science teachers will be introduced to the value of scientific inquiry, elements of engineering design, 21st century careers in science, technology, engineering and math (STEM) and how high school students need to be prepared for these careers.

Courses for graduate students:

BR C 688: Catalysis and Catalytic Processes
(Cross-listed with CH E). (3-0) Cr. 3.
Prereq: CH E 382
Principles and applications of heterogeneous and homogeneous catalysis. Adsorption. Reaction kinetics and mass transfer effects. Catalyst characterization. Industrial catalytic processes.

Biorenewable Resources and Technology

Interdisciplinary Graduate Program

The graduate program in Biorenewable Resources and Technology (BRT) offers students advanced study in utilizing plant and crop-based resources in the production of biobased products (fuels, chemicals, materials, and energy). The BRT program was the first graduate program in biorenewable resources established in the United States.

This multi-disciplinary program offers the degrees of master of science and doctor of philosophy in Biorenewable Resources and Technology, and a minor to students taking major work in other departments. Students admitted to the Biorenewable Resources and Technology interdepartmental graduate program may pursue MS, Ph.D., or a Ph.D. minor degree. Additionally a 12 credit hour BRT Graduate Certificate is offered online. The home department of any BRT student is the department of the student's major professor, who serves as the Chair of the student's Program of Study (POS) Committee.

The curriculum is designed to encourage students to obtain co-major degrees in Biorenewable Resources and Technology and a more traditional science or engineering discipline. A thesis is required for the master of science degree.Over 160 ISU faculty affiliated members, 29 departments in all seven colleges and 20 research centers and institutes are involved in this highly interdisciplinary graduate program. A complete and up-to-date listing is maintained at: http://www.biorenew.iastate.edu.

Master of Science

The Master of Science degree in Biorenewable Resources and Technology requires 32 credits: a minimum of 8 credits of core required courses; 9 credits of core elective courses representing at least 3 of the 4 barrier areas identified by the United States Department of Energy (DOE); at least 9 credits of research; and an additional 6 credits selected from elective courses (including additional research credit). Prerequisite to major graduate work is a bachelor's degree or prior graduate training in engineering or a physical or biological discipline, including agricultural sciences.

The core required courses (8 credits min. required) for the Biorenewable Resources and Technology graduate program include:

BRT 501	Fundamentals of Biorenewable Resources	3
BRT 506C	Biobased Products Seminar: Research Presentations	1
BRT 515	Biorenewables Law and Policy	3
BRT 592L	Biorenewable Resources Laboratory	1
or BRT 507	Technology-Led Entrepreneurship in Biorenewables	
Core electives in 3/4 barrier areas approved list*		9
Research		9
Electives or Research		6
Total Credits		32

*Students must complete approved core elective courses from at least three of the four bioeconomic development barrier areas: plant science, production, processing, and utilization. These are selected in consultation with the student's Program of Study (POS) committee. Additionally, students are to complete the determined amount of elective credits required for their degree, and in consultation with their POS committee, as well as research credits.

Graduates of the program will be equipped with skills to design, develop and/or manage cost effective and environmentally attractive technologies and systems for producing fuels, chemicals, materials, foods and energy from biorenewable resources.

Doctor of Philosophy (PhD) Degree

The Ph.D. degree in Biorenewable Resources and Technology requires 72 credits. A minimum of 8 credits of core required courses; 18 credits of core elective courses representing at least 3 of the 4 barrier areas identified by the United States Department of Energy (DOE); at least 22 credits of research; and an additional 24 credits selected from elective courses (including additional research credit).

BRT 501	Fundamentals of Biorenewable Resources	3
BRT 506C	Biobased Products Seminar: Research Presentations	1
BRT 515	Biorenewables Law and Policy	3
One credit from the following:		1
BRT 507	Technology-Led Entrepreneurship in Biorenewables	
BRT 592L	Biorenewable Resources Laboratory	
Core electives in 3/4 barrier areas approved list*		18
Research		22
Electives or Research		24
Total Credits		72

*Students must complete approved core elective courses from at least three of the four bioeconomic development barrier areas: plant science, production, processing, and utilization. These are selected in consultation with the student's Program of Study (POS) committee. Additionally, students are to complete the determined amount of elective credits required for their degree, and in consultation with their POS committee, as well as research credits.

Graduates of the program will be equipped with skills to design, develop and/or manage cost effective and environmentally attractive technologies and systems for producing fuels, chemicals, materials, foods and energy from biorenewable resources.

Ph.D. Minor

The Ph.D. minor in Biorenewable Resources and Technology requires 15 credits: a minimum of 6 credits of core required courses: 3 credits of BRT 501* and 1 credit of BRT 506C and an additional 9 credits of core elective courses representing at least 3 of the 4 barrier areas identified by the United States Department of Energy (DOE).

BRT 501	Fundamentals of Biorenewable Resources	3
BRT 506C	Biobased Products Seminar: Research Presentations	1
2 credits from:		2
BRT 515	Biorenewables Law and Policy	
BRT 592L	Biorenewable Resources Laboratory	
or BRT 507	Technology-Led Entrepreneurship in Biorenewables	
Core electives in 3/4 barrier areas*		9
Total Credits		15

*Students must complete approved core elective courses from at least three of the four bioeconomic development barrier areas: plant science, production, processing, and utilization. These are selected in consultation with the student's Program of Study (POS) committee. Additionally, students are to complete the determined amount of elective credits required for their degree, and in consultation with their POS committee, as well as research credits.

Graduate Certificate

Through a series of 12 credit hours of graduate coursework, the Biorenewable Resources and Technology certificate will offer students from a wide variety of science and engineering backgrounds an exposure to advanced study in the use of plant- and crop-based resources for the production of biobased products, including fuels, chemicals, materials, and energy. The program aims to train professionals to serve the emerging bioeconomy, and in so doing to serve state, national, and global needs in moving toward a more sustainable industrial economy.
See certificate details : http://www.elo.iastate.edu/graduate-certificates/biorenewable-resources-and-technology-graduate-certificate-online/.

Courses primarily for graduate students, open to qualified undergraduates:

BRT 501: Fundamentals of Biorenewable Resources
(3-0) Cr. 3. S.
Prereq: Previous coursework in introductory physics and chemistry is recommended.
Introduction to the science and engineering of converting biorenewable resources into bioenergy and biobased products. Survey of biorenewable resource base and properties; description of biofuels and biobased products; production of biorenewable resources; processing technologies for fuels, chemicals, materials, and energy; environmental impacts; technoeconomic analysis of production and processing; and biofuels policy.

BRT 506C: Biobased Products Seminar: Research Presentations
(1-0) Cr. 1. F.S.
Research presentations throughout the semester as part of the course seminar series and during the course. Research Poster Symposium at the end of the semester. Typically taken in the last semester(s) when completing degree program. Offered on a satisfactory-fail basis only.

BRT 507: Technology-Led Entrepreneurship in Biorenewables
(Cross-listed with BR C). (1-0) Cr. 1. S.
Prereq: Graduate Standing or Permission of Instructor.
Develop an understanding of the relationship between discovery research entrepreneurship and innovation in biorenewables. Understand critical techno-commercial analyses and intellectual property. Learn critical skills needed to found a company, including how to define key assets, write a business plan, leverage local resources, and secure funding.

BRT 511: Bioprocessing and Bioproducts
(3-0) Cr. 3. F.
Prereq: A E 216 or equivalent, MATH 160 or MATH 165, one of CHEM 167 or higher, BIOL 173 or BIOL 211 or higher or BRT 501, senior or graduate classification
Sustainability, cleaner production. Taxonomy, kinetics, metabolism, aerobic and anaerobic fermentation. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis. Term paper for graduate level only.

BRT 515: Biorenewables Law and Policy
(Cross-listed with POL S). (3-0) Cr. 3. F.
Evaluation of the biorenewables field as it relates to the areas of law and policy. Primary emphasis on the following topics: concerns that motivated the development and expansion of the biorenewables field, a history of the interactions between biorenewable pathways. U.S. law and policy and controversies that have arisen from these interactions and their effects.

BRT 516: International Biorenewables Law & Policy
(Cross-listed with POL S). (3-0) Cr. 3. S.
Evaluation of the international biorenewables field as it relates to the areas of law and policy. Primary emphasis on the following topics: concerns that motivated the development and expansion of the field by adopting countries, a history of the interactions between biorenewable pathways. Law and policy in adopting countries and international controversies that have arisen from these interactions and their effects.

BRT 535: Thermochemical Processing of Biomass
(Cross-listed with M E). (3-0) Cr. 3. S.
Prereq: Undergraduate course work in thermodynamics and transport phenomena
Introduction to thermal and catalytic processes for the conversion of biomass to biofuels and other biobased products. Topics include gasification, fast pyrolysis, hydrothermal processing, syngas to synfuels, and bio-oil upgrading. Application of thermodynamics, heat transfer, and fluid dynamics to bioenergy and biofuels.

BRT 540: Bioprocessing and Bioproducts
(Cross-listed with C E, FS HN). (3-0) Cr. 3. F.
Prereq: C E 326 or equivalent, MATH 160 or MATH 165, CHEM 167 or higher, BIOL 173 or BIOL 211 or higher, senior or graduate classification
Sustainability, cleaner production. Taxonomy, kinetics, metabolism, microbial cultivation, aerobic and anaerobic fermentation. Antibiotics, food supplements, fermented foods, vitamin production. Biofuels, bioenergy and coproducts. Mass/energy balances, process integration, pretreatment, separation. Membrane reactors, bioelectrolysis, microbial fuel cells, nanotechnology, genetic engineering, mutagenesis.

BRT 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Permission of instructor
Investigation/study of an approved barrier area(s) topic on an individual basis. Course content and requirements designed and developed in consultation with the student's major professor/instructor to determine barrier areas covered, but in all cases a formal report should be written.

BRT 592L: Biorenewable Resources Laboratory
(0-3) Cr. 1. F.S.SS.
Prereq: Graduate student status. Undergraduates with instructor approval
An introduction to hands-on experimental laboratory techniques including laboratory safety, calibration, proper usage of chemistry apparatus, chemicals, analytical equipment, and fundamental techniques to ensure successful research.

Courses for graduate students:

BRT 611: Advanced Food Processing
(Cross-listed with FS HN). (3-0) Cr. 3. F.
Prereq: FS HN 311, or FS HN 471/472 or equivalent, or FS HN 511.
Recent advances in the science and technology of food processing and preservation; examples include both thermal and non-thermal processes, including cold plasma, nanotechnology, food packaging, and extrusion. Advances in extraction and separation technologies, waste management, by-product utilization, biorenewables and sustainability in food processing industry will also be discussed. Students to research on select topics and present.

BRT 699: Research
Cr. arr. Repeatable. F.S.SS.
Prereq: Permission of student's major professor

Dietetics - Graduate Program

Interinstitution Graduate program

Participating institutions: Iowa State University; Colorado State University; Kansas State University; Michigan State University; Montana State University; North Dakota State University; Oklahoma State University; South Dakota State University; University of Kansas Medical Center; University of Nebraska.

Dietetics is an interinstitutional distance education program offered through the Web. The student selects a home institution, which grants the degree. After admission at the home institution, the student takes courses from each of the ten institutions: Iowa State University, Colorado State University, Kansas State University,Michigan State University, Montana State University, North Dakota State University, Oklahoma State University, South Dakota State University: Kendra Kattelman, University of Kansas Medical Center, and University of Nebraska.

At Iowa State University, Dietetics is a specialization within the Master of Family and Consumer Sciences degree program (MFCS-Diet) that consists of 36 credits. This is a non-thesis option and a special project or creative component is required. Students typically complete the program in 6-8 semesters while employed full-time. Admission is limited to those who are Registered Dietitians or Registration-eligible Dietitians. A computer with minimum specifications, web access, and an email address are required for completing the program.

The department cooperates in the interinstitution Master of Family and Consumer Sciences program to offer a specialization in Dietetics. The Master of Family and Consumer Sciences-Dietetics is designed for the Registered Dietitian or Registration-eligible Dietitian. The 36 credit program is non-thesis and seeks to develop research skills, stimulate independent thought, and provide up-to-date knowledge in foods, nutrition, and foodservice/business management. This program prepares individuals to integrate and apply the principles from the biomedical sciences, human behavior, and management to design and lead effective food and nutrition programs in a variety of settings. Students may build a program of study from offerings of the partner institutions such as human nutrition, nutrient metabolism, biostatistics, health promotion/disease prevention, foodservice systems management, food science, lifespan nutrition, wellness, entrepreneurship, nutrition education, nutritional assessment and food safety. The online program is tailored for credentialed, practicing dietetics professionals who seek to enhance their knowledge in a specific area of dietetics practice or retool for new career opportunities in dietetics practice.

Admission procedures: Admission to the MFCS-Diet program requires exactly the same procedures as admission to the Graduate College. See. Graduate College section of this catalog.

Registration: Students choosing to receive their degree from Iowa State University complete all the admissions, registration and fee payment processes through ISU.

Courses primarily for graduate students, open to qualified undergraduates:

DIET 511: Research Methods
(3-0) Cr. 3. F.S.
Prereq: Enrollment in GP-IDEA MFCS in Dietetics
An overview of diverse research approaches focusing on methods for collecting and analyzing quantitative and qualitative data. www only. Only one of DIET 511 or FCEDS 511 may count toward graduation.

DIET 524: Financial Management and Cost Controls
(3-0) Cr. 3. SS.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Overview of the fundamental knowledge of financial management, managerial accounting, and operational cost controls for dietetics professionals. Topics include a review of managerial accounting concepts for not- for-profit organizations and for-profit organizations based on the Uniform System of Accounts, value and risk analysis, budgeting, asset management, franchising and management contracts, cost-volume-profit analyses, and operational applications for financial performance.

DIET 526: Obesity Across the Lifespan
(3-0) Cr. 3. F.
Exploration of the affects that obesity has on public health, the healthcare system, and society in general. Overview of strategies to prevent obesity across the lifespan.

DIET 527: Food Writing for Professionals
(3-0) Cr. 3. F.
Prereq: Enrollment in GP-IDEA MFCS in Dietetics
Understanding and appreciating how to communicate effectively in writing about food and food-related topics. Hands-on experience in research and writing for various audiences and types of media.

DIET 530: Nutrition in Wellness
(3-0) Cr. 3. SS.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Addresses wellness promotion through nutrition. Nutritional risk and protective factors will be examined in relation to public health and individual nutrition. www only.

DIET 532: Maternal and Child Nutrition
(3-0) Cr. 3. SS.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Critical examination of behavioral, physiological, and public health issues impacting dietary and nutritional factors that support normal growth and development. Content focuses on early stages of the life cycle: gestation, lactation, infancy, preschool, school age, and adolescence. www only.

DIET 538: Nutrition: A Focus on Life Stages
(3-0) Cr. 3. Alt. F., offered irregularly.Alt. SS., offered irregularly.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Explores influence of normal physiological stresses on nutritional needs throughout the life span. Evaluates dietary intake and identification of appropriate community nutrition services in on-line discussions. Specific considerations, such as the influence of age and cultural heritage, are incorporated. www only.

DIET 540: Nutrition and Physical Activity in Aging
(Cross-listed with GERON). (3-0) Cr. 3. F.
WWW only. Basic physiologic changes during aging and their impacts in health and disease. The focus will be on successful aging with special emphasis on physical activity and nutrition. Practical application to community settings is addressed.

DIET 544: Pediatric Clinical Nutrition
(3-0) Cr. 3. F.
Prereq: enrollment in GP-IDEA MFCS in dietetics
Examines the physiological, biochemical and nutritional aspects of disease processes relevant to infants and children up to 18 years of age. Discussion of medical nutrition therapy for a variety of medical conditions in this population including inborn errors of metabolism, food hypersensitivity, obesity, and diseases of the major organ systems. www only.

DIET 546: Phytochemicals
(3-0) Cr. 3. Alt. F., offered irregularly.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Overview of phytochemicals (non-nutritive biologically active compounds) from fruits, vegetables, cereals and oilseeds. Covers recent findings of chemistry, physiological functions, and potential health implications of phytochemicals. www only.

DIET 547: Functional Foods in Chronic Disease Prevention
(3-0) Cr. 3.
Examination of nutritional science, food science, regulatory principles, and nutrient metabolism to understand and explain functional foods, nutraceuticals, and dietary supplements. Additionally students will evaluate the biochemical basis, technologies, legal requirements, and clinical assessment in the marketplace.

DIET 550: Finance and Cost Controls
(3-0) Cr. 3. F.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Overview of the fundamental knowledge of hospitality managerial accounting, cost controls, and financial management. Important topics include financial statement analysis, cost concepts, cost-volume-profit analysis, calculating and controlling food and beverage costs, pricing, and capital budgeting. www only.

DIET 554: Statistics
(3-0) Cr. 3. Alt. F., offered irregularly.Alt. S., offered irregularly.Alt. SS., offered irregularly.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Tools used to make statistical decisions. Major emphasis on explanation and understanding of important concepts involved; basic theme is understanding of data and methods used to analyze such data. www only. Only one of DIET 554 or Stat 401, 495, 542 may count toward graduation by students in the GPIDEA Dietetics program.

DIET 556: Advanced Nutrition: Micronutrients
(3-0) Cr. 3. S.SS.
Prereq: BBMB 404 or BBMB 420 or equivalent; enrollment in GP-IDEA MFCS in Dietetics
Integration of the molecular, cellular and physiological aspects of vitamins and minerals in mammalian systems. Interactions among nutrients, metabolic consequences of deficiencies or excesses, relevant polymorphisms, major research methodologies, and current topics related to micronutrients and non-nutrient components. www only. Only one of DIET 556 or NUTRS 502 may count toward graduation.

DIET 558: Advanced Nutrition: Macronutrients
(3-0) Cr. 3. F.
Prereq: BBMB 404 or BBMB 420 or equivalent; enrollment in GP-IDEA MFCS in Dietetics
Integration of the molecular, cellular and physiological aspects of macronutrients and energy metabolism in mammalian systems. Dietary energy, carbohydrates, fiber, lipids, proteins, their interactions, metabolic consequences, and major research methodologies. www only. Only one of DIET 558 or NUTRS 501 may count toward graduation.

DIET 560: Advanced Medical Nutrition Therapy
(3-0) Cr. 3. SS.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Pathophysiology of selected acute and chronic disease states and their associated medical problems. Specific attention directed to medical nutrition needs of patients in the treatment of each disease state. www only. Only two of DIET 560 or NUTRS 561, 564 may count toward graduation.

DIET 565: International Nutrition and World Hunger
(3-0) Cr. 3. F.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Identification and assessment of malnutrition in low-income countries. Social, cultural, political, economic, and geographic determinants of malnutrition. Protein-energy malnutrition, vitamin and mineral deficiencies. Intervention approaches; international efforts and local sustainability. www only.

DIET 566: Nutrition Counseling and Education Methods
(Cross-listed with FS HN). (2-2) Cr. 3. F.
Prereq: FS HN 361 and FS HN 362
Application of counseling and learning theories with individuals and groups in community and clinical settings. Includes discussion and experience in building rapport, assessment, diagnosis, intervention, monitoring, evaluation, and documentation. Literature review of specific counseling and learning theories.

DIET 567: Nutrition for Dietitians
(3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: DIET 360; BBMB 301, undergraduate course in physiology; enrollment in GP-IDEA MFCS in Dietetics
Study of the current scientific literature to evaluate current trends and issues in nutrition science and dietetic practice. Emerging areas of research investigating the role of nutrients in health and disease in humans will be explored. Emphasis on the impact of emerging research on nutrition recommendations and interventions designed to promote human health. www only.

DIET 568: Entrepreneurship Theory and Practice
(3-0) Cr. 3. Alt. SS., offered odd-numbered years.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Definition and discussion of entrepreneurship and its importance to economic and business environment. www only.

DIET 569: Dietary and Herbal Supplements
(3-0) Cr. 3. Alt. SS., offered odd-numbered years.
Prereq: Enrollment in GP-IDEA MFCS in Dietetics
Develop skills to partner with patients in making dietary supplement decisions. Explore the safe, efficacious use of botanicals and supplements in nutritional support of aging, maternal health and wellness. Discussions on supplementation in the prevention and treatment of chronic disease include: arthritis, cancer, cardiovascular, diabetes, digestive, liver and renal disorders.

DIET 570: Nutrition and Human Performance
(3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Develop an understanding of nutrition based on knowledge of the biochemical and physiological process and functions of specific nutrients in meeting nutritional requirements. Emphasis on the relationship of optimal nutrition and physical efficiency and performance. www only.

DIET 571: Leadership in Dietetics
(3-0) Cr. 3. SS.
Using leadership theories to develop the fundamental concepts and skills to bridge the gap between theory and practice. Students will be able to successfully evaluate classic and contemporary leadership theories, investigate current leadership trends and identify positive applications in the dietetics community.

DIET 572: Environmental Scanning and Analysis of Current Issues in Dietetics
(3-0) Cr. 3. F.S.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Overview of current topics, issues, and trends in dietetics practice. www only.

DIET 573: Healthcare Administration
(3-0) Cr. 3. SS.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
A comprehensive review of today's health care institutions and their response to the economics, social, ethical, political, legal, technological, and ecological environments. www only.

DIET 574: Nutrition and Immunology
(3-0) Cr. 3. F.
Principles and issues related to nutrition and immunology. Impact of nutrients and nutritional status on immune responses. Impact of disease states on nutritional status.

DIET 595: Grant Writing for the Professional
(3-0) Cr. 3. SS.
Prereq: enrollment in GP-IDEA MFCS in Dietetics
Grant writing, identifying external funding, managing grants, preparing manuscripts for peer-reviewed publication, and preparing papers and poster for presentation at professional meetings.

DIET 597: Nutritional Aspects of Oncology
(Cross-listed with FS HN, NUTRS). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: B.S. in nutrition, dietetics, biology, or related discipline.
Understanding of basic cancer biology and methodology used to study nutrition and cancer relationships. Using current research as a basis, the role of nutrition in specific cancers will be explored. Students will learn about sources of information for cancer prevention programs, and how to apply this information to clinical patient management.

DIET 598: Clinical Aspects of Nutrition Support
(3-0) Cr. 3. S.
Prereq: Enrollment in GPIDEA - Dietetics program
Specialized nutrition assessment and support. Review of energy expenditure and substrate utilization in specific disease states. Current Methods for the initiation and management of enteral and parenteral nutrition therapy including access, metabolic and mechanical complications. Evaluation of nutrition support methodology in selected disease states.

DIET 599: Creative Component
Cr. arr. Repeatable. F.S.SS.
Prereq: Enrollment in GPIDEA MS Dietetics
For non-thesis option only.

Ecology and Evolutionary Biology

Interdepartmental Graduate Major

The Ecology and Evolutionary Biology (EEB) interdepartmental major is offered through ten departments -- Agronomy; Anthropology; Ecology, Evolution and Organismal Biology; Entomology; Genetics, Development and Cell Biology; Geological and Atmospheric Sciences; Horticulture; Mathematics; Natural Resource Ecology and Management; Plant Pathology; and Statistics. Faculty in these departments cooperate to offer courses and direct research leading to MS and PhD degrees with a major in Ecology and Evolutionary Biology.

The EEB major is designed for students interested in the study of mechanisms controlling the composition, structure, and functional processes of ecological systems and the mechanisms that regulate the pattern and rate of evolutionary change within and among species. Applicants should have completed an undergraduate or master's of science or art degree in one of the biological, physical, or mathematical sciences. Applicants also should have taken undergraduate courses in both basic ecology and evolution.

The EEB curriculum includes a core course, seminar courses, and an extended field trip. Cooperating departments provide courses and research opportunities in the following areas:

- Conservation and Restoration Ecology;
- Environmental Statistics, Stochastic Modeling, and Quantitative Ecology and Evolution;
- Evolutionary Ecology;
- Landscape Ecology, Modeling, and Spatial Dynamics;
- Natural Resources Ecology and Management;
- Physiological and Behavioral Ecology;
- Population, Community, and Ecosystems Ecology;
- Population, Quantitative, and Evolutionary Genetics; and
- Systematics, biodiversity, and biogeography.

In addition, offerings are available in the ethics and practice of research in the biological sciences as well as in science communication (both written and oral).

Students majoring in EEB are trained for careers focused on basic or applied ecology and evolutionary biology in a variety of settings, including academia, government, industry, and private organizations. Graduates have a broad understanding of ecology and evolutionary biology, experience designing and conducting research, writing grant proposals, and communicating effectively with scientific colleagues at meetings and through publications.

Information on admission procedures (https://eeb.iastate.edu/admissions), academic requirements (https://eeb.iastate.edu/academics), and faculty research areas (https://eeb.iastate.edu/dir/faculty) is available on the EEB website (http://www.eeb.iastate.edu).

Courses primarily for graduate students, open to qualified undergraduates:

EEB 511: Conceptual Foundations in Ecology and Evolutionary Biology
(3-2) Cr. 4. F.
Prereq: Graduate classification
Introduction to key figures and ideas that have shaped the development of ecology and evolutionary biology. Covers major developments in ecology and evolutionary biology at five levels of biological organization: Genome, Organism, Population, Community, and Ecosystem. Impacts of these developments on current approaches to investigation and argument formulation. Effects of technological advances on the direction of scientific investigations. Introduction to analytical skills important for critical thinking in ecology and evolutionary biology and the impact of accepted lines of scientific reasoning on the objectives and conduct of research, such as explanation and prediction, design of studies as experimentation, and structured or unstructured observation.

EEB 585: Extended Field Trip
(1-6) Cr. 2. Repeatable. Alt. F., offered irregularly.Alt. S., offered irregularly.Alt. SS., offered irregularly.
Prereq: Graduate classification, permission of instructor
Extended field trip to study major terrestrial and aquatic ecosystems. Location and duration vary. Report required.

EEB 585A: Extended Field Trip: Pre-Trip Lecture
(1-0) Cr. 1. Repeatable. Alt. F., offered irregularly.Alt. S., offered irregularly.Alt. SS., offered irregularly.
Prereq: Graduate classification, permission of instructor
Extended field trip to study major terrestrial and aquatic ecosystems. Location and duration vary. Report required.

EEB 585B: Extended Field Trip: Travel
(0-6) Cr. 1. Repeatable. Alt. F., offered irregularly.Alt. S., offered irregularly.Alt. SS., offered irregularly.
Prereq: Graduate classification, EEB 585A and permission of instructor.
Extended field trip to study major terrestrial and aquatic ecosystems. Location and duration vary. Report required.

EEB 590: Special Topics
Cr. 1-3. Repeatable. F.S.SS.
Prereq: Graduate classification and permission of instructor
For students wishing to conduct in-depth study of a particular topic in ecology and evolutionary biology.

Courses for graduate students:

EEB 698: Seminar
(1-0) Cr. 1. Repeatable. F.S.
Reports and discussion of recent research and literature.

EEB 699: Research
Cr. arr. Repeatable. F.S.SS.
Thesis and dissertation research.

Engineering Management

Engineering Management Master's Degree Online

The Engineering Management Program focuses on developing an individual's engineering, science and management skills so they can succeed in a technology driven environment. There is a growing need for engineers that can build multi-disciplinary design teams, then lead those teams to solve technical and business challenges. The Iowa State University Master of Engineering in Engineering Management Program is designed to train leaders who can meet both the technical and managerial challenges in developing modern complex engineered systems. The program can be completed on line or in residence, part-time or full-time.

Admission Requirements

Unrestricted admission requires (1) a 3.0 grade point average from an ABET accredited undergraduate engineering program, (2) two years of engineering experience or current full-time employment as an engineer, (3) calculus, engineering statistics, and engineering economy. A GRE is not required for this program.

Applicants for admission to the Engineering Management Program apply through the Graduate College at Iowa State University. Each applicant must submit:

- Application and application fee
- Official academic transcripts
- Three letters of recommendation
- Resume

Applications should be submitted as early as possible before the beginning of the semester for which admission is sought. Individuals may also take up to 9 credits at Iowa State as a non-degree seeking student and then transfer them to the program when they are admitted. (http://www.elo.iastate.edu/how-elo-works/admission-and-enrollment)

The Master of Engineering in Engineering Management Program at Iowa State University is focused on supporting working professionals so teaching or research assistantships typically are not available.

Degree Requirements

Engineering Management Core:

I E 563	Engineering and Systems Management	3
I E 570	Systems Engineering and Project Management	3
MGMT 583	Strategic Management of Innovation	3
SCM 524	Strategic Process Analysis and Improvement	3
Engineering courses:		
I E 564	Decision Analysis in System Design	
I E 561	Continuous Quality Improvement of Process	
I E 541	Inventory Control and Production Planning	
CON E 380	Engineering Law	
Business courses		
FIN 501	Financial Valuation and Corporate Financial Decisions	
MKT 501	Marketing	
MGMT 503	Professional Responsibility in Business and Society	
I E 450	Technical Sales for Engineers I	

Genetics and Genomics

Graduate Major

Work is offered for the master of science and doctor of philosophy degrees with a major in Genetics and Genomics in fourteen cooperating departments: Agronomy; Animal Science; Biochemistry, Biophysics and Molecular Biology; Biomedical Sciences; Ecology, Evolution and Organismal Biology; Entomology; Food Science and Human Nutrition; Genetics, Development and Cell Biology; Horticulture; Materials Science and Engineering; Plant Pathology and Microbiology; Natural Resource Ecology and Management; Veterinary Microbiology and Preventive Medicine; and Veterinary Pathology.

Students are admitted by the approval of the Chair after review by the Genetics and Genomics Admissions Committee. Students are admitted either to participate in research rotations with several faculty before deciding on a major professor and laboratory, or by direct admission into a specific lab and department. First year students participating in rotations with Genetics and Genomics faculty will take GENET 697 Graduate Research Rotation.

The diversity of faculty in the Genetics and Genomics major ensures a broad, well-balanced education from the best instructors, while offering flexibility in choice of research area. Genetics and Genomics faculty have strengths in many areas, from fundamental studies at the molecular, cellular, organismal, and population levels, to research with immediate practical application. Ongoing research projects span all the major areas of theoretical and experimental genetics, including genomics, molecular studies of gene regulation, gene mapping, genetics of disease, transposable element studies, developmental genetics, quantitative and statistical genetics, computational molecular biology, evolutionary genetics, and population genetics.

Undergraduate Preparation

Undergraduates wishing to prepare for graduate study in Genetics and Genomics should elect courses in basic biology, chemistry at least through organic chemistry, one year of college-level physics, mathematics at least through calculus, at least one thorough course in basic transmission and molecular genetics, one semester of upper level statistics and one semester of upper level biochemistry. Incoming students who have not completed an upper level statistics course and an upper level biochemistry course prior to beginning in the program will take STAT 401 Statistical Methods for Research Workers and BBMB 404 Biochemistry I during their first year of graduate training. A waiver may be requested for these courses by providing appropriate documentation (catalog description and syllabus) to the curriculum committee showing completion of an upper level statistics and upper level biochemistry course equivalent to STAT 401 Statistical Methods for Research Workers and BBMB 404 Biochemistry I.

See information from the College of Agriculture and Life Sciences or the College of Liberal Arts and Sciences for information on a bachelor of science degree in Genetics.

All Ph.D. candidates take a core curriculum comprising one course each from the following four categories and attend seminars and workshops as described:

Transmission Genetics		
GDCB 510	Transmission Genetics	
Molecular Genetics		
GDCB 511	Advanced Molecular Genetics	
Quantitative, Population, and Evolutionary Genetics		
AN S 561 & AGRON 561	Population and Quantitative Genetics for Breeding and Population and Quantitative Genetics for Breeding	
EEOB 562	Evolutionary Genetics	
EEOB 563	Molecular Phylogenetics	
EEOB 566	Molecular Evolution	
EEOB 567	Empirical Population Genetics	
GDCB 536	Statistical Genetics	
Genomics, Bioinformatics and Statistical Genetics		
AN S 556	Current Topics in Genome Analysis	
BCB 544	Fundamentals of Bioinformatics	
STAT 516	Statistical Design and Analysis of Gene Expression Experiments	
STAT 416	Statistical Design and Analysis of Gene Expression Experiments	3
BCB 567	Bioinformatics I (Bioinformatics Algorithms)	
BCB 568	Bioinformatics II (Statistical Bioinformatics)	
BCB 569	Bioinformatics III (Structural Bioinformatics)	
BCB 570	Bioinformatics IV (Systems Biology)	
EEOB 561	Evolutionary and Ecological Genomics	3
COM S 549	Advanced Algorithms in Computational Biology	3
COM S 550	Evolutionary Problems for Computational Biologists	3
COM S 551	Computational Techniques for Genome Assembly and Analysis	3

Students will give three research presentations (GENET 690 Graduate Student Seminar in Genetics), attend two genetics and genomics faculty seminar series (GENET 691 Faculty Seminar in Genetics), and participate in two Workshops in Genetics and Genomics (GENET 591 Workshop in Genetics) during their graduate training. First-year graduate students will take GENET 692 Conceptual Foundations of Genetics.

Students may elect a computational molecular biology specialty within the genetics major. This requires that the research project be in the field of computational molecular biology. IG2 majors will be expected to complete all of the courses required for the genetics and genomics major, except that one semester of BCB 690 Student Seminar in Bioinformatics and Computational Biology can be substituted for GENET 690 Graduate Student Seminar in Genetics. Students will be expected to take additional courses in the area of specialization.

M.S. students will take the above core courses and seminars with the following changes: participate in one Workshop in Genetics (GENET 591 Workshop in Genetics) and present their research once (GENET 690 Graduate Student Seminar in Genetics). Additional coursework may be selected to satisfy individual interests or departmental requirements.

The course designator Genet applies to graduate courses taught by the interdepartmental major in Genetics and Genomics.

Students wishing to minor in genetics and genomics must submit a complete application to the graduate program. Requirements for the successful completion of a minor at the Ph.D. or M.S. levels are: completion of three of the four categories of the common-core required lecture courses listed above. One semester of Seminar in Genetics is recommended.

GENET 690	Graduate Student Seminar in Genetics	1
GENET 691	Faculty Seminar in Genetics	1
GENET 692	Conceptual Foundations of Genetics	1

One member of the POS committee must be a Genetics faculty member.

Student Outcomes: Most students awarded doctoral degrees continue their training as postdoctoral associates at major research institutions in the U.S. or abroad in preparation for research and/or teaching positions in academia, industry, or government. A few go directly to permanent research positions in industry. Many students awarded master's degrees continue their training as doctoral students; however, some choose research support positions in academia, industry, or government. A more thorough list of outcomes is available at our web site.

Courses primarily for graduate students, open to qualified undergraduates:

GENET 539: Ethics and Biological Sciences
(2-0) Cr. 2. S.
Introduction to Bioethics through case study discussion and recent news events. Students will read and discuss contemporary issues in science ethics, including some of the following topics: ethics and responsible research practice, animal ethics and the use of animals in teaching and research, cloning, human reproductive and stem cell research, regulation of genetically modified crops and foods, plant biotechnology, gene patents. Students will be divided into groups to develop their own case study, to be presented in class at the end of the term. Offered on a satisfactory-fail basis only.

GENET 590: Special Topics
Cr. arr. Repeatable. F.S.SS.
Contact individual faculty for special projects or topics. Graded.

GENET 591: Workshop in Genetics
(1-0) Cr. 1. Repeatable. F.
Prereq: Permission of instructor
Current topics in genetics research. Lectures by off-campus experts. Students read background literature, attend preparatory seminars, attend all lectures, meet with lecturers.

Courses for graduate students:

GENET 690: Graduate Student Seminar in Genetics
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Permission of instructor
Research presentations by students to improve their ability to: orally present scientific work in a clear and meaningful way, critically evaluate oral presentations, and give and receive constructive criticism. Students may enroll in one seminar per school year.

GENET 691: Faculty Seminar in Genetics
(1-0) Cr. 1. Repeatable. F.
Prereq: Permission of instructor
Faculty research seminars that introduce students to the variety of genetics research projects on campus and provide an opportunity for students to become engaged in the scientific presentation to the point where they can think critically and ask meaningful questions.

GENET 692: Conceptual Foundations of Genetics
(1-0) Cr. 1. F.
Prereq: Permission of instructor
Landmark papers in the development of genetics concepts. Papers are presented and discussions led by students, guided and mentored by the instructors. Instructors provide a broad overview and history of the development of fundamental concepts in genetics.

GENET 697: Graduate Research Rotation
Cr. arr. Repeatable. F.S.SS.
Graduate research projects performed under the supervision of selected faculty members in the graduate Genetics major.

GENET 699: Research
Cr. arr. Repeatable. F.S.SS.
Research.

Graduate Studies

Graduate students may enroll in Graduate Studies (GR ST) courses for professional development or to fulfill certain enrollment requirements. No major is granted in Graduate Studies.

Courses primarily for graduate students, open to qualified undergraduates:

GR ST 529: Preparing Publishable Thesis Chapters
(3-0) Cr. 3. S.
Prereq: Instructor permission
Reporting original research results within the norms for writing of a student's discipline. Emphasis on preparing thesis/dissertation chapters that will be both acceptable to the Graduate College and ready for submission to a refereed journal in the student's discipline. Focus on reporting student-generated data, norms for discourse within disciplines, and how thesis chapters differ from journal manuscripts.

GR ST 565: Responsible Conduct of Research in Science and Engineering
(1-0) Cr. 1. F.S.
Prereq: Graduate classification
Ethical and legal issues facing researchers in the sciences and engineering.

GR ST 566: Communications in Science
(0.5-0) Cr. 0.5. Alt. S., offered odd-numbered years.
Prereq: graduate classification
Reading and reviewing manuscripts; publishing papers; oral and poster presentations.

GR ST 567: Time Management and Mentoring
(0.5-0) Cr. 0.5. Alt. F., offered even-numbered years.
Prereq: graduate classification
Balancing life and career; mentoring; lab management.

GR ST 568: The Interview Process
(0.5-0) Cr. 0.5. Alt. S., offered odd-numbered years.
Prereq: graduate classification.
Applying and interviewing for academia, industry and government.

GR ST 569: Grant Writing
(1-0) Cr. 1. Alt. F., offered odd-numbered years.
Prereq: at least two prior years of graduate classification.
Writing a winning proposal.

GR ST 570: Teaching Practices
(0.5-0) Cr. 0.5. Alt. S., offered even-numbered years.
Prereq: graduate classification.
Preparation of a teaching portfolio and course materials; lecturing, technology.

GR ST 585: Preparing Future Faculty Introductory Seminar
Cr. 2. F.
Prereq: One year of graduate course work; admission into PFF program
Introduction to faculty life issues such as hiring, tenure, teaching, and service at a variety of higher education institutions. Includes presentations from faculty at other institutions.

GR ST 586: Preparing Future Faculty Intermediate Seminar
Cr. 1-3. S.
Prereq: Admission into PFF program; completion of 585 or permission of instructor
Consideration of a wide range of faculty life issues. Includes topics such as higher education trends, diversity issues, learning styles, assessment, grant and proposal writing, and legal and ethical issues. Written components include job and teaching portfolios.

GR ST 587: Preparing Future Faculty Teaching Practicum
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor, GR ST 585, credit for or concurrent enrollment in GR ST 586
Students complete a stand-alone teaching assignment at Iowa State or another higher education institution. Written components include pedagogical documents.

GR ST 588: Preparing Future Faculty Special Topics
Cr. 1-3. Repeatable. F.S.
Prereq: Permission of instructor, GR ST 585, credit for or concurrent enrollment in GR ST 586
In-depth study of topic providing academic professional development.

Courses for graduate students:

GR ST 633: Summer Graduate Assistant
Cr. R. SS.
Only for students not registered in other courses in the summer term.

GR ST 680: Doctoral Post Prelim (Continuous) Registration
Cr. R. Repeatable.
Reserved for Ph.D. candidates only. See the Graduate College Handbook for specific requirements.

GR ST 681: Required Registration
Cr. 1. Repeatable. F.S.SS.
Required registration for graduate students when they have no mandatory classes left to take. Students need to register for Section A, B, or C. Offered on a satisfactory-fail basis only.

GR ST 681A: Required Registration: Doctoral Continuous Registration
Cr. 1. Repeatable, maximum of 6 times.
Prereq: Must have taken and passed preliminary oral exam.
Offered on a satisfactory-fail basis only. Credits may not count toward graduation.

GR ST 681B: Required Registration: Final Exam Only
Cr. 1. Repeatable, maximum of unlimited times.
Prereq: Completed all necessary program requirements to take final exam.
Offered on a satisfactory-fail basis only. This course cannot be used toward graduation.

GR ST 681C: Required Registration: Graduate Assistant Enrollment
Cr. 1. Repeatable, maximum of Unlimited times.
Prereq: Student needs to be a Graduate Assistant
Offered on a satisfactory-fail basis only. The course cannot count toward graduation.

GR ST 697: Curricular Practical Training
Cr. R. Repeatable. F.S.SS.
Professional work period.

Human Computer Interaction

Interdepartmental Graduate Program

Human Computer Interaction is an interdepartmental graduate program that seeks to improve the way individuals and groups use computers through an understanding of the social and cognitive aspects of the design and use of computational devices. Students in the program learn about cognitive psychology, graphic design principles, the impacts of technology on society, evaluating system usability, and cutting edge computer programming for computational perception and language parsing.

Student research projects have explored the latest in virtual reality studies, improving natural interaction through touch screens and 3D camera gesture controls, virtual engineering using force feedback devices, and many other projects at the bleating edge of technological innovation. Graduates of the program have gone to work at many of the largest technology firms in the US and abroad while others have gone on to positions in academia.

Degrees are offered for the Master of Science (MS) and Doctor of Philosophy (PhD) degrees with a major in Human Computer Interaction (HCI). A Graduate Certificate and an Online Master of Science degree in Human Computer Interaction are also offered; these degrees are

especially targeted for the benefit of students working in business and industry wanting education in this field. The graduate program in Human Computer Interaction (HCI) welcomes applicants from a diverse collection of technical and creative fields whose unifying characteristic is the desire to develop new ways to bridge the gap between human and machine. The students must demonstrate skill in software development and proficiency in high-level, object-oriented programming. These skills can be acquired after admission to the program. Other entrance requirements will include an undergraduate degree and transcripts, test scores and other indicators that the applicant can be successful at the graduate level. All students admitted to the MS or PhD program on campus must secure a graduate assistantship.

All programs of study for the PhD must include:

1. one core course of their choice from each of the categories of Implementation, Design, Evaluation and Phenomena, if not completed as part of the student's Masters program
2. two more courses of their choice from a list of recommended electives
3. four semesters of HCI 591 Seminar in Human Computer Interaction
4. a minimum of nine research credits.

The MS degree calls for 30 credits of course work including appropriate credit for the Master's thesis. MS students must take one core course of their choice from each of the categories of Implementation, Design, Evaluation and Phenomena. MS Students must also take two semesters of HCI 591 Seminar in Human Computer Interaction.

The Online HCI MS program is most appropriate for individuals with a bachelor's degree in a scientific, engineering, business, or artistic discipline, who are pursuing a professional career, and who already have a strong base of information technology skills. Requirements for the Online Master of Science Program include 27 credits of coursework, plus a three-credit capstone course, with a final presentation at the end of the degree program.

Requirements for the HCI Graduate Certificate program include three core HCI courses plus one elective.

Information on applications procedures and specific requirements of the major can be obtained from the following Internet address: http://www.hci.iastate.edu/Academics/index.php.

Courses primarily for graduate students, open to qualified undergraduates:

HCI 504: Evaluating Digital Learning Environments
(Cross-listed with C I). (3-0) Cr. 3. S.
Prereq: C I 501
Principles and procedures to plan, design, and conduct effective evaluation studies (formative, summative, usability) in different settings are studied. Opportunities to engage in real or simulated evaluation projects of substantial scope are provided. Create evaluation instruments, develop methods with which to evaluate a product or program, conduct try-outs or usability sessions, analyze the data, report the findings, and recommendations are some of the course activities.

HCI 507: Principles of 3D Character Animation
(Cross-listed with ARTIS). (0-6) Cr. 3.
Prereq: ARTIS 308
Animation techniques using the computer and available software. Principles of character animation. Prior knowledge of modeling, lighting, texturing and rendering with available software is assumed.

HCI 509: Computer/Video Game Design and Development
(Cross-listed with ARTIS). (0-6) Cr. 3. Repeatable, maximum of 12 credits.
Prereq: Permission of instructor
Independent project based creation and development of "frivolous and non-frivolous" computer games in a cross-disciplinary team. Projects require cross-disciplinary teams. Aspects of Indie development and computer/video game history will be discussed.

HCI 515: Statistical Natural Language Processing
(Cross-listed with ENGL, LING). (3-0) Cr. 3.
Prereq: STAT 330 or equivalent, recommended ENGL 219 or LING 219, or ENGL 511 or LING 511
Introduction to computational techniques involving human language and speech in applications such as information retrieval and extraction, automatic text categorization, word prediction, intelligent Web searching, spelling and grammar checking, speech recognition and synthesis, statistical machine translation, n-grams, POS-tagging, word-sense disambiguation, on-line lexicons and thesauri, markup languages, corpus analysis, and Python programming language.

HCI 520: Computational Analysis of English
(Cross-listed with ENGL, LING). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENGL 510 or LING 510, and ENGL 511 or LING 511
Concepts and practices for analysis of English by computer with emphasis on the applications of computational analysis to problems in applied linguistics such as corpus analysis and recognition of learner language in computer-assisted learning and language assessment.

HCI 521: Cognitive Psychology of Human Computer Interaction
(Cross-listed with PSYCH). (3-0) Cr. 3.
Prereq: Graduate classification or instructor approval
Biological, behavioral, perceptual, cognitive and social issues relevant to human computer interactions.

HCI 522: Scientific Methods in Human Computer Interaction
(Cross-listed with PSYCH). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: PSYCH 521 and STAT 101 or equivalent
Basics of hypothesis testing, experimental design, analysis and interpretation of data, and the ethical principles of human research as they apply to research in human computer interaction.

HCI 525: Optimization Methods for Complex Designs
(3-0) Cr. 3. F.
Prereq: M E 160, MATH 265
Optimization involves finding the 'best' according to specified criteria. Review of a range of optimization methods from traditional nonlinear to modern evolutionary methods such as Genetic algorithms. Examination of how these methods can be used to solve a wide variety of design problems across disciplines, including mechanical systems design, biomedical device design, biomedical imaging, and interaction with digital medical data. Students will gain knowledge of numerical optimization algorithms and sufficient understanding of the strengths and weaknesses of these algorithms to apply them appropriately in engineering design. Experience includes code writing and off-the-shelf routines. Numerous case-studies of real-world situations in which problems were modeled and solved using advanced optimization techniques.

HCI 558: Introduction to the 3D Visualization of Scientific Data
(Cross-listed with COM S, GEOL). (2-2) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Graduate-student standing in the mathematical or natural sciences or engineering; basic programming knowledge
Introduction to visualizing scientific information with 3D computer graphics and their foundation in human perception. Overview of different visualization techniques and examples of 3D visualization projects from different disciplines (natural sciences, medicine, and engineering). Class project in interactive 3D visualization using the ParaView, Mayavi, TVTK, VTK or a similar system.

HCI 570: UX Lab Studies: Eyetracking & Other UX Tools
(1-0) Cr. 1.
Practical introduction to User Experience (UX) tools and how to use them for research: Designing a UX study; developing meaningful user tasks; how to plan a research study that integrates eyetracking measures, UX measures, behavioral measures, surveys, interviews and IRB applications; analyzing UX data; and presenting UX study results.

HCI 571: Augmented Reality
(3-0) Cr. 3.
Prereq: M E 557/CPR E 557/COM S 557, or equivalent computer graphics experience
Fundamental technologies enabling augmented reality (AR) application development. Assessment and integration of the hardware and software systems necessary for AR including, tracking, image processing and rendering. Programming skills in C++ and GPU-based optimization are developed to enable evaluation of interaction devices and modalities afforded by AR.

HCI 574: Computational Implementation and Prototyping in HCI
Cr. 3. S.
Fundamental concepts of software programming and the practical use of the Python programming language. Assignments include user interaction and interface design, information visualization, as well as other computational HCI tools. Intended for graduate students without prior background in software development. Requires programming during class lectures.

HCI 575: Computational Perception
(Cross-listed with COM S, CPR E). (3-0) Cr. 3. S.
Prereq: Graduate standing or permission of instructor
This class covers statistical and algorithmic methods for sensing, recognizing, and interpreting the activities of people by a computer. This semester we will focus on machine perception techniques that facilitate and augment human-computer interaction. The main goal of the class is to introduce computational perception on both theoretical and practical levels. Participation in small groups to design, implement, and evaluate a prototype of a human-computer interaction system that uses one or more of the techniques covered in the lectures.

HCI 580: Virtual Environments, Virtual Worlds, and Application
(Cross-listed with M E). (3-0) Cr. 3. F.
Prereq: Senior or Graduate status.
A systematic introduction to the underpinnings of Virtual Environments (VE), Virtual Worlds, advanced displays and immersive technologies; and an overview of some of the applications areas particularly virtual engineering.

HCI 585: Developmental Robotics
(Cross-listed with CPR E). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: knowledge of C/C++ programming language.
An introduction to the emerging interdisciplinary field of Developmental Robotics, which crosses the boundaries between robotics, artificial intelligence, developmental psychology, and philosophy. The main goal of this field is to create autonomous robots that are more intelligent, more adaptable, and more useful than the robots of today, which can only function in very limited domains and situations.

HCI 587: Models and Theories in Human Computer Interaction
(3-0) Cr. 3.
Survey of the multidisciplinary models and theories that form the foundation of the science of Human Computer Interaction. Application of the scientific method to solve practical problems by using analyses or approaches from the behavioral and social sciences, and information and computer technology.

HCI 589: Design and Ethics
(Cross-listed with ARTGR). (3-0) Cr. 3. F.S.
Prereq: Graduate classification or permission of instructor.
Issues in ethics and decision-making as they relate to technology, design, design research, HCI, and the design industry.

HCI 590: Special Topics
Cr. arr. Repeatable.
Investigation of problems of special interest in human computer interaction.

HCI 591: Seminar in Human Computer Interaction
Cr. 1-3. Repeatable.

HCI 592: Entrepreneurship Workshop
(1-0) Cr. 1. F.
Students will be taken step-by-step through activities that must be undertaken when attempting to commercialize a technology or start their own company. Speakers will be brought in to introduce relevant topics, provide resources, answer questions, and provide working examples.

HCI 595: Visual Design of HCI
Cr. 3. SS.
Human interaction design as it applies to HCI. Aspects of audience analysis, design methodologies for creating concepts and solutions, techniques of concept prototyping, and the fundamentals of visual design such as color, type, symbolism, and grid structure. Class discussions, tutorials, and hands-on projects.

HCI 596: Emerging Practices in Human-Computer Interaction
Cr. 3. SS.
Prereq: HCI 521
Usability evaluation with emphasis on requirements gathering, rapid prototyping, evaluation, and communicating results through report writing along with emerging practices.

HCI 598: HCI Design, Implementation and Implications
Cr. 3. F.S.
Prereq: 21 credits in human computer interaction or permission of the instructor
Capstone course in HCI. Through a significant design project, students demonstrate their mastery of core courses in HCI. This course is the final course for students in the HCI Online MS program.

HCI 599: Creative Component
(3-0) Cr. 3.
Creative component for nonthesis option of Master of Science degree. Offered on a satisfactory-fail basis only.

Courses for graduate students:

HCI 603: Advanced Learning Environments Design
(Cross-listed with C I). (3-0) Cr. 3. S.
Prereq: C I 503
Exploration of advanced aspects of the instructional design process. Application of analysis, design, development and production, evaluation, implementation, and project management principles. Focus on the production and use of instructional technology with an emphasis on the instructional design consulting process. Theory and research in instructional technology provides the foundation for design decisions.

HCI 655: Organizational and Social Implications of Human Computer Interaction
(Cross-listed with MIS). (3-0) Cr. 3.
Prereq: Graduate Classification
Examine opportunities and implications of information technologies and human computer interaction on social and organizational systems. Explore ethical and social issues appurtenant to human computer interaction, both from a proscriptive and prescriptive perspective. Develop informed perspective on human computer interaction. Implications on research and development programs.

HCI 681: Cognitive Engineering
(Cross-listed with I E). (3-0) Cr. 3.
Prereq: I E 572 or I E 577 or PSYCH 516 or HCI/PSYCH 521 or equivalent
Provides an overview of human cognitive capabilities and limitations in the design of products, work places, and large systems. Contexts vary broadly and could range from simple use of mobile devices to an air-traffic control or nuclear plant command center. Course focuses on what we can infer about users' thoughts and feelings based on what we can measure about their performance and physiological state. Covers the challenge of designing automated systems.

HCI 697: HCI Internship
Cr. R. Repeatable.
Prereq: Permission of Director of Graduate Education, graduate classification

HCI 699: Research
Cr. arr. Repeatable.

Immunobiology

Immunobiology Interdepartmental Graduate Program

Work is offered for the master of science and doctor of philosophy degrees with a major in Immunobiology. Faculty are drawn from twelve university departments along with researchers from the National Animal

Disease Center. Participating departments include: Animal Science; Biochemistry, Biophysics, and Molecular Biology; Biomedical Sciences; Chemical & Biological Engineering; Entomology; Food Science and Human Nutrition; Kinesiology; Natural Resource Ecology & Management; Veterinary Clinical Sciences; Veterinary Diagnostic & Production Animal Medicine; Veterinary Microbiology & Preventative Medicine; and Veterinary Pathology. The diversity of faculty expertise ensures a broad education, while offering flexibility in choice of specialization. Ongoing research projects include areas such as: antibody and cell-mediated immunity, gene expression, immunochemistry, immunogenetics, immunomodulation, immunophysiology, mucosal immunity and nutritional immunology. Additional information about program faculty members is available at: www.immunobiology.iastate.edu (http://www.immunobiology.iastate.edu).

Students may enter the Immunobiology program in one of two ways; prospective students may apply directly to the major, or current ISU graduate students may be admitted as a co-major or minor in Immunobiology. Ph.D. students admitted into the Interdepartmental Immunobiology major will take IMBIO 697 Graduate Research Rotation during their first two semesters. From these rotations the student will select a major professor and join a home department. Affiliating with a major professor is done by the end of the second semester.

Before entering the Immunobiology program, prospective students should have a strong background in the biological sciences; typically including work in immunology, genetics and biochemistry. Prior research experience is highly encouraged. The submission of GRE General Test scores is required for admission.

Immunobiology students should include in their program of study a core of courses which will provide a broad coverage of the basic program in immunobiology. Formal courses should include immunology, biochemistry, and statistics. Additional coursework may be selected to satisfy individual interests or departmental requirements. The foreign language and teaching requirements are determined by the student's home department. All students will take a minimum of one seminar course per fall and spring semester.

Graduates of the Immunobiology program will have a broad understanding of the interdisciplinary field of immunobiology and will be able to effectively integrate the principles of immunology with related disciplines. They are able to effectively communicate with scientific colleagues and the general public in both formal and informal settings. Graduates are able to integrate theory and research to address complex problems facing scientific professionals studying animal and human health, taking into account related ethical, social, legal and environmental issues. They are skilled at carrying out research, communicating research results, and writing persuasive grant proposals.

Graduate Study in Immunobiology

Curriculum Requirements for Immunobiology Doctoral Students

Ph.D. candidates majoring in Immunobiology must take at least 72 graduate credits. This 72 credits includes the below core course requirements and applicable research credits earned. Credits taken during a student's M.S. program in Immunobiology at Iowa State University will count towards their Ph.D. in Immunobiology.

Ph.D. students should take each of the following:

BBMB 405	Biochemistry II	3
IMBIO 602	Current Topics Workshop in Immunology Repeated each Fall	1
IMBIO 604	Seminar in Immunobiology Repeated each Spring	1
IMBIO 699	Research	arr †
STAT 401	Statistical Methods for Research Workers	4
V MPM 615	Molecular Immunology	3
V PTH 554	Ethics in Scientific Research and Writing	1

† Arranged with instructor.

Take one of the following two:

V MPM 520	Medical Immunology I	4
V MPM 575	Immunology	3

Take at least two courses from the following approved electives:

BBMB 645	Molecular Signaling	2
GDCB 528	Advances in Molecular Cell Biology	3
V MPM 540	Livestock Immunogenetics	2
V MPM 608	Molecular Virology	3
V MPM 625	Mechanisms of Bacterial Pathogenesis	4
V MPM 629	Advanced Topics in Cellular Immunology	2
V PTH 655	Cellular and Molecular Pathology I	3
V PTH 656	Cellular and Molecular Pathology II	3

Curriculum Requirements for Immunobiology Master's Students

All M.S. students majoring in Immunobiology are required to complete a minimum of 30 graduate credits. These 30 credits includes core course requirements and applicable research credits earned. The requirements for M.S. students are the same as that for Ph.D. students with the exception of the elective credits. M.S. students are required to take **at least one course from the list of electives** as opposed to the two course minimum for Ph.D. students.

Curriculum Requirements for a Minor in Immunobiology at the PhD Level

Graduate students studying at Iowa State University with an interest in completing an Immunobiology minor for their Ph.D. studies are required to take a total of 12 credit hours of coursework including core courses and approved electives.

Students must be approved for the minor by the Immunobiology program and must follow Graduate College guidelines for POS Committee membership.

Graduate students wishing to seek a minor in Immunobiology are encouraged to contact the Immunobiology Interdepartmental Graduate Program Coordinator for further information. Inquiries can be submitted to: idgp@iastate.edu.

Immunobiology Minor Curriculum at the Ph.D. Level Includes:

One course from each of the following two categories:

Category A:

V MPM 520	Medical Immunology I	4
V MPM 575	Immunology	3

Category B:

V MPM 615	Molecular Immunology	3
V MPM 629	Advanced Topics in Cellular Immunology	2

One enrollment in the following:

IMBIO 602	Current Topics Workshop in Immunology	1

Minimum of 2 courses from any of the following approved electives:

BBMB 645	Molecular Signaling	2
GDCB 528	Advances in Molecular Cell Biology	3
MICRO 554	Virology	1
V MPM 540	Livestock Immunogenetics	2
V MPM 608	Molecular Virology	3
V MPM 625	Mechanisms of Bacterial Pathogenesis	4
V MPM 629	Advanced Topics in Cellular Immunology	2
V PTH 655	Cellular and Molecular Pathology I	3
V PTH 656	Cellular and Molecular Pathology II	3

Courses for graduate students:

IMBIO 602: Current Topics Workshop in Immunology
(1-0) Cr. 1. Repeatable. F.
Lectures provided by off-campus experts. Students are required to participate in discussion sessions with lecturers.

IMBIO 604: Seminar in Immunobiology
(1-0) Cr. 1. Repeatable. S.
Student and faculty presentation.

IMBIO 661: Comparative Immunology and Infectious Disease
(Cross-listed with V PTH). (2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Graduate level Immunology or permission of instructor.
Discuss and define similarities and differences of varied host responses to infectious challenge. Learning will focus on comparative aspects of the host response and the unique aspects of immunity from different organisms, while highlighting molecular and mechanistic similarities of pathogen recognition, response and resolution.

IMBIO 690: Special Topics
Cr. arr. Repeatable.
Advanced study of specific topics in specialized field of immunobiology.

IMBIO 697: Graduate Research Rotation
Cr. arr. Repeatable.
Graduate research projects performed under the supervision of selected faculty members in the Interdepartmental Immunobiology major.

IMBIO 699: Research
Cr. arr. Repeatable.

Information Assurance

Interdepartmental Graduate Major

Iowa State University has been offering courses in information assurance since 1995 and has one of the largest programs in the country. Graduate degrees can be obtained in a traditional on campus setting or as an on-line program. For information on the Engineering-LAS Online Learning program visit www.eol.iastate.edu. (http://www.eol.iastate.edu)

Students graduating from the major will help to fill the need for well-educated system security specialists in the government, private sector, and academia. The program objectives identified as being critical to the accomplishment of this mission are:

1. Impart and enhance knowledge about information infrastructure security
2. Expand and develop the ability to engineer complex systems
3. Instill and nurture social awareness, and the ability to function in a team
4. Instill and nurture a sense of ethics
5. Develop an understanding of strategic and policy issues

We offer 4 different graduate degree options:

1. Masters of Science with thesis
2. Masters of Science without thesis
3. Masters of Engineering (coursework only)
4. Graduate certificate

Graduate Certificate:

A graduate certificate in Information Assurance is offered, which consists of four courses (12 credits): The graduate certificate is targeted for off-campus students as a way to either supplement their education or as way to try out online education courses. All of the certificate courses will transfer into the MS or MENGR degree in IA.

for Certificate in Information Assurance

INFAS 530	Network Protocols and Security	3
INFAS 531	Information System Security	3
INFAS 532	Information Warfare	3
INFAS 533	Cryptography	3
or INFAS 535	Steganography and Digital Image Forensics	
or INFAS 534	Legal and Ethical Issues in Information Assurance	
or INFAS 536	Computer and Network Forensics	
or CPR E 537	Wireless Network Security	
Total Credits		12

For additional information students should visit http://www.iac.iastate.edu.

Master of Science with & without thesis:

The degree Master of Science with a major in information assurance is under a cooperative arrangement with various home departments including Electrical and Computer Engineering, Computer Science, Political Science, Supply Chain and Information Systems, and Mathematics.

The degree Master of Science with thesis is recommended for students who intend to continue toward the Doctor of Philosophy degree or to undertake a career in research and development. The non-thesis Master of Science degree requires a creative component and is intended for students interested in a career in information assurance.

Students interested in the interdepartmental major apply and are admitted to both a home department (the department that is most closely aligned with the student's research interest and background) and to the program. The home department sets the admission standards, course requirements, and thesis standards. (**Note:** Electrical and Computer Engineering is the only home department for off-campus students pursuing the Master of Science in Information Assurance)

The program is broadly based and uses courses in the various departments. The program will consist of 24 course credits with 6 credits of research work for a Master of Science with thesis. A non-thesis Master of Science will consist of 27 credits of courses and 3 credits of creative component. The courses are divided into three categories: core, electives, and thesis research. A student's Program of Study Committee, in consultation with the student, determines the elective courses to be taken and the acceptability of transfer credits. The major professor will be selected from the discipline where the student is admitted (home department).

The basic prerequisite for admission to this program is a baccalaureate degree in engineering, mathematics, computer science, management information systems, political science, or closely related field. The GRE or GMAT examination may be required based on the standards of the home department. If the GRE or GMAT is not required it will be considered in admissions decisions if offered. Potential students with baccalaureate degrees in the physical sciences, statistics, or other related fields will be considered on an individual basis, possibly with provisional admission.

Master of Engineering:

The Master of Engineering (MENGR) in Information Assurance degree is only offered to off-campus students. This program is designed to assist all individuals who already have a bachelor's degree in computing or related areas to pursue an in-depth study in information assurance. The Master of Engineering program is based on coursework credits only (a thesis or creative component is not required). Courses are offered via our Engineering-LAS Online Learning streaming media online education program. (**Note:** Electrical and Computer Engineering is the only home department for the Master of Engineering in Information Assurance)

A coursework only Master of Engineering degree in Information Assurance consists of 30 credits. The courses are divided into three categories: core, electives, and capstone course. (**Note**: Students pursuing the MENGR do not have a program of study committee and the major professor is the Information Assurance, Director of Graduate Education (DoGE)

Students interested in the MENGR in IA degree apply and are admitted to Information Assurance (InfAs) with ECpE as the home department. The admission requirements for students entering the program without work experience are the same as the admission requirements for the ECpE department. For students with 3 or more years of work experience in a computer related position the GRE and GPA minimum may be waived. Students with an undergraduate degree in a non computing field that have at least 3 years of work experience in an information technology field may be admitted to the program.

Courses primarily for undergraduates:

INFAS 131: Introduction to Computer Security Literacy
(Cross-listed with CPR E). (1-0) Cr. 1.
Basic concepts of practical computer and Internet security: passwords, firewalls, antivirus software, malware, social networking, surfing the Internet, phishing, and wireless networks. This class is intended for students with little or no background in information technology or security. Basic knowledge of word processing required. Offered on a satisfactory-fail basis only.

INFAS 332: Cyber Defense Competition
(Cross-listed with CPR E). (0-2) Cr. 1. Repeatable. S.
Participation in cyber defense competition driven by scenario-based network design. Includes computer system setup, risk assessment and implementation of security systems, as well as defense of computer and network systems against trained attackers. Team based. Offered on a satisfactory-fail basis only.

INFAS 430: Network Protocols and Security
(Dual-listed with INFAS 530). (Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: CPR E 381 or equivalent
Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

Courses primarily for graduate students, open to qualified undergraduates:

INFAS 530: Network Protocols and Security
(Dual-listed with INFAS 430). (Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: CPR E 381 or equivalent
Detailed examination of networking standards, protocols, and their implementation. TCP/IP protocol suite, network application protocols. Network security issues, attack and mitigation techniques. Emphasis on laboratory experiments.

INFAS 531: Information System Security
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530 or COM S 586 or MIS 535
Computer, software, and data security: basic cryptography, security policies, multilevel security models, attack and protection mechanisms, legal and ethical issues.

INFAS 532: Information Warfare
(Cross-listed with CPR E). (3-0) Cr. 3. S.
Prereq: CPR E 531
Computer system and network security: implementation, configuration, testing of security software and hardware, network monitoring. Authentication, firewalls, vulnerabilities, exploits, countermeasures. Study and use of attack tools. Ethics in information assurance. Emphasis on laboratory experiments.

INFAS 533: Cryptography
(Cross-listed with CPR E, MATH). (3-0) Cr. 3. S.
Prereq: MATH 301 or CPR E 310 or COM S 330
Basic concepts of secure communication, DES and AES, public-key cryptosystems, elliptic curves, hash algorithms, digital signatures, applications. Relevant material on number theory and finite fields.

INFAS 534: Legal and Ethical Issues in Information Assurance
(Cross-listed with CPR E, POL S). (3-0) Cr. 3. S.
Prereq: Graduate classification; CPR E 531 or INFAS 531
Legal and ethical issues in computer security. State and local codes and regulations. Privacy issues.

INFAS 535: Steganography and Digital Image Forensics
(Cross-listed with CPR E, MATH). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: E E 524 or MATH 317 or MATH 407 or COM S 330
Basic principles of covert communication, steganalysis, and forensic analysis for digital images. Steganographic security and capacity, matrix embedding, blind attacks, image forensic detection and device identification techniques. Related material on coding theory, statistics, image processing, pattern recognition.

INFAS 536: Computer and Network Forensics
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: CPR E 489 or CPR E 530
Fundamentals of computer and network forensics, forensic duplication and analysis, network surveillance, intrusion detection and response, incident response, anonymity and pseudonymity, privacy-protection techniques, cyber law, computer security policies and guidelines, court testimony and report writing, and case studies. Emphasis on hands-on experiments.

INFAS 538: Reverse Engineering and Security Testing
(Cross-listed with CPR E). (2-3) Cr. 3. S.
Prereq: COM S 321 or CPR E 381, COM S 352 or CPR E 308
Techniques and tools for understanding the behavior of software/hardware systems based on reverse engineering. Flaw hypothesis, black, grey, and white box testing as well as other methods for testing the security of software systems. Discussion of counter-reverse engineering techniques.

INFAS 592: Seminar in Information Assurance
Cr. 1-3. Repeatable.
Prereq: Permission of instructor
Projects or seminar in Information Assurance.

Courses for graduate students:

INFAS 632: Information Assurance Capstone Design
(Cross-listed with CPR E). (3-0) Cr. 3.
Prereq: INFAS 531, INFAS 532, INFAS 534
Capstone design course which integrates the security design process. Design of a security policy. Creation of a security plan. Implementation of the security plan. The students will attack each other's secure environments in an effort to defeat the security systems. Students evaluate the security plans and the performance of the plans. Social, political and ethics issues. Student self-evaluation, journaling, final written report.

INFAS 634: Current Research Problems in Cyber Security
(3-0) Cr. 0. Repeatable. F.S.
Prereq: CPR E 530, CPR E 531, permission of instructor.
Discussion of national cybersecurity/information systems security problems. Students will learn how to apply research techniques, think clearly about these issues, formulate and analyze potential solutions, and communicate their results. Working in small groups under the mentorship of technical clients from government and industry, each student will formulate, carry out, and present original research on current cybersecurity/information assurance problems of interest to the nation. This course will be run in a synchronized distance fashion, coordinating some activities with our partner schools and our technical clients.

INFAS 697: Information Assurance Summer Internship
Cr. R.
Prereq: Permission of department, graduate classification
One semester and one summer maximum per academic year professional work period. Offered on a satisfactory-fail basis only.

Interdisciplinary Graduate Studies

www.grad-college.iastate.edu/igs/ (http://www.grad-college.iastate.edu/igs)

Interdepartmental Graduate Program

The degree of master of science or master of arts with major in interdisciplinary graduate studies is available to graduate students who wish to have a more diversified program of advanced study than that generally permitted students who specialize in a single subject. Areas of specialization in arts and humanities, biological sciences, international development studies, physical sciences, social sciences, community development (see below) and a general area are designed to broaden and supplement a student's program. Students must take courses in three different graduate subject matter areas, each subject contributing a minimum of nine credits toward the 35 graduate credits required for the degree. Courses which may be used for credit toward this degree program are selected from those listed in the Graduate College Catalog for graduate credit.

Both thesis and nonthesis options are available except in arts and humanities in which a thesis is required. If the thesis option is chosen, a minimum of three credits of IGS 699 Thesis Research is required and a maximum of five credits of IGS 699 Thesis Research may be counted in the total of 35 required credits. If the nonthesis option is elected, evidence of original creative effort must be presented. This may be in the form of a demonstration of independent creativity such as a written report of laboratory, field, or library research; a project in fine arts; or some other original contribution acceptable to the student's committee. In the nonthesis option a minimum of three credits of IGS 599 Creative Component is required and a maximum of five credits of IGS 599 Creative Component may be counted toward the total of 35 graduate credits. The student, in consultation with the program of study committee, will decide on the option. The committee also aids the student in planning a program of study and in selecting appropriate courses. Graduates will have experience in designing their own program centered around issues they have identified. Because of the interdisciplinary nature of IGS, students are expected to synthesize knowledge from three different areas of study.

Students who wish to apply for admission to interdisciplinary graduate studies should communicate with the chair of the program, the chair of the supervisory committee or one of its members.

Students in IGS may select a 37-credit area of specialization in Community Development. The Community Development area of specialization, offered in collaboration with five other universities in the Great Plains Interactive Distance Education Alliance, is offered exclusively through courses on the Web.

Courses primarily for graduate students, open to qualified undergraduates:

IGS 520: Orientation in Community Development
(1-0) Cr. 1.
Introduction to the Community Development program. Focus on on-line delivery methods, graduate level research and writing, technology skills.

IGS 599: Creative Component
Cr. arr. Repeatable.

Courses for graduate students:

IGS 699: Thesis Research
Cr. arr. Repeatable.

Molecular, Cellular, and Developmental Biology

MCDB Interdepartmental Graduate Program

Work is offered for the master of science and doctor of philosophy degrees with a major in Molecular, Cellular, and Developmental Biology. Faculty are drawn from sixteen university departments along with researchers from the National Animal Disease Center. Participating departments include: Agronomy; Animal Science; Biochemistry, Biophysics & Molecular Biology; Biomedical Sciences; Chemistry; Chemical & Biological Engineering; Ecology, Evolution, & Organismal Biology; Entomology; Food Science & Human Nutrition; Genetics, Development & Cell Biology; Horticulture; Kinesiology; Physics & Astronomy; Plant Pathology; Veterinary Microbiology & Preventive Medicine; and Veterinary Pathology. Facilities and qualified faculty are available in these departments for conducting fundamental research in the various aspects of molecular, cellular, and developmental biology. Ongoing research projects include molecular and cellular studies of viral, prokaryotic, plant, and animal systems. Additional information about the program and faculty is available at: www.mcdb.iastate.edu (http://www.mcdb.iastate.edu).

Prospective students are admitted by the MCDB program following receipt of a complete application and after review by the MCDB Admissions Committee. Students are admitted either to participate in research rotations with several faculty before deciding on a major professor and laboratory, or by direct admission into a specific lab and department. Ph.D. students typically enter via rotation and M.S students typically enter via a direct admit. Those students admitted through a rotation admit are required to complete a minimum of three research lab rotations with faculty of interest and take MCDB 697 Graduate Research Rotation during their first two semesters. At the end of their second semester, students on rotation must select a major professor from the faculty participating in the program. Current ISU graduate students may be admitted as a co-major or minor with MCDB.

Before entering the MCDB program, prospective students should have a strong background in the biological sciences; typically including work in biological sciences (two years), organic chemistry (one year), physics (one year), and mathematics (through one year of calculus). Prior research experience is highly encouraged. The submission of GRE General Test scores is required for admission.

Undergraduate Study

A special program in Molecular, Cellular, and Developmental Biology is not offered for the baccalaureate. Undergraduates wishing to prepare for graduate study in molecular, cellular, and developmental biology should elect courses in biochemistry, biology, genetics, microbiology; and mathematics through calculus; chemistry through organic; and one year of physics.

The following are recommended to undergraduates desiring an introduction to this area:

BIOL 313	Principles of Genetics	3
BIOL 313L	Genetics Laboratory	1
BIOL 314	Principles of Molecular Cell Biology	3
BIOL 423	Developmental Biology	3
BIOL 423L	Developmental Biology Laboratory	1

Curriculum Requirements for MCDB

Ph.D. candidates majoring in MCDB must take at least 72 graduate credits. These 72 credits include the core course requirements (below) and applicable research credits earned. Credits taken during a student's M.S. program in MCDB at Iowa State University may count towards their Ph.D. in MCDB.

Students seeking an M.S. degree must take a total of 30 credits, with not less than 22 credits earned at ISU. M.S. students must take the core curriculum but need to complete only two of the three components in molecular biology, cell biology, or developmental biology.

Additional coursework for both Ph.D. and M.S. degrees may be selected by the student in consultation with his/her Program of Study (POS) Committee to meet departmental requirements and to satisfactorily prepare the student for their research project.

Graduate credits of B or better earned at another institution may be transferred at the discretion of the POS Committee and with the approval of the MCDB Program and the ISU Graduate College.

Additional information relating to credits required for graduate degrees can be found in the ISU Graduate College Handbook (http://www.grad-college.iastate.edu/common/handbook).

MCDB Core Curriculum requirements include:

BBMB 404	Biochemistry I	3
BBMB 405	Biochemistry II	3
Students with a Biochemistry background can elect to take the 500-level sequence:		
BBMB 504	Amino Acids and Proteins	2
BBMB 505	Bioenergetics and Metabolism	2
BBMB 506	Membrane Biochemistry	2
BBMB 507	Biochemistry of Nucleic Acids	2

All Ph.D. students must take one course from each of the following areas: A) Cellular Biology, B) Developmental Biology, & C) Molecular Biology.

A. Cellular Biology

GDCB 528	Advances in Molecular Cell Biology	3
GDCB 545	Plant Molecular, Cell and Developmental Biology *See footnote	3
B M S 575	Cell Biology	3
BBMB 645	Molecular Signaling	2

B. Developmental Biology

GDCB 533	Advances in Developmental Biology	3
GDCB 545	Plant Molecular, Cell and Developmental Biology *See footnote	3

C. Molecular Biology

MICRO 502	Microbial Genetics and Genomics	3
GDCB 511	Advanced Molecular Genetics	3
GDCB 545	Plant Molecular, Cell and Developmental Biology *See footnote	3
V MPM 608	Molecular Virology	3
BBMB 676	Biochemistry of Gene Expression in Eucaryotes	2

***Footnote: GDCB 545 - Plant Molecular, Cellular, and Developmental Biology may be used to fulfill any one of the required component areas.**

In addition to the above course requirements, MCDB graduate students are required to take:

1. **Two semesters of research seminar every year**.

   One of these seminars must be MCDB 698, Seminar in Molecular, Cellular, and Developmental Biology. In seminar, students will make journal and research presentations and attend MCDB seminars. Subject to approval by the POS committee, acceptable alternatives to fulfill the second seminar requirement include 1) a "for credit" research seminar series offered by the student's home department, 2) a workshop comprised of a research seminar series, or 3) another ISU research seminar series.

2. **One credit hour of ethics training. Possible ethics courses include:**

GR ST 565	Responsible Conduct of Research in Science and Engineering	1
V PTH 554	Ethics in Scientific Research and Writing	1

***Not required*, but highly recommended for MCDB graduate students:**

BCB 544	Fundamentals of Bioinformatics	4

Non-native English speakers must pass the English Requirement as established by the university. Depending on the results of this exam additional courses may be required to meet English proficiency standards.

MCDB graduate students need to teach one semester as part of their training for an advanced degree. Students whose first language is not English must take and pass the Oral English Certification Test (OECT) to be eligible to teach.

Curriculum Requirements for Graduate Students Seeking a MCDB Minor

Graduate students studying at Iowa State University with an interest in completing a MCDB minor for their Ph.D. are required to complete the following curriculum requirements.

Students must be approved for the minor by the MCDB program and must follow Graduate College guidelines for POS Committee membership.

Graduate students wishing to seek a minor in MCDB are encouraged to contact the MCDB Interdepartmental Graduate Program Coordinator for further information. Inquiries can be submitted to idgp@iastate.edu.

MCDB Minor Curriculum at the Ph.D. Level Includes:

BBMB 404	Biochemistry I	3
BBMB 405	Biochemistry II	3

Students with a Biochemistry background can elect to take the 500-level sequence:

BBMB 504	Amino Acids and Proteins	2
BBMB 505	Bioenergetics and Metabolism	2
BBMB 506	Membrane Biochemistry	2
BBMB 507	Biochemistry of Nucleic Acids	2

One course in each of two of the following three areas: A) Cellular Biology, B) Developmental Biology, & C) Molecular Biology.

A. Cellular Biology

GDCB 528	Advances in Molecular Cell Biology	3
GDCB 545	Plant Molecular, Cell and Developmental Biology *See footnote	3
B M S 575	Cell Biology	3
BBMB 645	Molecular Signaling	2

B. Developmental Biology

GDCB 533	Advances in Developmental Biology	3
GDCB 545	Plant Molecular, Cell and Developmental Biology *See footnote	3

C. Molecular Biology

MICRO 502	Microbial Genetics and Genomics	3

GDCB 511	Advanced Molecular Genetics	3
GDCB 545	Plant Molecular, Cell and Developmental Biology *See footnote	3
V MPM 608	Molecular Virology	3
BBMB 676	Biochemistry of Gene Expression in Eucaryotes	2

***Footnote: GDCB 545 - Plant Molecular, Cellular, and Developmental Biology may be used to fulfill any one of the required component areas.**

In addition to the above course requirements, MCDB graduate minors are required to register once for:

MCDB 698	Seminar in Molecular, Cellular, and Developmental Biology	1-2

Courses primarily for graduate students, open to qualified undergraduates:

MCDB 511: Advanced Molecular Genetics
(Cross-listed with GDCB). (3-0) Cr. 3. S.
Prereq: BIOL 313 and BBMB 405
Mechanisms of molecular genetic processes in eukaryotes and prokaryotes, including DNA replication and repair, transcription, translation and regulation of gene expression. Critical evaluation and discussion of current primary literature, methodologies and experimental data.

MCDB 528: Advances in Molecular Cell Biology
(Cross-listed with GDCB). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: Courses in general cell biology and biochemistry
Cell biological processes including cell signaling, cell division, intracellular trafficking, biogenesis of organelles, cell adhesion and motility.

MCDB 533: Advances in Developmental Biology
(Cross-listed with GDCB). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 314 or Biol 423
Fundamental principles in multicellular development. Emphasis on cellular and molecular regulation of developmental processes, and experimental approaches as illustrated in the current literature.

MCDB 545: Plant Molecular, Cell and Developmental Biology
(Cross-listed with GDCB, PLBIO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: Biol 313, BIOL 314, BIOL 330 or BBMB 405
Plant nuclear and organelle genomes; regulation of gene expression; hormone signaling; organization, function, and development of plant cells and subcellular structures; regulation of plant growth and development.

MCDB 590: Special Topics
Cr. arr. Repeatable.

Courses for graduate students:

MCDB 676: Biochemistry of Gene Expression in Eucaryotes
(Cross-listed with BBMB). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: BBMB 404 and BBMB 504; and BBMB 506 and BBMB 507; or BBMB 405 or BBMB 505 and or GDCB 511
Analysis of the biochemical processes involved in expression of eucaryotic genes and the regulation thereof, including RNA polymerase, transcriptional regulatory proteins, enhancers and silencers, chromosome structure, termination, RNA processing, RNA transport, RNA turnover, small RNAs, translational regulation, protein turnover.

MCDB 697: Graduate Research Rotation
Cr. 1-6. Repeatable. F.S.
Graduate research projects performed under the supervision of selected faculty members in the molecular, cellular, and developmental biology program.

MCDB 698: Seminar in Molecular, Cellular, and Developmental Biology
(Cross-listed with BBMB, GDCB, MICRO, V MPM). (2-0) Cr. 1-2. Repeatable. F.S.
Student and faculty presentations.

MCDB 699: Research
Cr. arr. Repeatable.

Neuroscience

Neuroscience Interdepartmental Graduate Program

Work is offered for the master of science and doctor of philosophy degrees with a major in neuroscience. Cooperating departments include Animal Science; Biochemistry, Biophysics and Molecular Biology; Biomedical Sciences; Chemical and Biological Engineering; Chemistry; Ecology, Evolution and Organismal Biology; Food Science and Human Nutrition; Genetics, Development and Cell Biology; Kinesiology; Psychology; Veterinary Clinical Sciences; and Veterinary Diagnostic and Production Animal Medicine.

The diversity of faculty in the Interdepartmental Neuroscience major provides students with a variety of research opportunities and reflects the structure of contemporary neuroscience which has become a diverse and inter-disciplinary field. Facilities and faculty are committed to research in the following areas: neuronal membrane functions, signal transduction, neuroanatomy, neurodegenerative diseases, neuroendocrinology, neurotoxicology, neuropathology, developmental neurobiology, neurogenetics, computational neuroscience, neural networks, behavioral neuroscience, tissue engineering, neuroregeneration and brain repair. Additional information about program faculty members is available at: www.neuroscience.iastate.edu (http://www.neuroscience.iastate.edu).

An undergraduate or advanced degree in one of the basic or applied sciences is ordinarily a prerequisite for admission to the program. Typical

program disciplines include majors in biochemistry, biology, biomedical sciences, human medicine, immunology, neurobiology, physiology, pharmacology, psychology, veterinary medicine, or zoology. Appropriate undergraduate coursework includes mathematics, chemistry, physics, and biological sciences. Prior research experience is highly encouraged. The submission of GRE General Test scores is required for admission.

Prospective students are admitted by the Neuroscience program following an internal application process and after review by the Neuroscience Admissions Committee. Students are admitted either to participate in research rotations with several faculty before deciding on a major professor and laboratory, or by direct admission into a specific lab and department. Ph.D. students typically enter via rotation and M.S students typically enter via a direct admit. Those students entering through a rotation admit are required to complete a minimum of three research lab rotations with faculty of interest. At the end of their second semester students on rotation must select a major professor from the faculty participating in the program.

Curriculum Requirements for Neuroscience Graduate Students

Ph.D. candidates majoring in Neuroscience must take at least 72 graduate credits. These 72 credits includes the below core course requirements and applicable research credits earned. Credits taken during a student's M.S. program in Neuroscience at Iowa State University will count towards their Ph.D. in Neuroscience.

Students seeking an M.S. degree must take a total of 30 credits, with not less than 22 credits earned at ISU. M.S. students have the same core requirements as Ph.D. students.

Additional coursework for both Ph.D. and M.S. degrees is selected by the student in consultation with his/her POS Committee to meet departmental requirements and to satisfactorily prepare the student for their research project.

Graduate credits of B or better earned at another institution may be transferred at the discretion of the POS Committee and with the approval of the Neuroscience Program and the ISU Graduate College.

Additional information relating to credits required for graduate degrees can be found in the ISU Graduate College Handbook (http://www.grad-college.iastate.edu/common/handbook).

All students majoring in Neuroscience are required to complete a core curriculum consisting of:

NEURO 556	Cellular, Molecular and Developmental Neuroscience	3
NEURO 557	Advanced Neuroscience Techniques	3
NEURO 661	Current Topics in Neuroscience Repeatable	2-3
NEURO 690	Journal Club in Neuroscience Taken every fall & spring	1
NEURO 696	Neuroscience Seminar Taken every fall & spring	1
NEURO 699	Research	arr †
BBMB 404	Biochemistry I	3
B M S 537	Neuroanatomy	3
STAT 401	Statistical Methods for Research Workers	4
MANDATORY ETHICS TRAINING: All Neuroscience students are also required to complete 1 credit hour of ethics training.		1

† Arranged with instructor.

In addition to the above coursework, all Neuroscience majors are expected to take a minimum of six credits of approved elective neuroscience courses. Pre-approved courses include:

A ECL 551	Behavioral Ecology	3
AN S 670	Molecular Biology of Muscle	3
BIOL 354	Animal Behavior	3
BIOL 436	Neurobiology	3
B M S 354	General Pharmacology	3
KIN 572	Neural Basis of Human Movement	3
PSYCH 410	Behavioral Neurology	3
PSYCH 519	Cognitive Neuropsychology	3
PSYCH 598C	Seminar in Cognitive Psychology: Cognitive Neuroscience	arr †

† Arranged with instructor.

Curriculum Requirements for Graduate Students Seeking a Neuroscience Minor

Graduate students interested in completing a Neuroscience minor are required to select 12 credits, with a minimum of 9 credits being from the list of approved courses (see below) and up to 3 credits of thesis/dissertation research (NEURO 699).

Students must be approved for the minor by the Neuroscience Program and must follow Graduate College guidelines for POS Committee membership.

Graduate students wishing to seek a minor in Neuroscience are encouraged to contact the Neuroscience Interdepartmental Graduate Program Coordinator for further information. Inquiries can be submitted to idgp@iastate.edu.

Approved Neuroscience Minor Courses

NEURO 556	Cellular, Molecular and Developmental Neuroscience	3
NEURO 557	Advanced Neuroscience Techniques	3

NEURO 661	Current Topics in Neuroscience	2-3
B M S 537	Neuroanatomy	3
COM S 474	Introduction to Machine Learning	3
KIN 572	Neural Basis of Human Movement	3
PSYCH 410	Behavioral Neurology	3
PSYCH 517	Psychopharmacology	3
PSYCH 519	Cognitive Neuropsychology	3
NEURO 699	Research (Up to 3 credits)	arr †

† Arranged with instructor.

Courses primarily for graduate students, open to qualified undergraduates:

NEURO 556: Cellular, Molecular and Developmental Neuroscience
(Cross-listed with B M S, GDCB). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: BIOL 335 or BIOL 436; physics recommended
Fundamental principles of neuroscience including cellular and molecular neuroscience, nervous system development, sensory, motor and regulatory systems.

NEURO 557: Advanced Neuroscience Techniques
(Cross-listed with GDCB). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: Neuro 556 or equivalent course
Research methods and techniques; lectures, laboratory exercises and/or demonstrations representing individual faculty specialties.

Courses for graduate students:

NEURO 661: Current Topics in Neuroscience
(Cross-listed with BBMB, GDCB). (2-0) Cr. 2-3. Repeatable. Alt. S., offered even-numbered years.
Prereq: NEURO 556 (or comparable course) or permission of instructor
Topics may include molecular and cellular neuroscience, neurodevelopment, neuroplasticity, neurodegenerative diseases, cognitive neuroscience, sensory biology, neural integration, membrane biophysics, neuroethology, techniques in neurobiology and behavior.

NEURO 690: Journal Club in Neuroscience
(1-0) Cr. 1. Repeatable. F.S.
Prereq: NEURO 556
Students are required to attend and make at least one presentation at a weekly journal club focusing on current topics.

NEURO 696: Neuroscience Seminar
(1-0) Cr. 1. Repeatable. F.S.
Prereq: NEURO 556
Presentations and discussion of research by students, faculty, and visiting scholars.

NEURO 699: Research
Cr. arr. Repeatable.

Nutritional Sciences

Graduate Study

The Interdepartmental Graduate Program in Nutritional Sciences (IGPNS), administered through the Graduate College, under the auspices of the Chairs of Food Science and Human Nutrition (FS HN) and Animal Science, will provide the structure for coordinating and enhancing interdisciplinary nutrition research and graduate education. M.S. and Ph.D. degrees in Nutritional Sciences will be offered with three specializations: Animal Nutrition, Human Nutrition, or Biochemical & Molecular Nutrition.

The following undergraduate course work is recommended of all applicants who are applying to the IGPNS, but may be modified depending upon the student's area of emphasis. Recommended course work includes organic chemistry with laboratory, physics, analytical chemistry, a nutrition course that requires biochemistry or organic chemistry as a prerequisite, and a course in biology/physiology or anatomy. Under certain circumstances students can be admitted or provisionally admitted with course work deficiencies. Students with an undergraduate degree will be generally admitted into the M.S. program and upon completion, they can then apply for admission into the Ph.D. program. However, exceptional students with experience can apply directly to the Ph.D. program.

The general requirements of the Nutritional Sciences degree at the MS level, in addition to those of Graduate College, are:

NUTRS 501	Biochemical and Physiological Basis of Nutrition: Macronutrients and Micronutrients	4
BBMB 404	Biochemistry I	3
BBMB 405	Biochemistry II	3
or BBMB 420	Mammalian Biochemistry	
STAT 401	Statistical Methods for Research Workers	4
FS HN 580	Orientation to Food Science and Nutrition Research	1
or AN S 501	Survey of Animal Disciplines	
AN S 603	Seminar in Animal Nutrition	1
or FS HN 682X	Seminary Reflection (experimental course)	
FS HN 581	Seminar (or AN S equivalent)	1

FS HN 681	Seminar (or AN S equivalent)	1
FS HN 590C	Special Topics: Teaching	1-3
or AN S 590L	Special Topics: Teaching	

Successful completion and defense of thesis

Students are expected to complete the course work established by the Program of Study (POS) committee based on specialization with a minimum of 30 graduate-level semester credits, not less than 22 of which must be earned at Iowa State University.

The general requirements of the Nutritional Sciences degree at the PhD level, in addition to those of the Graduate College, are:

- Completion of all requirements of the MS degree in Nutritional Sciences
- 3 additional credits of graduate-level biochemistry (6 credits total including those for the M.S.), graduate-level statistics (STAT 402 Statistical Design and the Analysis of Experiments), and physiology (if not taken for the M.S.)
- Additional graduate-level courses in the field of study as deemed appropriate by the POS Committee and specialization, and additional teaching assistant requirements (FS HN 590C Special Topics: Teaching).

Satisfactory completion of a preliminary examination, a written dissertation, seminar presentation of dissertation research, and defense of the dissertation is also required. Overall a minimum of 72 graduate-level semester credits, no less than 36 of which must be earned at Iowa State University

Courses primarily for graduate students, open to qualified undergraduates:

NUTRS 501: Biochemical and Physiological Basis of Nutrition: Macronutrients and Micronutrients
(4-0) Cr. 4. F.
Prereq: Credit or enrollment in BBMB 404 or BBMB 420
Integration of the molecular, cellular, and physiologic aspects of energy, macronutrient, and micronutrient metabolism in mammalian systems. Survey course that includes interactions among nutrients (dietary carbohydrate, fiber, lipid, protein, vitamins, and minerals) and non-nutrients, metabolic consequences of nutrient deficiencies or excesses, relevant polymorphisms, and major research methodologies.

NUTRS 503: Biology of Adipose Tissue
(2-0) Cr. 2. Alt. S., offered odd-numbered years.
Prereq: Undergraduate: consent of instructor; Graduate: NutrS 501
Principles regarding the development of adipose tissue and its role in energy balance, and will focus considerably on endocrine and immune actions of the adipocyte. Course material will be in lecture format, including handouts and selected journal articles. Students will be asked to lead critical discussions of key research findings as summary material for a given topic. Species differences will be highlighted, particularly as they relate to research models.

NUTRS 504: Nutrition and Epigenetic Regulation of Gene Expression
(1-0) Cr. 1. Alt. S., offered even-numbered years.
Prereq: graduate standing; undergraduate with consent of instructor
Discussion of epigenetic regulation of gene expression and the role that nutrition plays in this process. Examination of current research literature to understand how different nutrients and physiological states influence epigenetics, as well as, the research methodology used to address these relations.

NUTRS 505: Short Course
(1-0) Cr. 1. SS.
Prereq: Permission of instructor

NUTRS 506: Diet and Cancer Prevention
(Cross-listed with TOX). (1-0) Cr. 1. Alt. F., offered even-numbered years.
Prereq: BBMB 404 and BBMB 405 or BBMB 420
Principles of cancer biology and cancer etiology will be integrated with the impacts of diet on cancer development and prevention. Contributions of research with humans, animals, cultured cells and cell free systems will be included. The importance of dietary contaminants, macronutrients and micronutrients will be examined with an emphasis on the strength of the evidence and mechanisms of action.

NUTRS 518: Digestive Physiology and Metabolism of Non Ruminants
(Cross-listed with AN S). (3-0) Cr. 3. Alt. S., offered odd-numbered years.
Prereq: AN S 419 or NUTRS 501
Digestion and metabolism of nutrients. Nutritional requirements and current research and feeding programs for poultry and swine.

NUTRS 519: Food Toxicology
(Cross-listed with FS HN, TOX). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: A course in biochemistry
Basic principles of toxicology. Toxicants in the food supply: modes of action, toxicant defense systems, toxicant and nutrient interactions, risk assessment. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

NUTRS 520: Digestive Physiology and Metabolism of Ruminants
(Cross-listed with AN S). (2-2) Cr. 3. Alt. S., offered even-numbered years.
Prereq: AN S 419 or NUTRS 501
Digestive physiology and nutrient metabolism in ruminant and preruminant animals.

NUTRS 542: Introduction to Molecular Biology Techniques
(Cross-listed with B M S, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. F.S.SS.
Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

NUTRS 542A: Introduction to Molecular Biology Techniques: DNA Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes genetic engineering procedures, sequencing, PCR, and genotyping. Offered on a satisfactory-fail basis only.

NUTRS 542B: Introduction to Molecular Biology Techniques: Protein
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, VDPAM). Cr. 1. Repeatable. S.SS.
Prereq: Graduate classification
Techniques. Includes: fermentation, protein isolation, protein purification, SDS-PAGE, Western blotting, NMR, confocal microscopy and laser microdissection, Immunophenotyping, and monoclonal antibody production. Sessions in basic molecular biology techniques and related procedures. Offered on a satisfactory-fail basis only.

NUTRS 542C: Introduction to Molecular Biology Techniques: Cell Techniques
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. F.S.
Includes: immunophenotyping, ELISA, flow cytometry, microscopic techniques, image analysis, confocal, multiphoton and laser capture microdissection. Offered on a satisfactory-fail basis only.

NUTRS 542D: Introduction to Molecular Biology Techniques: Plant Transformation
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. S.
Includes: Agrobacterium and particle gun-mediated transformation of tobacco, Arabidopsis, and maize, and analysis of tranformants. Offered on a satisfactory-fail basis only.

NUTRS 542E: Introduction to Molecular Biology Techniques: Proteomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: two-dimensional electrophoresis, laser scanning, mass spectrometry, and database searching. Offered on a satisfactory-fail basis only.

NUTRS 542F: Introduction to Molecular Biology Techniques: Metabolomics
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. F.
Includes: metabolomics and the techniques involved in metabolite profiling. For non-chemistry majoring students who are seeking analytical aspects into their biological research projects. Offered on a satisfactory-fail basis only.

NUTRS 542G: Introduction to Molecular Biology Techniques: Genomic
(Cross-listed with B M S, BBMB, EEOB, FS HN, GDCB, HORT, NREM, V MPM, VDPAM). Cr. 1. Repeatable. S.
Offered on a satisfactory-fail basis only.

NUTRS 549: Advanced Vertebrate Physiology I
(Cross-listed with AN S, KIN). (4-0) Cr. 4. F.
Prereq: Biol 335; credit or enrollment in BBMB 404 or BBMB 420
Overview of mammalian physiology. Cell biology, endocrinology, cardiovascular, respiratory, immune, digestive, skeletal muscle and reproductive systems.

NUTRS 552: Advanced Vertebrate Physiology II
(Cross-listed with AN S, KIN). (3-0) Cr. 3. S.
Prereq: BIOL 335; credit or enrollment in BBMB 404 or BBMB 420
Cardiovascular, renal, respiratory, and digestive physiology.

NUTRS 561: Medical Nutrition and Disease I
(4-0) Cr. 4. F.
Prereq: FS HN 360, FS HN 361, FS HN 367, BIOL 256 and 256L or BIOL 306 or BIOL 335
(Dual listed with FS HN 461.) Pathophysiology of selected chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state.

NUTRS 562: Assessment of Nutritional Status
(3-0) Cr. 3.
Prereq: FS HN 461/NUTRS 561 or NUTRS 501
Overview and practical applications of methods for assessing nutritional status, including: theoretical framework of nutritional health and disease, dietary intake, biochemical indices, clinical examination, and body composition.

NUTRS 563: Community Nutrition
(3-0) Cr. 3. F.
Prereq: FS HN 265 or FS HN 360; FS HN 366 recommended
Dual listed with FS HN 463. Survey of current public health nutrition problems among nutritionally vulnerable individuals and groups. Discussion of the multidimensional nature of those problems and of community programs addressing them. Grant writing as a means for funding community nutrition program development. Significant emphasis on written and oral communication at the lay and professional level. Field trip.

NUTRS 564: Medical Nutrition and Disease II
(3-0) Cr. 3-4. S.
Prereq: FS HN 360, FS HN 461, or NUTRS 561.
(Dual listed with FS HN 464.) Pathophysiology of selected acute and chronic disease states and their associated medical problems. Specific attention will be directed to medical nutrition needs of patients in the treatment of each disease state.

NUTRS 597: Nutritional Aspects of Oncology
(Cross-listed with DIET, FS HN). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: B.S. in nutrition, dietetics, biology, or related discipline.
Understanding of basic cancer biology and methodology used to study nutrition and cancer relationships. Using current research as a basis, the role of nutrition in specific cancers will be explored. Students will learn about sources of information for cancer prevention programs, and how to apply this information to clinical patient management.

Courses for graduate students:

NUTRS 618: Vitamins and Minerals
(Cross-listed with AN S). Cr. 2. Alt. S., offered even-numbered years.
Prereq: Biochemistry, physiology, basic nutrition
Understanding molecular aspects of vitamin and mineral metabolism and homeostasis in humans and animals. An in-depth examination of the chemistry of vitamins and minerals, including genetic mutations, proteins involved in absorption and excretion, and their necessity in biological processes.

NUTRS 619: Advanced Nutrition and Metabolism - Protein
(Cross-listed with AN S). (2-0) Cr. 2.
Prereq: BBMB 405
Digestion, absorption, and intermediary metabolism of amino acids and protein. Regulation of protein synthesis and degradation. Integration of cellular biochemistry and physiology of mammalian protein metabolism.

NUTRS 620: Advanced Nutrition and Metabolism - Energy
(Cross-listed with AN S). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: BBMB 405
Energy constituents of feedstuffs and energy needs of animals as related to cellular biochemistry and physiology. Interpretations of classical and current research.

NUTRS 680: Modern Views of Nutrition
Cr. R. Repeatable. F.
Current concepts in nutrition and related fields. Required for all graduate students in nutrition.

NUTRS 690: Special Problems
Cr. arr. Repeatable. F.S.SS.

NUTRS 695: Grant Proposal Writing
(Cross-listed with FS HN). (1-0) Cr. 1. F.
Prereq: 3 credits of graduate course work in food science and/or nutrition
Grant proposal preparation experiences including writing and critiquing of proposals and budget planning. Formation of grant writing teams in food science and/or nutrition. Offered on a satisfactory-fail basis only.

NUTRS 699: Research in Nutritional Sciences
Cr. arr. F.S.SS.
Offered on a satisfactory-fail basis only.

Plant Biology

(Interdepartmental Graduate Major)

The Interdepartmental Plant Biology major (IPB) coordinates graduate education and research in the areas of plant biology including but not limited to plant biochemistry, plant cellular and molecular biology and plant physiology. Graduate study in IPB, leading to the M.S. and Ph.D. Degrees, is offered through eight participating departments: Agronomy, Biochemistry, Biophysics & Molecular Biology, Chemical and Biological Engineering, Chemistry, Ecology, Evolution and Organismal Biology, Genetics Development & Cell Biology, Horticulture, and Plant Pathology.

Research conducted by the faculty and students of the major represents both basic and applied aspects of plant physiology, biochemistry and molecular biology. The experimental approaches represented in the major span the range of complexity from molecular studies, to cellular, organismal and the ecological level (crop monocultures and natural populations). Graduates have a broad understanding of basic, functional plant biology with emphases on fundamental biology, biochemistry, and molecular biology. They are able to address complex research and policy problems in agriculture, biotechnology, and basic plant biology.

All M.S. candidates take a core curriculum comprising courses recommended from the following four categories, attend research seminars, research credits (PLBIO 699 Research), annual Loomis

Distinguished Lecture in Plant Biology and mini-symposium and retreats. Students will take additional courses of interest as directed by their Program of Study (POS) Committee members.

A total of 36 credits including a minimum of 16 course credits are required for a M.S.

(1) Complete the following core courses:

STAT 401	Statistical Methods for Research Workers	4
BBMB 316	Principles of Biochemistry	3
or BBMB 404	Biochemistry I	
or		
BBMB 504	Amino Acids and Proteins	
BBMB 505	Bioenergetics and Metabolism	
GDCB 513	Plant Metabolism	2
Two seminar presentations *		
GDCB 545	Plant Molecular, Cell and Developmental Biology	3
Take additional courses from the following		
AGRON 516	Crop Physiology	
GR ST 529	Preparing Publishable Thesis Chapters	
AGRON 625	Genetic Strategies in Plant Breeding	
BBMB 405	Biochemistry II	
BBMB 607	Plant Biochemistry	
BBMB 645	Molecular Signaling	
BBMB 660	Membrane Biochemistry	
BBMB 675	Nucleic Acid Structure and Function	
BBMB 676	Biochemistry of Gene Expression in Eucaryotes	
BIOL 454	Plant Anatomy	
BIOL 474	Plant Ecology	
EEOB 563	Molecular Phylogenetics	
EEOB 566	Molecular Evolution	
GDCB 510	Transmission Genetics	
EEOB 553	Agrostology	
GDCB 511	Advanced Molecular Genetics	
GDCB 528	Advances in Molecular Cell Biology	
GDCB 545	Plant Molecular, Cell and Developmental Biology	

* enroll each term in the Interdepartmental Plant Biology seminar PLBIO 696 Research Seminar or its listed equivalent. The first seminar must be during the student's first year and is a 20-minute seminar. The last presentation must be an exit seminar.

All Ph.D. candidates take a core curriculum comprising courses recommended from the following four categories, attend research seminars, research credits (PLBIO 699 Research), annual Loomis

Distinguished Lecture in Plant Biology and mini-symposium and retreats. Students will take additional courses of interest as directed by their Program of Study (POS) Committee members.

A total of 72 credits including a minimum of 24 course credits are required for a Ph.D.

STAT 401	Statistical Methods for Research Workers	4
BBMB 404	Biochemistry I	3
or		4
BBMB 504	Amino Acids and Proteins	
BBMB 505	Bioenergetics and Metabolism	
GDCB 513	Plant Metabolism	2
Four seminar presenatations *		
One of the following		
BBMB 405	Biochemistry II	
GDCB 511	Advanced Molecular Genetics	
GDCB 545	Plant Molecular, Cell and Developmental Biology	
Take additional courses from the following		
AGRON 516	Crop Physiology	
GR ST 529	Preparing Publishable Thesis Chapters	
PLBIO 513	Plant Metabolism	2
PLBIO 545	Plant Molecular, Cell and Developmental Biology	3
PLBIO 696	Research Seminar	1
PLBIO 699	Research	arr †
AGRON 625	Genetic Strategies in Plant Breeding	
BBMB 405	Biochemistry II	
BBMB 607	Plant Biochemistry	
BBMB 645	Molecular Signaling	
BBMB 660	Membrane Biochemistry	
BBMB 675	Nucleic Acid Structure and Function	
BBMB 676	Biochemistry of Gene Expression in Eucaryotes	
BIOL 454	Plant Anatomy	
BIOL 474	Plant Ecology	
EEOB 563	Molecular Phylogenetics	
EEOB 566	Molecular Evolution	
GDCB 510	Transmission Genetics	
GDCB 511	Advanced Molecular Genetics	
GDCB 528	Advances in Molecular Cell Biology	
GDCB 545	Plant Molecular, Cell and Developmental Biology	

† Arranged with instructor.

* enroll each term in the Interdepartmental Plant Biology seminar PLBIO 696 Research Seminar or its listed equivalent. The first seminar must be during the student's first year and is a 20-minute seminar. The last presentation must be an exit seminar.

Requirements for students seeking Plant Biology as Minor:

STAT 401	Statistical Methods for Research Workers	4
BBMB 404	Biochemistry I	3
or		4
BBMB 504	Amino Acids and Proteins	
BBMB 505	Bioenergetics and Metabolism	
9 credits from the following		
AGRON 516	Crop Physiology	
BBMB 607	Plant Biochemistry	
GDCB 513	Plant Metabolism	
GDCB 545	Plant Molecular, Cell and Developmental Biology	

In addition to the required core courses, a wide selection of courses is available to IPB graduate students for broadening their scientific education. Decisions about which courses are taken and when they are taken are made by the student, initially in consultation with his or her temporary advisor, and then with his or her major advisor and eventually with the POS Committee, which also serves as the Thesis or Dissertation Committee.

Courses primarily for graduate students, open to qualified undergraduates:

PLBIO 513: Plant Metabolism
(Cross-listed with GDCB). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: BIOL 330, PHYS 111, CHEM 331; one semester of biochemistry recommended
Photosynthesis, respiration, and other aspects of plant metabolism.

PLBIO 545: Plant Molecular, Cell and Developmental Biology
(Cross-listed with GDCB, MCDB). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: Biol 313, BIOL 314, BIOL 330 or BBMB 405
Plant nuclear and organelle genomes; regulation of gene expression; hormone signaling; organization, function, and development of plant cells and subcellular structures; regulation of plant growth and development.

Courses for graduate students:

PLBIO 696: Research Seminar
(Cross-listed with AGRON, BBMB, FOR, GDCB, HORT). Cr. 1. Repeatable. F.S.
Research seminars by faculty and graduate students. Offered on a satisfactory-fail basis only.

PLBIO 699: Research
Cr. arr. Repeatable.

Seed Technology and Business

(Interdepartmental Graduate Major)

The Graduate Program in Seed Technology and Business offers students advanced study in the seed science and technology and business management appropriate for application in the seed sector. The program is offered by nine departments in the Colleges of Business and Agriculture and Life Sciences: Accounting, Agronomy, Finance, Horticulture, Logistics, Operations, and Management Information Systems, Management, Marketing and Plant Pathology. This multidisciplinary program offers a focused online curriculum for a Master of Science in Seed Technology and Business, along with Graduate Certificates in Seed Science and Technology and in Seed Business Management.

Online Graduate Program in Seed Technology & Business

The curriculum offers a set of scientific and technical courses that are focused on seed, with a set of basic management courses, similar to those in the core courses of an MBA program. The business courses will use examples drawn from the seed industry. A creative component is required for the Master of Science degree.

Prerequisite for the program is a bachelor's degree in business, agriculture, other biological discipline, or related degrees. Graduate training in these disciplines will also be considered.

Graduates of the Graduate Program in Seed Technology and Business will be prepared for roles in management and leadership within private and public seed and seed-related organizations.

All of the courses listed below are required for the Master of Science degree. The pace of the course sequence is designed to allow the students with work and other commitments to participate. Students will complete the creative component under the guidance of their Program of Study Committee. In many cases, the creative component topic will be associated with the student's work.

Graduates of the Master of Science curriculum will be prepared for roles in management and leadership within seed related organizations, private and public.

Master of Science in Seed Technology and Business

STB 501	Strategic Management	2
STB 503	Information Systems	2
STB 504	Marketing and Logistics	3
STB 507	Organizational Behavior	2

STB 508	Accounting and Finance	3
STB 509	Seed Trade, Policy and Regulation	3
STB 510	Crop Improvement	3
STB 534	Seed and Variety, Testing and Technology	2
STB 535	Introduction to the Seed Industry	1
STB 539	Seed Conditioning and Storage	2
STB 536	Quantitative Methods for Seed	2
STB 543	Seed Physiology	2
STB 547	Seed Production	2
STB 592	Seed Health Management	2
STB 595	Seed Quality, Production, and Research Management	3
STB 599	Creative Component	2-3

The program also offers two graduate certificates:

Graduate certificate in Seed Science and Technology

STB/AGRON 535	Introduction to the Seed Industry	1
STB/AGRON 536	Quantitative Methods for Seed	2
STB/AGRON 510	Crop Improvement	3
STB/HORT 543	Seed Physiology	2
STB/PL P 592	Seed Health Management	2
STB/AGRON 547	Seed Production	2
STB/AGRON 534	Seed and Variety, Testing and Technology	2
STB/AGRON 539	Seed Conditioning and Storage	2
STB/AGRON 595	Seed Quality, Production, and Research Management	3

Graduate certificate in Seed Business Management

STB/AGRON 535	Introduction to the Seed Industry	1
STB/BUSAD 501	Strategic Management	2
STB/BUSAD 503	Information Systems	2
STB/BUSAD 504	Marketing and Logistics	3
STB/BUSAD 507	Organizational Behavior	2
STB/BUSAD 508	Accounting and Finance	3
STB/BUSAD 509	Seed Trade, Policy and Regulation	3

Graduate certificate courses may be applied to the Master of Science in Seed Technology and Business. Those interested in these graduate certificates should contact the Program for details.

Information on application procedures and specific requirements of the major can be obtained at our website: http://www.seedgrad.iastate.edu or by writing to seedgrad@iastate.edu (//seedgrad@iastate.edu).

Courses primarily for graduate students, open to qualified undergraduates:

STB 501: Strategic Management
(Cross-listed with BUSAD). (2-0) Cr. 2.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Critical analysis of current practice and case studies in strategic management with an emphasis on integrative decision making. Strategy formulation and implementation will be investigated in the context of complex business environments.

STB 503: Information Systems
(Cross-listed with BUSAD). (2-0) Cr. 2.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Introduction to a broad variety of information systems (IS) topics, including current and emerging developments in information technology (IT), IT strategy in the context of corporate strategy, and IS planning and development of enterprise architectures. Cases, reading, and discussions highlight the techniques and tactics used by managers to cope with strategic issues within an increasingly technical and data-driven competitive environment.

STB 504: Marketing and Logistics
(Cross-listed with BUSAD). (3-0) Cr. 3.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Integration of the business functions concerned with the marketing and movement of goods along the supply chain with the primary goal of creating value for the ultimate customer. Coordination of marketing, production, and logistics activities within the firm and with outside suppliers and customers in the supply chain.

STB 507: Organizational Behavior
(Cross-listed with BUSAD). (2-0) Cr. 2.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Understanding human behavior in organizations, and the nature of organizations from a managerial perspective. Special emphasis on how individual differences, such as perceptions, personality, and motivation, influence individual and group behavior in organizations and on how behavior can be influenced by job design, leadership, groups, and the structure of organizations.

STB 508: Accounting and Finance
(Cross-listed with BUSAD). (3-0) Cr. 3.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Survey of fundamental topics in accounting and finance. Financial statement reporting and analysis for agriculture firms, corporate governance issues related to financial reporting, (e.g., Sarbanes-Oxley). Basic tools and techniques used in financial management, including stock and bond valuation. How to assess and use capital budgeting methods to evaluate proposed firm investments.

STB 509: Seed Trade, Policy and Regulation
(Cross-listed with BUSAD). (3-0) Cr. 3.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
Cultural, financial, economic, political, legal/regulatory environments shaping an organization's international business strategy. Topics include entry (and repatriation) of people, firms, goods, services, and capital. Special attention to the institutions of seed regulation and policy. Ethical issues facing managers operating in an international context.

STB 510: Crop Improvement
(Cross-listed with AGRON). (3-0) Cr. 3.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
A study of the basic principles and methods in the genetic improvement of crop plants. Methods used in manipulating genomes through the use of biotechnology. Methods of cultivar development. Quantitative procedures for describing response to selection. Analysis of the relationship of reproductive characters and growth characteristics to response to selection.

STB 534: Seed and Variety, Testing and Technology
(Cross-listed with AGRON). (2-0) Cr. 2.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
The components of seed quality and how they are assessed in the laboratory, including traits derived from modern biotechnology. The impact of new technologies on seed quality testing. Variety maintenance procedures and breeder seed. Variety identification: phenotype and grow-out trials, isozyme testing, and DNA marker testing. Procedures for evaluating varieties. The variance tests appropriate for fixed effects analysis of variance. Statistical inference and stratification for yield trials. Use of strip plot testing.

STB 535: Introduction to the Seed Industry
(Cross-listed with AGRON). Cr. 1.
Prereq: Admission to MS in Seed Technology and Business program or by special arrangement with the instructor
An analysis of the defining characteristics of the seed industry and introduction to the Master in Seed Technology and Business curriculum. The tasks of crop improvement and seed production will be analytically related to basic management functions and classifications of management activities that are used in the study of business administration. Management tasks and roles will be analyzed in related to the public policy issues that shape the seed industry, including ethical and economical approaches to biotechnology, intellectual property, and corporate responsibility.

STB 536: Quantitative Methods for Seed
(Cross-listed with AGRON). (2-0) Cr. 2. F.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
Quantitative Methods for analyzing and interpreting agronomic and business information for the seed industry. Principles of experimental design and hypothesis testing, regression, correlation, analysis of variance, and graphical representation of data. Use of spreadsheets and statistical software for manipulating, analyzing and presenting data.

STB 539: Seed Conditioning and Storage
(Cross-listed with AGRON). (2-0) Cr. 2.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
The technical operations which may be carried out on a seed lot from harvest until it is ready for marketing and use. The opportunities for quality improvement and the risks of deterioration which are present during that time. Analysis of the costs of and benefits of operations. Evaluation of equipment based on benefits to the customer and producer. Interpretation of the role of the conditioning plant and store as a focal points within the overall operations of a seed company.

STB 543: Seed Physiology
(Cross-listed with HORT). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: Admission to the Graduate Seed Technology and Business Program or approval of the instructor
Brief introduction to plant physiology. Physiological aspects of seed development, maturation, longevity, dormancy and germination. Links between physiology and seed quality.

STB 547: Seed Production
(Cross-listed with AGRON). (2-0) Cr. 2.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
Survey of crop production; including management of soil fertility, planting dates, populations, weed control, and insect control. Analysis of the principles of seed multiplication and the key practices which are used to ensure high quality in the products. Field inspection procedures and production aspects that differ from other crop production. Foundation seed production. Analysis of the typical organization of field production tasks. Resources and capabilities required. Survey of differences in seed production strategies between crops and impact of differences on management of seed production.

STB 592: Seed Health Management
(Cross-listed with PL P). (2-0) Cr. 2. Alt. S., offered even-numbered years.
Prereq: Admission to the Graduate Program in Seed Technology and Business/Consent of instructor
Munkvold. Occurrence and management of diseases during seed production, harvest, conditioning, storage, and planting. Emphasis on epidemiology, disease management in the field, seed treatment, effects of conditioning on seed health, and seed health testing. Credit may not be obtained for both Pl P/STB 592 and Pl P 594.

STB 595: Seed Quality, Production, and Research Management
(Cross-listed with AGRON). (3-0) Cr. 3.
Prereq: Admission to the Seed Technology and Business Master's Degree Program or approval of the instructor
Advanced survey of the organization, staff capabilities and management characteristics typical in seed production and crop improvement in seed enterprises. Analysis of the use of quality information in the management of seed operations and sales. Process management applications for seed. Production planning for existing capacity. Analysis of the manager's tasks in the annual cycle and how the tasks of these managers relate to the general categories of business management roles. Difference in management strategies used with different situations and groups of employees.

STB 599: Creative Component
Cr. 2-3.
Prereq: Admission to the Master's in Seed Technology and Business degree program and permission of the instructor
A written report based on research, library readings, or topics related to the student's area of specialization and approved by the student's advisory committee.

Toxicology

toxmajor@iastate.edu (//toxmajor@iastate.edu)

Interdepartmental Graduate Major

Toxicology is the science of studying the adverse effects of substances on living organisms. Students observe, gather data and predict risks and outcomes in populations. Whole organism research and cellular and molecular approaches are used to determine toxicant exposure and mechanisms. Work is offered for the degrees doctor of philosophy and master of science. Students majoring in toxicology will be affiliated with one of the following cooperating departments: Agricultural and Biosystems Engineering; Animal Science; Biochemistry, Biophysics and Molecular Biology; Biomedical Sciences; Chemistry; Entomology; Food Science and Human Nutrition; Genetics, Development and Cell Biology; Geological and Atmospheric Sciences; Natural Resource Ecology and Management; Physics; Plant Pathology and Microbiology; Veterinary Diagnostic and Production Animal Medicine; Veterinary Microbiology and Preventive Medicine; and Veterinary Pathology.

The prerequisites for entrance into the graduate toxicology major include an undergraduate degree in a relevant area of study; for example, chemical engineering, biology, biochemistry, chemistry, ecology, entomology, food science and technology, microbiology, nutritional science, zoology, or veterinary medicine. Minimum undergraduate coursework should include the following or their equivalent:

- 1 year of college mathematics, including calculus
- 1 year of inorganic chemistry with quantitative analysis
- 1 course in physics
- 1 year of organic chemistry
- 2 years of biological sciences including 1 course in physiology

Other courses that are considered desirable in undergraduate preparation include: biochemistry, physical chemistry, qualitative analysis, and some specialized courses such as histology or advanced physiology.

Facilities and faculty are available for fundamental research in such areas as agricultural toxicology, drug discovery and prevention, ecotoxicology, environmental fate and effects of chemicals, insect toxicology, aquatic toxicology, food safety, nutritional toxicology, mycotoxins, neurotoxicology, cellular and molecular toxicology, reproductive toxicology, and veterinary toxicology.

Ph.D. and M.S. Students should register for TOX 689 (R) every fall and spring semester during their training.

Students majoring in toxicology will be affiliated with a cooperating department. All Ph.D. students take a core curriculum consisting of:

TOX 501	Principles of Toxicology	3
TOX 502	Toxicology Methods	3
TOX 504	Toxicology Seminar (taken twice)	1
7 additional credits in approved toxicology courses		7

BBMB 405	Biochemistry II (2 additional credits of biochemistry courses)	
BBMB 404	Biochemistry I	
2 additional credits of upper level BBMB coursework. 3 credits in physiology, histology, pathology, neuroscience, immunobiology or cellular and molecular biology.		2 and 3
STAT 401	Statistical Methods for Research Workers	4
STAT 402	Statistical Design and the Analysis of Experiments	3
GR ST 565	Responsible Conduct of Research in Science and Engineering (or)	1
V PTH 554	Ethics in Scientific Research and Writing	1

M.S. students take a core of:

TOX 501	Principles of Toxicology	3
TOX 502	Toxicology Methods	3
TOX 504	Toxicology Seminar	1
3 additional credits in approved toxicology courses		3
BBMB 404	Biochemistry I	3
BBMB 405	Biochemistry II	3
STAT 401	Statistical Methods for Research Workers	4
Additional coursework is selected to meet departmental requirements and to satisfy individual student research interestes		
GR ST 565	Responsible Conduct of Research in Science and Engineering (or)	1
V PTH 554	Ethics in Scientific Research and Writing	1

A graduate minor in toxicology is available for students enrolled in other majors.

A minor for an M.S. degree includes one semester of TOX 689X and:

TOX 504	Toxicology Seminar	1
TOX 501	Principles of Toxicology	3
3 credits in other approved toxicology courses		3

A minor at the Ph.D. level includes one semester of TOX 689X and:

TOX 504	Toxicology Seminar	1
TOX 501	Principles of Toxicology	3
6 credits in other approved toxicology course work		6

One member of the student's program of study committee will be a member of the toxicology faculty.

Most students awarded doctoral degrees continue their training as postdoctoral associates at major research institutions in the U.S. or abroad in preparation for research and/or teaching positions in academia, industry, the military, veterinary research, or government environmental and public health institutions. A few go directly to permanent research positions in industry. Many students awarded master's degrees continue their training as doctoral students; however, some choose research support positions (i.e., technician, chemist, research associate) in academia, industry, or government. A more thorough list of outcomes is available at our Web site.

Graduates of the Toxicology major will be able to carefully design, execute and analyze experiments that extend the knowledge of toxicology and closely related sciences. They will be able to clearly communicate research findings, and thoroughly evaluate the literature of toxicology, contributing significantly to the advancement of the field.

Courses primarily for undergraduates:

TOX 354: General Pharmacology
(Dual-listed with TOX 554). (Cross-listed with B M S). (3-0) Cr. 3. S.
Prereq: B M S 549 and B M S 552; BBMB 404, BBMB 405
General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems.

TOX 401: Principles of Toxicology
(Dual-listed with TOX 501). (3-0) Cr. 3. F.
Prereq: BBMB 404 or equivalent
Principles of toxicology governing entry, fate, and effects of toxicants on living systems. Includes toxicokinetics and foreign compound metabolism relative to toxification or detoxification. Fundamentals of foreign compound effects on metabolism, physiology, and morphology of different cell types, tissues, and organ systems.

TOX 419: Foodborne Hazards
(Cross-listed with FS HN, MICRO). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: MICRO 201 or MICRO 302, a course in biochemistry
Pathogenesis of human microbiological foodborne infections and intoxications, principles of toxicology, major classes of toxicants in the food supply, governmental regulation of foodborne hazards. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

TOX 420: Food Microbiology
(Cross-listed with FS HN, MICRO). (3-0) Cr. 3.
Prereq: MICRO 201 or MICRO 302
Effects of microbial growth in foods. Methods to control, detect, and enumerate microorganisms in food and water. Foodborne infections and intoxications.

TOX 426: Veterinary Toxicology

(Dual-listed with TOX 526). (Cross-listed with VDPAM). (3-0) Cr. 3. S.

Prereq: Third year classification in veterinary medicine

Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials.

TOX 429: Foodborne Toxicants

(Dual-listed with TOX 529). (2-0) Cr. 2. Alt. F., offered odd-numbered years.

Prereq: A course in biochemistry

Mechanisms of action, metabolism, sources, remediation or detoxification, risk assessment of major foodborne toxicants of current interest, design of HACCP plans for use in food industries targeting foodborne toxicants. Taught online only.

TOX 490: Independent Study

Cr. 1-2. Repeatable. F.S.SS.

Prereq: Permission of instructor is required prior to registration.

Independent study with a faculty mentor. Intended for students enrolled in the Pharmacology and Toxicology minor. Students in the Pharmacology and Toxicology minor may use no more than 9 credits of university-wide 490 credits towards the total of 120 credits required for graduation.

TOX 499: Undergraduate Research

Cr. 1-3. Repeatable, maximum of 3 credits. F.S.SS.

Prereq: Permission of instructor is required prior to registration.

Independent research under faculty guidance. Intended for students enrolled in the Pharmacology and Toxicology minor. Offered on a satisfactory-fail basis only. Students may use no more than 9 credits of university-wide 499 credits towards the total of 120 credits required for graduation.

Courses primarily for graduate students, open to qualified undergraduates:

TOX 501: Principles of Toxicology

(Dual-listed with TOX 401). (3-0) Cr. 3. F.

Prereq: BBMB 404 or equivalent

Principles of toxicology governing entry, fate, and effects of toxicants on living systems. Includes toxicokinetics and foreign compound metabolism relative to toxification or detoxification. Fundamentals of foreign compound effects on metabolism, physiology, and morphology of different cell types, tissues, and organ systems.

TOX 502: Toxicology Methods

(0-6) Cr. 3. Alt. S., offered even-numbered years.

Prereq: TOX 501

Provides demonstrations or laboratory experience in the application of methods used in toxicology, including safety procedures, calculation and data analysis, teratologic and morphologic evaluation, cellular/molecular toxicological techniques, electrophysiologic measures, in vitro enzyme induction/biotransformation, neural and behavioral toxicology testing.

TOX 504: Toxicology Seminar

(1-0) Cr. 1. Repeatable, maximum of 2 credits. F.S.SS.

Prereq: Permission of instructor required

Presentation of a seminar about a current topic in toxicology as part of a weekly series of seminars by graduate students, faculty, and guest lecturers from off campus. Graduate student speakers will meet with the instructor at least one week prior to their formal presentation.

TOX 506: Diet and Cancer Prevention

(Cross-listed with NUTRS). (1-0) Cr. 1. Alt. F., offered even-numbered years.

Prereq: BBMB 404 and BBMB 405 or BBMB 420

Principles of cancer biology and cancer etiology will be integrated with the impacts of diet on cancer development and prevention. Contributions of research with humans, animals, cultured cells and cell free systems will be included. The importance of dietary contaminants, macronutrients and micronutrients will be examined with an emphasis on the strength of the evidence and mechanisms of action.

TOX 515: Regulatory Toxicology

(1-0) Cr. 1. Alt. F., offered even-numbered years.

Prereq: BBMB 404 or FSHN 403

Survey of approaches used by toxicologists in government and industry for generating, enforcing and complying with laws and regulations. Regulatory policies and decision making. Toxicological risk assessment and risk analysis. Taught online only.

TOX 519: Food Toxicology

(Cross-listed with FS HN, NUTRS). (3-0) Cr. 3. Alt. F., offered even-numbered years.

Prereq: A course in biochemistry

Basic principles of toxicology. Toxicants in the food supply: modes of action, toxicant defense systems, toxicant and nutrient interactions, risk assessment. Assessed service learning component. Only one of FS HN 419 and FS HN 519 may count toward graduation.

TOX 526: Veterinary Toxicology
(Dual-listed with TOX 426). (Cross-listed with VDPAM). (3-0) Cr. 3. S.
Prereq: Third year classification in veterinary medicine
Study of toxicological diseases of animals emphasizing clinical recognition, circumstances of poisoning, differential diagnosis with clinical and laboratory data, therapeutic procedures, preventive management and public health implications. Supplemented with case-based materials.

TOX 529: Foodborne Toxicants
(Cross-listed with FS HN). (2-0) Cr. 2. F.
Prereq: A course in biochemistry; enrollment in GP-IDEA Food Safety and Defense Graduate Certificate or permission of instructor.
Mechanisms of action, metabolism, sources, remediation/detoxification, risk assessment of major foodborne toxicants of current interest, design of HAACP plans for use in food industries targeting foodborne toxicants, discussion of toxicants from a food defense perspective. Offered online only.

TOX 546: Clinical and Diagnostic Toxicology
(Cross-listed with VDPAM). (0-3) Cr. 1-3. Repeatable. F.S.SS.
Prereq: D.V.M. degree or VDPAM 526
Advanced study of current problems and issues in toxicology. Emphasis on problem solving utilizing clinical, epidemiological, and laboratory resources.

TOX 550: Pesticides in the Environment
(Cross-listed with ENT). (2-0) Cr. 2. S.
Prereq: 9 credits of biological sciences
Fate and significance of pesticides in soil, water, plants, animals, and the atmosphere.

TOX 554: General Pharmacology
(Dual-listed with TOX 354). (Cross-listed with B M S). (3-0) Cr. 3. S.
Prereq: B M S 549 and B M S 552; BBMB 404, BBMB 405
General principles; drug disposition; drugs acting on the nervous, cardiovascular, renal, gastrointestinal, and endocrine systems.

TOX 565: Methods in Biostatistics and Epidemiology
(Cross-listed with STAT). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: STAT 500 or STAT 401; STAT 543 or STAT 447
Statistical methods commonly used in epidemiology and human and animal health studies. Overview of cohort studies, case-control studies and randomized clinical trials. topics include inference procedures for disease risk factors, analysis of time-to-event and survival data, analysis of longitudinal studies of disease progression and health status, approaches to handling missing data, and meta-analysis. Examples will come from recent studies of physical and mental health, nutrition and disease progression in human and animal populations. Use of statistical software: SAS or R.

TOX 570: Risk Assessment for Food, Agriculture and Veterinary Medicine
(Cross-listed with AGRON, VDPAM). (3-0) Cr. 3. F.
Prereq: Statistics 300-level or higher.
Risk assessment principles as applied to biological systems. Exposure and effects characterization in human and animal health and ecological risk assessment. Risk analysis frameworks and regulatory decision-making. Introduction to quantitative methods for risk assessment using epidemiological and distributional analysis. Uncertainty analysis. This course is available only by distance.

TOX 575: Cell Biology
(Cross-listed with B M S). (3-0) Cr. 3. F.
Prereq: 10 credits in biological science and permission of instructor
A multi-instructor course covering major topics in cell structure and function, including: universal features of prokaryotic and eukaryotic cells, types of utilization and conversion of energy, genetic control of cell shape and functionality, internal organization of cells, communication between cells and their environment, development of multicellular systems. Students have to write a term paper.

TOX 590: Special Topics
Cr. arr. Repeatable.
Contact individual faculty for special projects or topics. Graded.

Courses for graduate students:

TOX 626: Advanced Food Microbiology
(Cross-listed with FS HN, MICRO). (3-0) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Topics of current interest in food microbiology, including new foodborne pathogens, rapid identification methods, effect of food properties and new preservation techniques on microbial growth, and mode of action of antimicrobials.

TOX 627: Rapid Methods in Food Microbiology
(Cross-listed with FS HN, MICRO). (2-0) Cr. 2. Alt. F., offered even-numbered years.
Prereq: FS HN 420 or FS HN 421 or FS HN 504
Provides an overview of rapid microbial detection methods for use in foods. Topics include historical aspects of rapid microbial detection, basic categories of rapid tests (phenotypic, genotypic, whole cell, etc.), existing commercial test formats and kits, automation in testing, sample preparation and "next generation" testing formats now in development.

TOX 656: Cellular and Molecular Pathology II
(Cross-listed with V PTH). (3-0) Cr. 3. Alt. S., offered even-numbered years.
Prereq: Graduate course in biochemistry, genetics, or cell biology
Cellular and molecular mechanisms of carcinogenesis.

TOX 675: Insecticide Toxicology
(Cross-listed with ENT). (2-3) Cr. 3. Alt. F., offered odd-numbered years.
Prereq: ENT 555 or TOX 501
Principles of insecticide toxicology; classification, mode of action, metabolism, and environmental effects of insecticides.

TOX 689: Current Topics in Toxicology
Cr. R. Repeatable. F.S.
Lecture and discussion participation on current topics in toxicology. An 80% attendance is expected to satisfactorily complete the course. Offered on a satisfactory-fail basis only.

TOX 697: Graduate Research Rotation
(0-12) Cr. 1-12. Repeatable, maximum of 3 times. F.S.SS.
Prereq: Admission to Toxicology graduate program
Graduate research projects performed under the supervision of selected faculty members in the graduate Toxicology major.

TOX 699: Research
Cr. arr. Repeatable. F.S.SS.
Research.

Transportation

(Interdepartmental Graduate Major)

Work is offered for the degree master of science with a major in transportation under a cooperative arrangement with various departments including Civil, Construction and Environmental Engineering (CCEE), Community and Regional Planning (CRP), and Logistics, Operations and Management Information Systems (LOMIS). Opportunities are afforded for research in such areas as modeling and performance of transportation systems, highway safety and information systems, remote sensing, environmental analysis, techniques for urban and regional transportation system planning, environmental and social policy analysis of transportation systems, transportation policy analysis, analysis of transportation technologies, commodity distribution, public administration of the transportation planning process, regional development and transportation system interrelationships, transportation economics and finance, and planning for logistics management.

Students majoring in transportation will develop a program of study under the guidance of a program of study committee selected by the student in consultation with and approved by the chair of the faculty supervisory committee. For administrative purposes, the student's home department will be the department originally admitting the student. A major professor may be selected from any of the three participating departments. A student must designate at least one member of the POS committee from his or her home department, and at least one member from outside the home department.

A student must complete at least 34 credits of acceptable work including preparation of a 6 credit thesis or a 2-3 credit creative component. A structured minor requires 12 credits of approved transportation courses and a thesis or creative component on a transportation related topic.

A required core includes:

C E 551	Urban Transportation Planning Models	3
TRANS 691	Seminar in Transportation Planning	1
STAT 401	Statistical Methods for Research Workers	4
one course from all three cooperating departments (CRP, CCEE, and LOMIS)		

Detailed requirements are available from the chair of the supervisory committee.

Graduate students pursuing a major in any of the cooperating departments who have an interest in transportation are encouraged to consider a formal declared minor in transportation. Students considering a declared minor should consult with the chair of the supervisory committee about the requirements for it.

Students typically focus their program of study to support a career in one of five areas: transportation consulting, regional and statewide transportation planning, transportation service operations and management, transportation policy and economic analysis, and transportation planning and operation for local and state governments. Graduates will have specific knowledge in one or more of these focus areas and the skills to conduct research and analysis of transportation issues. These skills allow graduates to be productive immediately in positions related to a focus area or to continue in more advanced transportation graduate work.

Courses primarily for graduate students, open to qualified undergraduates:

TRANS 555: Economic Analysis of Transportation Investments
(3-0) Cr. 3.
Prereq: C E 350 or C E 355
Application of economic analysis methodologies to evaluate transportation projects. Multi-modal approaches to evaluate impacts of transportation investments and maximize economic efficiency while considering equity and other social issues related to investment options.

TRANS 599: Creative Component
Cr. 1-3.
Prereq: Pre-enrollment contract required
Advanced topic for creative component report in lieu of thesis.

Courses for graduate students:

TRANS 691: Seminar in Transportation Planning
Cr. 1. Repeatable. S.
Provides an overview of current transportation issues; speakers provide seminars on a variety of timely transportation topics.

TRANS 699: Research
Cr. arr. Repeatable.

Wind Energy Science, Engineering and Policy

Graduate Study

Wind Energy Science, Engineering and Policy (WESEP) is an interdisciplinary Ph.D. program that prepares graduates for wind energy related careers in industry, academia, and government institutions. WESEP is a unique integration of engineering, science, and policy-related disciplines that provides students with an opportunity for breadth and depth in their program of study.

Students take a set of 11 courses and participate each semester in a one-credit seminar course. Of the 11 courses, two courses are introductory wind energy courses, eight are core courses, and one is an advanced specialization course in wind energy. The seminar course will address research methods and communications in science and engineering. Students are also required to pass a qualifying examination in the first 18 months of their program, a preliminary examination generally taken by the end of year three, and a final oral defense with written dissertation to complete the program.

Of the eight core courses, students select five courses from a primary thrust area, providing disciplinary depth, and three courses from a secondary thrust area, providing interdisciplinary breadth. Students can take additional courses within the other thrust areas as needed for their research, but this requirement ensures students are research-capable in two thrust areas.

WESEP Thrust areas

- Wind resource characterization and aerodynamics of wind farms
- Wind energy conversion system and grid operations
- Manufacturing, construction, and supply chain
- Turbine reliability & health monitoring
- Economics, policy and public perception

Admission Requirements

Applicants should have an undergraduate GPA of at least 3.0 (B average) and a B.S. degree from a calculus-based undergraduate curriculum. A calculus-based undergraduate curriculum is one in which students take the equivalent of two years of calculus, covering differential and integral calculus, multivariable and vector calculus, and differential equations, and one year of physics, covering mechanics, thermodynamics, electric circuits, electromagnetics, and optics. The GRE is not required. Applicants who do not meet these general standards will be evaluated on an individual basis.

Courses primarily for graduate students, open to qualified undergraduates:

WESEP 501: Wind Energy Resources
(3-0) Cr. 3.
Prereq: Graduate standing
Forecasting, wind measurement and analysis, site placement, aerodynamic principles associated with blade design, power generation technologies, power electronic topologies used in wind energy conversion, collection circuits, and grid operation with high wind penetration.

WESEP 502: Wind Energy Systems
(3-0) Cr. 3.
Prereq: Graduate standing
Systems approach to wind turbine design, manufacturing, installation, integrated with wind economics and policy issues. Topics include manufacturing practices used to produce wind turbines, construction practices, sensing and inspection technologies used in monitoring wind farm health, and the impact of policy making on the wind energy industry.

WESEP 511: Wind Energy System Design
(3-0) Cr. 3.
Prereq: WESEP 501 and WESEP 502
Advanced design, control, and operation of wind plants. Topics include electromechanical energy conversion systems, aerodynamic and aeroelastic loads, optimal control of wind farms, life cycle management strategies, tall tower design, and prediction of component residual life.

WESEP 590: Special Topics
Cr. 1-3. Repeatable.
Advanced study of a research topic in the field of wind energy, science, engineering, and policy.

WESEP 594: Wind Energy Real-Time Research Collaborative Seminar
(1-0) Cr. 1. Repeatable. F.S.
Prereq: Graduate standing
Identifying current wind energy research issues and conducting components of the research cycle in real-time, including proposal development, investigation/analysis/discovery, publication and presentation, ethical behavior, and leadership.

Interdisciplinary Undergraduate and Graduate Programs

Locate information for each program from the A-Z catalog index.

Honors Program

The Honors Program provides a vehicle for highly motivated and able students to pursue an innovative and challenging undergraduate education. Oversight of students' progress is primarily the responsibility of the undergraduate colleges. The college Honors Program committees approve programs of study and are responsible for program administration. The University Honors Program Committee, which includes the chairs of the college programs, is responsible for the general coordination of the college Honors Programs and the First-Year Honors Program.

Students in the Honors Program are given a variety of academic opportunities to help them benefit fully from their undergraduate education. To enhance their individualized programs of study, students are offered honors courses, seminars, and opportunities for independent research.

Honors courses and honors sections of regular courses are offered by several departments and programs. These courses often have limited enrollment. Most of these courses are listed by department or program. (See for example Economics, Engineering, English, Mathematics, Physics, and Speech Communication.) Specific information about the full range of honors courses and seminars for the current academic year, including the honors courses offered by individual departments and programs, may be obtained from the Honors Program Office, 2130 Jischke Honors Building.

In addition to taking established honors courses, honors students may designate a course as an honors course with the agreement of the course instructor and obtaining approval from the Honors Program director. Most departments offer opportunities for independent study and research under 290 and 490; when designated by an H, these courses also carry honors credit.

Research grants are available to support honors research.

Courses primarily for undergraduates:

HON 121: First-Year Honors Seminar
(0-2) Cr. 1. F.
Prereq: Membership in the First-Year Honors Program
Orientation to Iowa State University and to the University Honors Program. Offered on a satisfactory-fail basis only.

HON 290: Special Problems
Cr. arr.
Prereq: Membership in and permission of the University Honors Program
Independent study on topics of an interdisciplinary nature. Intended primarily for freshmen and sophomores. Offered on a satisfactory-fail basis only.

HON 290H: Honors
Cr. 1-2. F.S.
Prereq: Membership in and permission of the University Honors Program
Independent study on topics of an interdisciplinary nature. Intended primarily for freshmen and sophomores. Offered on a satisfactory-fail basis only.

HON 290U: Undergraduate Research
Cr. arr. F.S.
Prereq: Membership in and permission of the University Honors Program
Independent study on topics of an interdisciplinary nature. Intended primarily for freshmen and sophomores. Offered on a satisfactory-fail basis only.

HON 302: Honors Leadership Seminar
(1-2) Cr. 2. F.
Prereq: Selection as a leader of a First-Year Honors Seminar
For students serving as leaders of First-Year Honors Seminars, under faculty supervision. Development of teaching and leadership skills within the context of an Honors education experience. Offered on a satisfactory-fail basis only.

HON 321: University Honors Seminars
Cr. 1-2. F.S.
Prereq: Membership in the University Honors Program
Interdisciplinary seminars on topics to be announced in advance. Offered on a satisfactory-fail basis only.

HON 322: University Honors Seminars
Cr. 1-2. F.S.
Prereq: Membership in the University Honors Program
Interdisciplinary seminars on topics to be announced in advance. Offered on a satisfactory-fail basis only.

HON 323: University Honors Seminars
Cr. 1-2. F.S.
Prereq: Membership in the University Honors Program
Interdisciplinary seminars on topics to be announced in advance. Offered on a satisfactory-fail basis only.

HON 324: University Honors Seminars
Cr. 1-2. F.S.
Prereq: Membership in the University Honors Program
Interdisciplinary seminars on topics to be announced in advance. Offered on a satisfactory-fail basis only.

HON 490: Independent Study
Cr. arr. Repeatable. F.S.
Prereq: Membership in and permission of the University Honors Program
Independent study on topics of an interdisciplinary nature. Intended primarily for juniors and seniors.

Iowa Lakeside Laboratory

Interinstitutional Program

Iowa Lakeside Laboratory is run cooperatively by the Iowa Lakeside Laboratory Consortium whose members include Drake University, Iowa State University, the University of Northern Iowa, and the University of Iowa. Lakeside courses can be taken for credit through all Consortium members. Students should check with their advisers to determine whether Lakeside courses can be used to satisfy major or minor requirements or college or university general education requirements.

The Laboratory was established in 1909 for the conservation and study of the rich flora and fauna of northwest Iowa, especially those of the Iowa Great Lakes region with its numerous lakes, wetlands, and prairies. Its campus is located on approximately 140 acres of restored prairie, wetland, and gallery forest along the west shore of West Okoboji Lake. Lakeside's mission is to provide undergraduate and graduate students an opportunity to get hands-on experience working with a variety of natural and human environments through its field-oriented summer courses and to provide research facilities and support for graduate students and faculty working on research projects in northwestern Iowa. Each summer, Iowa Lakeside Laboratory offers students a unique educational experience: small, full-immersion, field-oriented courses in the natural sciences (archaeology, ecology, environmental science, hydrology, evolution, geology, soils, taxonomy). All courses meet all day from Monday through Friday. The majority of courses run for 4 weeks. Enrollments in most courses are limited to 8 to 10 students.

Courses are taught at the undergraduate (sophomore and junior) and the senior/graduate level. Students obtain one credit for each week (40 hours) in class. One and two week courses are also available, including courses designed especially for teachers. Weather permitting, students normally spend at least part of each day doing field work, either as part of their class work or working on individual or group projects. Because some courses are offered intermittently, the current Iowa Lakeside Laboratory summer brochure or the Lakeside Lab Website (www.lakesidelab.org (http://www.lakesidelab.org)) should be consulted for the list of courses being offered in a given summer session. The Lakeside Lab Website (www.lakesidelab.org (http://www.lakesidelab.org)) also contains additional information about the Laboratory and about each course being offered.

Research projects by undergraduates, graduate students and faculty can be done either on the campus or at many nearby natural areas. Undergraduate and graduate students are strongly encouraged to do independent projects at Lakeside and graduate students are welcome to use it as a base for their thesis and dissertation research. Laboratory space and other facilities are available for long-term or short-term research projects.

Teaching and research facilities include eight laboratory buildings, a library, and a lecture hall. Living accommodations include cottages, motel-style units, and a large mess hall. All students are encouraged to stay at Lakeside while they are taking courses to take full advantage of its educational, professional, and social life.

Financial Aid

Iowa Lakeside Laboratory Scholarships are available to both undergraduates and graduate students. All scholarships cover room and board. Information about how to apply for Iowa Lakeside Laboratory Scholarships is included on the Website (www.lakesidelab.org (http://www.lakesidelab.org)). Students should also consult the Student Financial Aid Office for other scholarship, work study, and loan programs for which they are eligible.

Registration

Students can only enroll in Iowa Lakeside Lab courses by submitting an Iowa Lakeside Lab Registration and Scholarship form and Housing form to the Iowa Lakeside Laboratory Administrative Office. These forms are found on the Iowa Lakeside Laboratory Website:(www.lakesidelab.org (http://www.lakesidelab.org)).

Early registration is advisable. Because enrollment in Lakeside courses is limited, students should register before May 1 for the following summer session. Housing is also limited and students must apply for housing or indicate that they plan to live off campus at the time of registration.

Courses primarily for undergraduates:

IA LL 293: Natural History Workshop
Cr. 1-2. SS.
Offered as demand warrants. Five-day-long, nontechnical introductions to a specific aspect of the natural history of the Upper Midwest or techniques for studying natural history.

IA LL 293G: Prairies
Cr. 1-2. SS.
Offered as demand warrants. Five-day-long, nontechnical introductions to a specific aspect of the natural history of the Upper Midwest or techniques for studying natural history.

IA LL 302: Plant-Animal Interactions
Cr. 4. Alt. SS., offered odd-numbered years.
Prereq: One course in the biological sciences
Introduction to ecology and co-evolution of plants and animals; emphasis on dispersal, pollination, and plant-herbivore interactions; field and laboratory work, reading, discussion.

IA LL 303I: Undergraduate Internships
(Cross-listed with NREM). Cr. 1-5. Repeatable. SS.
Prereq: Permission of instructor and sophomore standing
Placement with county conservation boards, camps, parks, etc. for experience as interpreters, rangers, and technicians.

IA LL 312I: Ecology
(Cross-listed with A ECL, ENSCI). Cr. 4. SS.
An introduction to the principles of ecology at the population, community and ecosystem level. Field studies of local lakes, wetlands and prairies are used to examine factors controlling distributions, interactions, and roles of plants and animals in native ecosystems.

IA LL 326I: Ornithology
(Cross-listed with A ECL). Cr. 4. SS.
The biology, ecology, and behavior of birds with emphasis on field studies of local avifauna. Group projects stress techniques of population analysis and methodology for population studies.

IA LL 333: Animals and Their Ecosystems
(4-0) Cr. 4.
Prereq: Introductory biology
Vertebrate and invertebrate animals of the Midwest are observed in nature either through passive observational techniques or active trapping exercises. Once identified, animals are placed in their proper taxonomic position (e.e., put onto the "Tree of Life"). They also are put into ecological perspective, including habitat pereferences (i.e., wetland, lake, prairie, forest, river, edge), trophic position, and activity patterns. Conservation status is discussed.

IA LL 364: Biology of Aquatic Plants
Cr. 4. Alt. SS., offered even-numbered years.
A field-oriented introduction to the taxonomy and ecology of aquatic plants in lakes, wetlands and rivers. Individual or group projects.

IA LL 367: Plant Taxonomy
Cr. 4. SS.
Principles of classification and evolution of vascular plants; taxonomic tools and collection techniques; use of keys. Field and laboratory studies emphasizing identification of local flowering plants and recognition of major plant families.

IA LL 371I: Introduction to Insect Ecology
(Cross-listed with ENT). (3-3) Cr. 4. Alt. SS., offered odd-numbered years.
Field and laboratory study of insects, their diversity, life history; emphasis on ecology and behavior.

IA LL 402I: Watershed Hydrology and Surficial Processes
(Cross-listed with AGRON, ENSCI). Cr. 4. SS.
Prereq: Four courses in physical or biological sciences or engineering
Effects of geomorphology, soils, and land use on transport of water and materials (nutrients, contaminates) in watersheds. Fieldwork will emphasize investigations of the Iowa Great Lakes watershed.

IA LL 403: Evolution
Cr. 4. SS.
Mechanisms and patterns in microevolution and macroevolution. Field exercises will emphasize studies of natural selection, adaptation, genetic variation, and population genetics of local plant and animal populations.

IA LL 404I: Behavioral Ecology
(Cross-listed with A ECL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: Two semesters of biology
Animal coloniality, courtship, territoriality, predator defense, habitat selection, foraging, mating systems, and parental care will be examined in the field in order to evaluate various ecological and evolutionary theories of animal behavior.

IA LL 408I: Aquatic Ecology
(Dual-listed with IA LL 508I). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

IA LL 415: Freshwater Invertebrates
Cr. 4. SS.
Prereq: One or more ecology courses
Field-oriented introduction to the identification, life-history, and ecology of common, free-living freshwater invertebrates of north-temperate lakes, rivers, and wetlands. Emphasis on the role of invertebrates in aquatic food chains and litter processing.

IA LL 419I: Vertebrate Ecology and Evolution
(Cross-listed with A ECL). Cr. 4. SS.
Field and laboratory study of representative vertebrates of northwestern Iowa. Observations and experimentation emphasize ecological histories by integrating concepts of functional morphology, behavioral ecology, and evolutionary biology.

IA LL 420I: Amphibians and Reptiles
(Cross-listed with A ECL). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: Two semesters of biology
Ecology, behavior, and conservation biology of amphibians and reptiles with emphasis on their anatomy and morphology; temperature and water regulation; locomotion; life history; reproduction; population and community ecology; and conservation.

IA LL 422I: Prairie Ecology
(Cross-listed with ENSCI). Cr. 4. SS.
Prereq: Familiarity with basic principles in biological sciences and ecology
Basic patterns and underlying physical and biotic causes of both regional and local distributions of plants and animals of North American prairies; field and laboratory analyses and projects.

IA LL 425I: Aquatic Toxicology and Wetland Dynamics in Freshwater Systems
Cr. 4. SS.
Prereq: Introductory biology course and general chemistry course
Fundamental knowledge and understanding of the scientific concepts related to the physio-chemical and biological environment. Problems and issues (global, national, regional, and local) associated with freshwater systems and how wetland restoration can be used to ameliorate problems. Discussion and application of basic tools used to assess aquatic toxicological problems.

IA LL 427I: Field Archaeology
(Cross-listed with ANTHR). Cr. 4. SS.
Nature of cultural and environmental evidence in archaeology and how they are used to model past human behavior and land use; emphasis on Iowa prehistory; basic reconnaissance surveying and excavation techniques.

IA LL 435I: Illustrating Nature I Sketching
(Cross-listed with BPM I). Cr. 2. SS.
Sketching plants, animals and terrain. Visual communication, development of a personal style, and integration of typographic and visual elements on a page will be emphasized.

IA LL 436I: Illustrating Nature II Photography
(Cross-listed with BPM I). Cr. 2. SS.
Beginning to intermediate technical and compositional aspects of color photography of natural areas and their plants and animals.

IA LL 450: Topics in Ecology and Sustainability
(Dual-listed with IA LL 550). Cr. 1-4.
Prereq: general biology course
Scientific introduction to ecology and evolution of important groups of organisms: algae to vertebrates, different ecological phenomena (e.g., fire and climate change), varying landforms, different ecosystems (e.g., prairies and aquatic systems); emphasis on sustainability with introduction to concepts, issues, and practices; ability to communicate environmental information through a variety of means.

IA LL 461I: Introduction to GIS
(Cross-listed with ENSCI, ENV S, L A). Cr. 4. SS.
Descriptive and predictive GIS modeling techniques, spatial statistics, and map algebra. Application of GIS modeling techniques to environmental planning and resource management.

IA LL 463I: Soil Formation and Landscape Relationships
(Dual-listed with IA LL 563I). (Cross-listed with AGRON, ENSCI). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

IA LL 480I: Ecology and Systematics of Diatoms
(Dual-listed with IA LL 580I). Cr. 4. SS.
Field and laboratory study of freshwater diatoms; techniques in collection, preparation, and identification of diatom samples; study of environmental factors affecting growth, distribution, taxonomic characters; project design and execution including construction of reference and voucher collections and data organization and analysis.

IA LL 484: Plant Ecology
Cr. 4. SS.
Principles of plant population, community, and ecosystem ecology illustrated through studies of native vegetation in local prairies, wetlands and forests. Group or individual projects.

IA LL 490I: Iowa Lakeside Laboratory
(Cross-listed with ANTHR, NREM). Cr. 1-6. Repeatable, maximum of 9 credits.
Prereq: 8 credits in biology and permission of instructor
Research opportunities for undergraduate students in the biological sciences. No more than 9 credits in Biol 490 may be counted toward graduation and of those, only 6 credits may be applied to the major.

IA LL 493: Natural History Workshop
Cr. 1-2. SS.
Offered as demand warrants. Five day-long, non-technical introductions to a specific aspect of the natural history of the Upper Midwest or techniques for studying natural history.

IA LL 494: Ecosystems of North America
Cr. 2-4. SS.
Prereq: A general ecology course and permission of the instructor
An extended field trip to study a particular type of ecosystem (prairie, coastal wetland, forest, alpine, coral reefs, etc.) or the ecosystems of a specific region (Rocky Mountains, Gulf Coast, Appalachian Mountains, Deserts of the Southwest, Central America, etc.). Prior to the field trip, there will be an orientation period and after each field trip a review and synthesis period. A field trip fee will be assessed to cover travel expenses.

IA LL 499: Undergraduate Research
Cr. 1-4. Repeatable.
Prereq: Junior or senior classification and permission of instructor

Courses primarily for graduate students, open to qualified undergraduates:

IA LL 501: Freshwater Algae
Cr. 4. SS.
Structure and taxonomy of freshwater algae based on field collected material; emphasis on genus-level identifications, habitats visited include lakes, fens, streams, and rivers; algal ecology.

IA LL 503: Graduate Internships
Cr. 1-5. SS.
Prereq: Permission of instructor and graduate standing
Placement with county conservation boards, camps, parks, schools, etc. for experience as interpreters, rangers, technicians, and teachers.

IA LL 508I: Aquatic Ecology
(Dual-listed with IA LL 408I). (Cross-listed with ENSCI, ENSCI, NREM, NREM). Cr. 4. SS.
Prereq: Courses in ecology, chemistry, and physics
Analysis of aquatic ecosystems; emphasis on basic ecological principles; ecological theories tested in the field; identification of common plants and animals.

IA LL 523I: Fish Ecology
(Cross-listed with A ECL). Cr. 4. Alt. SS., offered even-numbered years.
Basic principles of fish interaction with the biotic and abiotic environment. Field methods, taxonomy, and biology of fish with emphasis on the fish fauna of northwestern Iowa.

IA LL 526I: Advanced Field Ornithology
(Cross-listed with A ECL). Cr. 2. SS.
Prereq: Concurrent registration in IA LL 326I
Field study of birds of the upper Midwest; extended field trip to Minnesota and Wisconsin; individual or group project.

IA LL 531I: Conservation Biology
(Cross-listed with A ECL, EEOB). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: IA LL 312I
Population-and community-level examination of factors influencing the viability of plant and animal populations from both demographic and genetic perspectives; assessment of biodiversity; design and management of preserves.

IA LL 532: Analysis of Environmental Data
(2-0) Cr. 2. SS.
Prereq: An undergraduate course in statistics, understanding of basic concepts such as correlation and regression, and familiarity with PC-based software for data analysis
Analysis of Environmental Data will provide students with training in the theory and application of a range of statistical techniques useful for the analysis of ecological and paleoecological data. Topics will include data management, exploratory data analysis, regression analysis, direct and indirect ordination methods, classification techniques, transfer functions and the analysis of temporal data. Practical classes will provide hands-on training in the use of statistical and graphical software including R, CANOCO, C2, and TWINSPAN. The course will be directed towards advanced undergraduate, graduate and working professionals in ecology and paleoecology.

IA LL 535I: Restoration Ecology
(Cross-listed with A ECL, EEOB, ENSCI). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: A course in ecology
Ecological principles for the restoration of native ecosystems; establishment (site preparation, selection of seed mixes, planting techniques) and management (fire, mowing, weed control) of native vegetation; evaluation of restorations. Emphasis on the restoration of prairie and wetland vegetation.

IA LL 550: Topics in Ecology and Sustainability
(Dual-listed with IA LL 450). Cr. 1-4.
Prereq: general biology course
Scientific introduction to ecology and evolution of important groups of organisms: algae to vertebrates, different ecological phenomena (e.g., fire and climate change), varying landforms, different ecosystems (e.g., prairies and aquatic systems); emphasis on sustainability with introduction to concepts, issues, and practices; ability to communicate environmental information through a variety of means.

IA LL 563I: Soil Formation and Landscape Relationships
(Dual-listed with IA LL 463I). (Cross-listed with AGRON, ENSCI). Cr. 4. Alt. SS., offered even-numbered years.
Prereq: AGRON 182 (or equivalent) or AGRON 260
Relationships between soil formation, geomorphology, and environment. Soil description, classification, geography, mapping, and interpretation for land use. Credit for only Agron 563 or 563I may be applied for graduation.

IA LL 564I: Wetland Ecology
(Cross-listed with EEOB, ENSCI). Cr. 4. SS.
Prereq: Ia LL 312I
Ecology, classification, creation, restoration, and management of wetlands. Field studies will examine the composition, structure and functions of local natural wetlands and restored prairie pothole wetlands. Individual or group projects.

IA LL 573: Techniques for Biology Teaching
(Cross-listed with A ECL, EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573A: Techniques for Biology Teaching : Animal Biology
(Cross-listed with A ECL, EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573B: Techniques for Biology Teaching: Plant Biology
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573C: Techniques for Biology Teaching: Fungi and Lichens
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573D: Techniques for Biology Teaching: Aquatic Ecology
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573E: Techniques for Biology Teaching: Prairie Ecology
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573F: Techniques for Biology Teaching: Wetland Ecology
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573G: Techniques for Biology Teaching: Limnology
(Cross-listed with A ECL, EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573H: Techniques for Biology Teaching: Animal Behavior
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573I: Techniques for Biology Teaching: Insect Ecology
(Cross-listed with A ECL, EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573J: Techniques for Biology Teaching: Biology of Invertebrates
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573K: Techniques for Biology Teaching: Non-invasive Use of Living Organisms
(Cross-listed with EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 573W: Techniques for Biology Teaching: Project WET
(Cross-listed with A ECL, EEOB). Cr. 1-2. Repeatable. SS.
The development and implementation of laboratory exercises suitable for inclusion in elementary, middle, high school, and community college biology and environmental courses. Exercises will be built around common organisms and ecosystems in Iowa. Field trips.

IA LL 575I: Field Mycology
(Cross-listed with EEOB). Cr. 4. Alt. SS., offered even-numbered years.
Identification and classification of the common fungi; techniques for identification, preservation, and culture practiced with members of the various fungi groups.

IA LL 580I: Ecology and Systematics of Diatoms
(Dual-listed with IA LL 480I). (Cross-listed with EEOB). Cr. 4. SS.
Field and laboratory study of freshwater diatoms; techniques in collection, preparation, and identification of diatom samples; study of environmental factors affecting growth, distribution, taxonomic characters; project design and execution including construction of reference and voucher collections and data organization and analysis.

IA LL 590: Graduate Independent Study
(Cross-listed with A ECL, ANTHR, EEOB). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

IA LL 590I: Special Topics: Graduate Independent Study
(Cross-listed with A ECL, ANTHR, EEOB). Cr. 1-4. Repeatable. SS.
Prereq: Graduate classification and permission of instructor

IA LL 593: Natural History Workshop
Cr. 1-3.
Prereq: Permission of instructor
Graduate workshop on some aspect of the natural history of the Upper Midwest or on techniques for studying natural history.

Courses for graduate students:

IA LL 699I: Research
(Cross-listed with A ECL, ANTHR, EEOB, GDCB). Cr. 1-4. Repeatable.

Interdisciplinary Minors

Entrepreneurial Studies

Interdepartmental Undergraduate Minor

Entrepreneurial Studies is an interdisciplinary program that provides opportunities for students to learn about entrepreneurship—the process of creating value through recognizing and developing opportunities. It serves to complement the student's major area of study, in any college, by offering a means of putting theory and science into practice. The goal of the Entrepreneurial Studies program is to provide the knowledge and skills needed to create value through recognizing and developing opportunities. In addition to feasibility analysis and business planning, the program deals with the topics of innovation, opportunity recognition, technology transfer, industry analysis, and competitive strategy. Although the program introduces some fundamental concepts from accounting, finance, marketing, and management, it does not attempt to substitute for any business courses in these areas.

A minor in entrepreneurial studies is available to all undergraduate students at ISU. Students must follow college specific rules in selecting courses. The college representatives to the supervisory committee will be responsible for advising students in their college, and will inform students about the details of the college rules.

A student seeking a minor in entrepreneurial studies must successfully complete a minimum of 15 credits in courses approved for use in the entrepreneurial studies program, including:

MGMT 310	Entrepreneurship and Innovation	3
MGMT 313	Feasibility Analysis and Business Planning	3
Or MGMT 410X Social Entrepreneurship (Experimental Course)		

MGMT 310 Entrepreneurship and Innovation is the introductory course and provides an overview of the entire field.

MGMT 313 Feasibility Analysis and Business Planning emphasizes developing an idea for a new venture, conducting a feasibility study, researching the potential market, analyzing the competition, and preparing a formal business plan.

Students take two entrepreneurship-oriented electives (6 cr.) from an approved course list and must also take 3 cr. of experiential learning. Up to six of the 15 credits required for the minor may also be used in the student's required program of study. Detailed information about the minor and the list of approved electives is available online at http://www.business.iastate.edu/undergraduate/prospective-students/choosing-your-major/minors/entrepreneurial-studies-minor/.

Graduate Certificate

An interdisciplinary graduate certificate in entrepreneurship and innovation is available to post-graduate students from any discipline. The program provides students an opportunity to learn about entrepreneurship, innovation, and the new venture creation process and to develop business skills that can be used to start a business. The program is flexible so that students can design a program that provides core entrepreneurship education through one required business management course as well as discipline-specific training from entrepreneurship courses in other colleges. Some of these courses for this certificate may be available online.

Students seeking this Graduate Certificate must meet minimum university criteria for admission to graduate programs. Students

interested in the Entrepreneurship and Innovation Certificate must successfully complete a minimum of 12 credits in courses approved for use in the certificate program, including one required course, MGMT 566 Entrepreneurship and New Business Creation and three entrepreneurship-oriented electives (9 cr.) chosen from an approved course list. MGMT 566 Entrepreneurship and New Business Creation focuses on the essentials of starting and operating a new business. Additional information as well as the list of approved electives can be found on the certificate website at http://www.business.iastate.edu/masters/graduate-certificates/entrepreneurship-and-innovation/.

Sustainability Minor

Sustainability is often defined as "meeting the needs of today without compromising the ability of future generations to meet their own needs." The minor in sustainability at Iowa State University is available to any ISU student who wants to further learn about sustainability issues affecting humans today and in the future.

The interdisciplinary minor in sustainability exposes students to ideas and issues related to a sustainable, balanced and ethical future for the planet and its inhabitants. The minor is at the interplay between environmental, social and economic factors in improving the quality of human life within the capacity of supporting ecosystems.

The minor will help students understand the dynamics of biological population growth and decline in the natural world, predator-prey models, over-exploitation of natural resources, energy balances, and much more. Students also will learn how human behavior affects the natural world and the ability of earth to sustain life.

In addition, students in the minor will understand how the decisions they make as consumers, workers, resource owners, citizens and policymakers affect human welfare in this and future generations. Students also will be able to articulate why some environmental, social and economic profiles are sustainable and others are not.

The minor will provide students knowledge sufficient to apply sustainable practices in their personal and professional lives.

The colleges of Agriculture and Life Sciences, Design, Engineering, and Liberal Arts and Sciences sponsor the minor in sustainability.

Requirements for the minor in sustainability

The minor in sustainability may be earned by completing a total of 15 credits including two required courses and nine elective credits from an approved list. Of the nine elective credits, at least six credits must be at the 300 level or higher.

Required courses:

T SC 220	Globalization and Sustainability	3
ANTHR 230	Globalization and the Human Condition	3

Emphasis Electives:

A B E 380	Principles of Biological Systems Engineering	3
A B E 388	Sustainable Engineering and International Development	3
A B E 480	Engineering Analysis of Biological Systems	3
AGRON 120	Introduction to Renewable Resources	3
AGRON 342	World Food Issues: Past and Present	3
AGRON 404	Global Change	3
AGRON 450	Issues in Sustainable Agriculture	3
ANTHR 336	Global Development	3
ARCH 346	Building Science and Technology II	3
ARCH 346L	Building Science and Technology II Lab	2
ARCH 347	Building Science and Technology III	3
ARCH 347L	Building Science and Technology III Lab	2
ARCH 348	Building Science and Technology IV	3
ARCH 348L	Building Science and Technology IV Lab	2
ARCH 351	Whole Building Energy Performance Modeling	3
ARCH 445	Building Science and Technology V	2
ARCH 575	Contemporary Urban Design Theory	3
ARCH 597	Seminar on the Built Environment III: Theory	3
ARTIS 360	Sustainable Design and Fabrication of Furniture	3
ARTIS 362	Artists, Designers and Sustainable Development	3
BIOL 204	Biodiversity	2
BIOL 355	Plants and People	3
BIOL 471	Introductory Conservation Biology	3
BIOL 472	Community Ecology	3
BIOL 484	Ecosystem Ecology	3
C R P 201	The North American Metropolis	3
C R P 291	World Cities and Globalization	3
C R P 293	Environmental Planning	3
C R P 320	Urban Geography	3
C R P 417	Urban Revitalization	3
C R P 429	Planning in Developing Countries	3
C R P 445	Transportation Policy and Planning	3
C R P 484	Sustainable Communities	3
C R P 491	Environmental Law and Planning	3
ECON 380	Energy, Environmental and Resource Economics	3
ECON 385	Economic Development	3
ECON 480	Intermediate Environmental and Resource Economics	3

ENGL 355	Literature and the Environment	3
ENSCI 381	Environmental Systems I: Introduction to Environmental Systems	3-4
ENSCI 201	Introduction to Environmental Issues	2
ENSCI 382	Environmental Systems II: Analysis of Environmental Systems	3
ENV S 270	Foundations in Natural Resource Policy and History	3
ENV S 324	Energy and the Environment	3
ENV S 334	Environmental Ethics	3
FS HN 242	The US Food System	3
GEOL 160	Water Resources of the World	3
GEOL 101	Environmental Geology: Earth in Crisis	3
GEOL 108	Introduction to Oceanography	3
GLOBE 201	Global Resource Systems	3
GLOBE 303	Agricultural, Food and Natural Global Resource Systems	3
GLOBE 304	Socio-Economic Global Resource Systems	3
GLOBE 402	Responses to Global Resource System Challenges	3
GLOBE 446	International Issues and Challenges in Sustainable Development	3
HORT 424	Sustainable and Environmental Horticulture Systems	3
JL MC 347	Science Communication	3
JL MC 474	Communication Technology and Social Change	3
L A 270	Foundations in Natural Resource Policy and History	3
L A 302	Ecological Design at the Regional Scale	6
L A 417	Urban and Peri-urban Watershed Assessment	3
M E 433	Alternative Energy	3
M E 479	Sustainability Science for Engineering Design	3
M E 484	Technology, Globalization and Culture	3
M E 486	Appropriate Technology Design	3
MAT E 394	Topics in Sustainable Engineering in Italy	3
NREM 120	Introduction to Renewable Resources	3
NREM 452	Ecosystem Management	3
NREM 471	Agroforestry Systems; Local and Global Perspectives	3
RUS 375	Russia Today	3
SOC 345	Population and Society	3
SOC 348	Global Poverty, Resources and Sustainable Development	3
SOC 382	Environmental Sociology	3
SOC 411	Social Change in Developing Countries	3
SUS E 501	Sustainable Design Studio I	5
SUS E 511	Sustainable Design Colloquium I	3
SUS E 521	Foundation of Sustainable Design	3
SUS E 531	Human Dimensions of Sustainability	3
SUS E 540	Methods for Sustainable Design	3
SUS E 550	Making Resilient Environments	3
T SC 343	Philosophy of Technology	3
TSM 324	Soil and Water Conservation Management	3
TSM 325	Biorenewable Systems	3

Technology and Social Change

Undergraduate Study

Technology and social change is a cross-disciplinary program examining the relationships between technologies and their social and cultural environments. Students will examine the ethical and philosophical contexts of technology, with a particular emphasis on global engagement. Through T SC, students will better understand the institutional and sociocultural consequences of technological change from differing perspectives and will become sensitive to the issues attending the use of technology to improve people's lives. Work in the program can also serve as preparation for advanced study in the field.

Minor

The program requirement for a minor in technology and social change is a minimum of 15 credits.

T SC 220	Globalization and Sustainability	3
3 credits from T SC cross-listed courses		3
9 credits selected from T SC cross-listed courses or from the list of T SC approved courses		9
Total Credits		15

At least 9 of the 15 credits must be in courses numbered 300 or above. Because technology and social change is an interdisciplinary study, minor programs must include coursework in at least two departments. Students seeking a minor should develop a specific program of courses either with the T SC faculty representative in their department or with the T SC coordinator. The student's minor program must be approved by the T SC program coordinator.

Graduate Study

The graduate minor in technology and social change is a cross-disciplinary program that enables students to study the interactions between technologies and their users, on both societal and individual levels. The minor strengthens the ability of students to apply differing perspectives in understanding the effects of the global exchange of

technologies and to heighten their sensitivity to the institutional and sociocultural issues attending the use of technology to improve people's lives.

Students choosing to minor in technology and social change will pursue a degree program in the major department. In consultation with their major professor, students are to identify a T SC Faculty member to serve on the committee guiding their program of study. This T SC Faculty member must be on the Graduate faculty and must be from a discipline outside the major field of study. With the agreement of the POS committee, the student declaring a minor in T SC will select a group of courses from the list of T SC approved courses available through the program coordinators. For the master's degree, this group should be at least 9 credits; for a doctoral degree, the group should be at least 15 credits. In either case, T SC 543C Seminar in Social Change and Development: Technological Innovation, Social Change and Development is required. Students may not include in their minor any courses from their own major. All programs of study that include a T SC minor must be approved by the T SC Program coordinator.

Courses primarily for undergraduates:

T SC 220: Globalization and Sustainability
(Cross-listed with ANTHR, ENV S, GLOBE, M E, MAT E, SOC). (3-0) Cr. 3. F.S.
An introduction to understanding the key global issues in sustainability. Focuses on interconnected roles of energy, materials, human resources, economics, and technology in building and maintaining sustainable systems. Applications discussed will include challenges in both the developed and developing world and will examine the role of technology in a resource-constrained world. Cannot be used for technical elective credit in any engineering department.
Meets International Perspectives Requirement.

T SC 342: World Food Issues: Past and Present
(Cross-listed with AGRON, ENV S, FS HN). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

T SC 342H: World Food Issues: Past and Present, Honors
(Cross-listed with AGRON, ENV S). (3-0) Cr. 3. F.S.
Prereq: Junior classification
Issues in the agricultural and food systems of the developed and developing world. Emphasis on economic, social, historical, ethical and environmental contexts. Causes and consequences of overnutrition/undernutrition, poverty, hunger and access/distribution. Explorations of current issues and ideas for the future. Team projects.
Meets International Perspectives Requirement.

T SC 343: Philosophy of Technology
(Cross-listed with PHIL). (3-0) Cr. 3. F.S.
Prereq: 6 credits of social science or T SC 341 and 3 credits of social science
Moral and other philosophical problems related to developments in technology. Topics may include conditions under which technological innovations contribute to human emancipation, relationship of technology and democracy, utility and limits of technical rationality, and problems of ensuring that benefits of technological advance are communally shared. Topics discussed with reference to such issues as contemporary developments in microelectronics, technology transfer to the Third World, etc.

Courses primarily for graduate students, open to qualified undergraduates:

T SC 543: Seminar in Social Change and Development
(Cross-listed with SOC). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology
Seminar in social change and development.

T SC 543B: Seminar in Social Change and Development: Sociology of Adoption and Diffusion
(Cross-listed with SOC). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology

T SC 543C: Seminar in Social Change and Development: Technological Innovation, Social Change and Development
(Cross-listed with SOC). (3-0) Cr. 3. Alt. F., offered even-numbered years.
Prereq: 6 credits in sociology

Wind Energy

The wind energy minor is primarily intended for students majoring in engineering or atmospheric sciences, but is available to all that meet the prerequisites, Math 166 and Physics 222. The minor is comprised of 15 credits, of which 6 are required of all students obtaining the minor. As per the University Catalog, at least 9 credits cannot be used to satisfy any other degree, program or University requirement.

Importance of Wind Energy Minor
Wind energy is a pivotal component of our nation's future energy portfolio, particularly given the desire to reduce the carbon footprint

through the use of renewables. The Midwest region is among the richest wind regions in the nation, with Iowa being the second leading state in the nation as measured by installed wind capacity of 3670 MW, after Texas. This minor will help provide this industry (planners, manufacturers, developers, utilities, and maintenance providers) with technical students with the knowledge and understanding of the science, engineering and policy of wind energy.

Student Learning Outcomes

The objectives of the proposed minor are to provide a broad understanding of the wind energy industry from component design and manufacturing, electric generation, transmission, and grid operations, to policy.

- Communicate objectives of a long-term national energy portfolio and how wind energy will contribute to meeting those objectives
- Understand the wind energy systems and design trade offs for the large components (e.g., blade, turbine, tower, and foundation)
- Manufacturing and supply chain considerations for economic production.
- Identify problems and potential solutions associated with integrating high wind penetrations into the electric grid.
- Communicate most significant reliability problems for wind turbines and be conversant with related monitoring technologies and maintenance methods to address them.
- Identify effects of existing and potential policies on wind energy growth

Learning outcomes will be assessed using tests, quizzes, homework and term papers.

Required Courses Course descriptions can be found here

ENGR 340	Introduction to Wind Energy: System Design & Delivery	3
AER E 381	Introduction to Wind Energy	3

Elective Courses Course descriptions can be found here. Choose 9 credits.

AER E 422	Vibrations and Aeroelasticity	3
AER E 423	Composite Flight Structures	3
AER E 481	Advanced Wind Energy: Technology and Design	3
C E 460	Foundation Engineering	3
C E 541	Dynamic Analysis of Structures	3
I E 543	Wind Energy Manufacturing	3
MAT E 362	Principles of Nondestructive Testing	3
E E 451	Engineering Acoustics	3
E M 451	Engineering Acoustics	3
M E 451	Engineering Acoustics	3
E E 452	Electrical Machines and Power Electronic Drives	3
E E 457	Power System Analysis II	3
E E 459	Electromechanical Wind Energy Conversion and Grid Integration	3
M E 325	Mechanical Component Design	3
M E 411	Automatic Controls	3
M E 417	Advanced Machine Design	3
M E 421	System Dynamics and Control	4
MTEOR 405	Environmental Biophysics	3
MTEOR 407	Mesoscale Meteorology	3
MTEOR 411	Synoptic Meteorology	3
MTEOR 417	Mesoscale Forecasting Laboratory	3
MTEOR 432	Instrumentation and Measurements	3
MTEOR 454	Dynamic Meteorology II	3

How to Apply

1. Complete the Request for Minor form (http://www.registrar.iastate.edu/sites/default/files/uploads/forms/minorform.pdf) available from the Iowa State Registrar's Office.

2. Obtain a signature from your academic adviser.

3. Submit the form to Dr. Frank Peters.

COLLEGES AND SCHOOLS

Undergraduate and Professional Degree Programs

The university is organized into eight colleges, including the Graduate College. Six colleges offer undergraduate degree programs, and the College of Veterinary Medicine offers the Doctor of Veterinary Medicine degree. The Graduate College (http://www.grad-college.iastate.edu) web site provides a complete listing (http://www.grad-college.iastate.edu/academics/programs/approgram s.php) of graduate majors, minors, certificates and programs.

Iowa State University is accredited by the Higher Learning Commission.

Agriculture and Life Sciences

Business

Design

Engineering

Human Sciences

Liberal Arts and Sciences

Veterinary Medicine

Graduate College

School of Education

ENTRY LEVEL COURSES

Resources for Course Information

http://catalog.iastate.edu

http://classes.iastate.edu

Additional experimental courses: courses not published in the catalog. The following courses are suitable for first year students. Course numbers that begin with 0 (e.g., MATH 010) may incur an additional "developmental course" fee. See the Tuition and Fees web site for more information about other fees (http://www.registrar.iastate.edu/fees/othfee).

A B E 170: Engineering Graphics and Introductory Design

(2-2) Cr. 3.

Prereq: Satisfactory scores in math placement assessments; credit or enrollment in MATH 142.

Applications of multi-view drawings and dimensioning. Techniques for visualizing, analyzing, and communicating 3-D geometries. Application of the design process including written and oral reports.

A M D 131: Fashion Products and Markets

(3-0) Cr. 3. F.

Fashion industry structure from concept to consumer. Focus on fashion-driven consumer goods. Development and prototyping of fashion products for a target market.

A M D 165: Dress and Diversity in Society

(3-0) Cr. 3. F.S.

Examination of diversity among consumers and introduction to forecasting trends in dress. Introduction to social justice issues.

Meets U.S. Diversity Requirement

AER E 160: Aerospace Engineering Problems With Computer Applications Laboratory

(2-2) Cr. 3. F.S.

Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165

Solving aerospace engineering problems and presenting solutions through technical reports. Significant figures and estimation. SI units. Graphing and curve fitting. Introduction to aerospace engineering and engineering design. Spreadsheet programs. History of aerospace. Systems thinking. Team projects.

AF AM 201: Introduction to African American Studies

(3-0) Cr. 3. F.S.

An interdisciplinary introduction to the study of African American culture. Includes history, the social sciences, literature, religion, and the arts, as well as conceptual frameworks for investigation and analysis of the African American experience.

Meets U.S. Diversity Requirement

AFAS 141: Foundations of the United States Air Force

(1-0) Cr. 1. F.

Basic introduction to the United States Air Force and Air Force Reserve Officer Training Corps. Mission and organization of the Air Force, officership and professionalism, military customs and courtesies, Air Force officer opportunities, and communication skills.

AGEDS 110B: Agricultural Studies (Fall only)

(1-0) Cr. 1. F.S.

Orientation to the department. Careers in agriculture.

MATH 025: High School Algebra

(4-0) Cr. 0. F.S.

Students should initially enroll in MATH 10. See description of MATH 10. Offered on a satisfactory-fail basis only.

MATH 030: High School Algebra

(4-0) Cr. 0. F.S.

Students should initially enroll in MATH 10. See description of MATH 10. Offered on a satisfactory-fail basis only.

MATH 101: Orientation in Mathematics

(1-0) Cr. 1. F.S.

For new majors. Campus resources and opportunities available to students. Careers and programs of study in mathematics. Mathematical reasoning, culture and resources. Description of main branches of mathematics. Offered on a satisfactory-fail basis only.

MATH 106: Discovering Mathematics

(3-0) Cr. 3. F.S.

Inquiry-based approach to mathematics, emphasizing the art, history, and beauty of the subject. Typical topics are mathematics from art, music, puzzles, patterns, and reasoning.

AGRON 110: Professional Development in Agronomy: Orientation

Cr. 1. F.

Orientation to college life, the profession of agronomy, and the agronomy curriculum.

AGRON 120: Introduction to Renewable Resources
(Cross-listed with ENV S, NREM). (3-0) Cr. 3. F.S.
Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management.

AGRON 206: Introduction to Weather and Climate
(Cross-listed with MTEOR). (3-0) Cr. 3. F.S.
Basic concepts in weather and climate, including atmospheric measurements, radiation, stability, precipitation, winds, fronts, forecasting, and severe weather. Applied topics include global warming, ozone depletion, world climates and weather safety.

AM IN 210: Introduction to American Indian Studies
(3-0) Cr. 3. F.S.SS.
Introduction to the multidisciplinary aspects of American Indian Studies. Topics include the relevant events and ideas defining the contemporary American Indian experience, on and off reservation, in the United States. Sovereignty, identity, jurisdiction, taxes, economic development, education, and other issues are addressed.
Meets U.S. Diversity Requirement

AN S 101: Working with Animals
(1-2) Cr. 2. F.S.
A hands-on introductory course in skills for proper care and management of domestic animals. Husbandry skills including health observation, animal movement, identification, management procedures, and environmental assessment are covered.

AN S 110: Orientation in Animal Science and ISU
(2-0) Cr. 1. F.S.
Orientation to the university and Department of Animal Science. Challenges and opportunities available to the professional animal agriculturalist. Professional goal setting, portfolio development, and development of interpersonal skills in the context of pursuing a career in animal science.

AN S 114: Survey of the Animal Industry
(2-0) Cr. 2. F.S.
Ways domestic animals serve the basic needs of humans for food, shelter, protection, fuel, and emotional well-being. Terminology, basic structures of the industries surrounding the production, care, and marketing of domestic animals in the U.S.

ANTHR 201: Introduction to Cultural Anthropology
(3-0) Cr. 3. F.S.SS.
Comparative study of culture as key to understanding human behaviors in different societies. Using a global, cross-cultural perspective, patterns of family life, economic and political activities, religious beliefs, and the ways in which cultures change are examined.
Meets International Perspectives Requirement.

ANTHR 202: Introduction to Biological Anthropology and Archaeology
(3-0) Cr. 3. F.S.
Human biological and cultural evolution; survey of the evidence from fossil primates, the human fossil record and the archaeological record, as well as living primates; introduction to research methods in archaeology and biological anthropology.

ANTHR 230: Globalization and the Human Condition
(3-0) Cr. 3. F.S.
An introduction to understanding key global issues in the contemporary world. Focuses on social relations, cultural practices and political-economic linkages among Africa, the Americas, Asia, Europe and the Pacific.
Meets International Perspectives Requirement.

ARCH 221: History of Architecture I
(3-0) Cr. 3. F.
Survey of western architectural ideas and practices in their social, cultural, and representational contexts. Comparisons with global examples. Ancient through 1750.
Meets International Perspectives Requirement.

ART H 280: History of Art I
(3-0) Cr. 3. F.
Development of the visual arts including painting, sculpture, architecture, and crafts, from the prehistoric through Gothic periods.
Meets International Perspectives Requirement.

ART H 292: Introduction to Visual Culture Studies
(3-0) Cr. 3.
An introduction to various topics in visual culture studies. The lecture course will provide students with a creative and intellectual context in which to study historical and contemporary instances of the visual in culture. Individual lectures examine significant trends in the visual arts, mass media, scientific imagery, visual communications, and other areas related to visual literacy and visual representation in local and global contexts. Cross cultural viewpoints and issues of diversity will be presented in relation to visual culture and related fields.
Meets U.S. Diversity Requirement

ASTRO 103: Evening Star

Cr. 1. F.S.

An entirely web-based course covering topics in celestial mechanics ("Rocket science!") for students with little or no previous experience. It combines the geography of the solar system with discussion of methods of traveling to the other planets. The course "lectures" are on-line, interactive units with built-in exercises, hands-on (offline) activities, and layers of help. Graded homework and quizzes are administered via Blackboard Learn. Students who take Astro 120 may count credit in only one of Astro 102 or 103 toward graduation.

ASTRO 120: The Sky and the Solar System

(3-0) Cr. 3. F.S.SS.

For the nonscientist. A survey of our view of the universe, and the exploration of the solar system and beyond. The sky: constellations; motions of the Sun, Moon, and planets; seasons and the calendar; eclipses. The solar system: origin and evolution; characteristics of the Sun, planets, satellites, comets, meteorites, and asteroids. The detection and characterization of other solar systems, and the search for life in the universe. Extensive use of the planetarium is included. Students who take Astro 120 may count credit in only one of Astro 102 or 103 toward graduation.

ASTRO 150: Stars, Galaxies, and Cosmology

(3-0) Cr. 3. F.S.

For the nonscientist. A survey of astronomy with a focus on the universe beyond our solar system. Basic observational astronomy and the history of astronomy. Stellar astronomy: motions, distances, sizes, spectra; types of stars; variability; binary systems. Stellar evolution: the birth, life, and death of stars, including supernovae, neutron stars, and black holes. The structure and evolution of the Milky Way Galaxy. Other galaxies, clusters of galaxies, quasars. Theories of the origin of the universe.

BBMB 101: Introduction to Biochemistry

(1-0) Cr. 1. F.

Research activities, career opportunities in biochemistry and biophysics, and an introduction to the structure of biologically important compounds. For students majoring in biochemistry, agricultural biochemistry or biophysics or considering one of these majors.

BIOL 101: Introductory Biology

(3-0) Cr. 3. F.S.SS.

Life considered at cellular, organism, and population levels. Function and diversity of the living world. Presentation of basic biological principles as well as topics and issues of current human interest. Does not satisfy biology major requirements.

BIOL 110: Introduction to Biology

Cr. 1. F.

Orientation to the scope of the biological sciences, and discussion of professional opportunities. Required of first year biology majors. Offered on a satisfactory-fail basis only.

BIOL 155: Human Biology

(3-0) Cr. 3. F.S.

A survey course of human biology, including principal structures and functions of the body systems and the diseases and disorders associated with them. Designed to meet general education requirements in natural science. Not recommended for those seeking a career in the allied health professions or for students majoring in life science. Does not satisfy biology major requirements.

BIOL 173: Environmental Biology

(Cross-listed with ENV S). (3-0) Cr. 3. F.S.

An introduction to the structure and function of natural systems at scales from the individual to the biosphere and the complex interactions between humans and their environment. Discussions of human population growth, biodiversity, sustainability, resource use, and pollution. Does not satisfy biology major requirements.

BIOL 211: Principles of Biology I

(3-0) Cr. 3. F.S.

Prereq: High school biology

Introduction to the nature of life, including the diversity of microbial, plant, and animal life; the nature of heredity; evolution; and principles of ecology. Intended for life science majors.

BIOL 211L: Principles of Biology Laboratory I

(0-3) Cr. 1. F.S.

Prereq: Credit or enrollment in BIOL 211

Laboratory to accompany 211.

BIOL 212: Principles of Biology II

(3-0) Cr. 3. F.S.

Prereq: High School Biology; high school chemistry or credit or enrollment in CHEM 163 or CHEM 177

Introduction to the chemical, molecular, and cellular basis of life; form and function of microbial, plant, and animal life. Intended for life science majors.

BIOL 212L: Principles of Biology Laboratory II

(0-3) Cr. 1. F.S.

Prereq: credit or enrollment in BIOL 212

Laboratory to accompany 212.

BIOL 255: Fundamentals of Human Anatomy
(3-0) Cr. 3. F.
Prereq: High School Biology and Chemistry, or BIOL 101
An introduction to human anatomy, beginning with cells and tissues, surveying all body systems, relating form to function. Systems covered include: integumentary, bones and joints, muscles, nervous, sensory, endocrine, circulatory, lymphatic, respiratory, digestive, urinary, and reproductive. Pre-Medical students should consider Biol 351 for their anatomy background. Does not satisfy biology major requirements.

BIOL 255L: Fundamentals of Human Anatomy Laboratory
(0-3) Cr. 1. F.
Prereq: Credit or enrollment in BIOL 255
Investigation of human anatomy using models and dissections of preserved organs and model mammals. Pre-Medical students should consider 351 for their anatomy background. Does not satisfy biology major requirements.

BUSAD 103: Orientation
(1-0) Cr. 1. F.S.
A required orientation for all College of Business students. Review of college and university requirements, transfer credits, academic planning, university policies and deadlines, and registration procedures. Includes group advising for course selection and registration. Only one of BUSAD 101, 102, or 103 may be counted toward graduation.

C E 160: Engineering Problems with Computational Laboratory
(2-2) Cr. 3. F.S.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Formulation of engineering problems using spreadsheets and Visual Basic for Application for solution. Presenting results using word processing, tables, and graphs. Introduction to engineering economics and statics. Civil engineering examples.

C E 170: Graphics for Civil Engineering
(0-4) Cr. 2. F.S.
Fundamental graphics. Introduction to computer aided drafting and modeling. Civil engineering applications.

C I 204: Social Foundations of Education in the United States
(3-0) Cr. 3. F.S.SS.
Introduction to the historical and contemporary landscape of schooling in the United States. Emphasis is placed on topics and tensions in the relationship between school and society (e.g. equity of access to education and competing purposes of education) and the implications of these topics and tensions for teaching and learning at the secondary level in public schools. For prospective teachers in an ISU Secondary Education teacher preparation program. Open to students who are considering teaching and/or work in education as a career path. Students in Early Childhood and Elementary Education programs should take C I 203.

C R P 201: The North American Metropolis
(3-0) Cr. 3. F.S.
Examination of the evolution of American urban centers from the colonial era to the present. Considers the demographic changes and social movements underway in urban America and explores how an understanding of the history of cities provides us with knowledge that we can use to improve our cities today.
Meets U.S. Diversity Requirement

CH E 160: Chemical Engineering Problems with Computer Applications Laboratory
(2-2) Cr. 3. F.S.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Formulation and solution of engineering problems. Significant figures. Use of SI units. Graphing and curve-fitting. Flowcharting. Introduction to material balances, engineering economics, and design. Use of spreadsheet programs to solve and present engineering problems. Solution of engineering problems using computer programming languages. Chemical Engineering examples.

CHEM 050: Preparation for College Chemistry
(3-0) Cr. 0. F.S.
Prereq: 1 year high school algebra
An in-depth active learning experience designed to impart the fundamental concepts and principles of chemistry, with an emphasis on mathematics skills and logical thinking. For students intending to enroll in general chemistry and who have not taken high school chemistry or who have not had a high school college preparatory chemistry course who need a review of chemical problem solving and chemical concepts. Credit for Chem 50 does not count toward graduation.

CHEM 160: Chemistry in Modern Society
(3-0) Cr. 3. F.S.
Aspects of chemistry visible to a non-scientist in our society. A survey of selected areas of chemistry with emphasis on the interface between chemistry and other fields of human activity.

CHEM 163: College Chemistry
(4-0) Cr. 4. F.S.SS.
Prereq: 1 year of high school algebra and geometry and Chem 50 or 1 year of high school chemistry; and credit or enrollment in CHEM 163L
A general survey of chemistry with an emphasis on conceptual problems for those who are not physical and biological science or engineering majors. Nomenclature, chemical reactions, stoichiometry, atomic structure, periodic properties, chemical bonding, states of matter, solutions, thermochemistry, acid-base theory, oxidation-reduction reactions, basic chemical kinetics, and chemical equilibrium. Only one of Chem 163, 167, 177, or 201 may count toward graduation.

CHEM 163L: Laboratory in College Chemistry
(0-3) Cr. 1. F.S.SS.
Prereq: Credit or enrollment for credit in CHEM 163
Laboratory to accompany CHEM 163. Must be taken with CHEM 163. Only one of Chem 163L, CHEM 167L, and CHEM 177L may count toward graduation.

CHEM 167: General Chemistry for Engineering Students
(4-0) Cr. 4. F.S.
Prereq: 1 year of high school chemistry or CHEM 50 and Math 143 pre-calculus or high school equivalent.
Principles of chemistry and properties of matter explained in terms of modern chemical theory with emphasis on topics of general interest to the engineer. Only one of Chem 163, 167, 177, or 201 may count toward graduation.

CHEM 177: General Chemistry I
(4-0) Cr. 4. F.S.SS.
Prereq: MATH 140 or high school equivalent, and CHEM 50 or 1 year high school chemistry, and credit or enrollment in CHEM 177L. Chemistry and biochemistry majors may consider taking CHEM 201
The first semester of a two semester sequence which explores chemistry at a greater depth and with more emphasis on concepts, problems, and calculations than 163. Recommended for physical and biological science majors, chemical engineering majors, and all others intending to take 300-level chemistry courses. Principles and quantitative relationships, stoichiometry, chemical equilibrium, acid-base chemistry, thermochemistry, rates and mechanism of reactions, changes of state, solution behavior, atomic structure, periodic relationships, chemical bonding. Only one of Chem 163, 167, 177, or 201 may count toward graduation.

CHEM 177L: Laboratory in General Chemistry I
(0-3) Cr. 1. F.S.SS.
Prereq: Credit or enrollment for credit in CHEM 177
Laboratory to accompany 177. 177L must be taken with 177. Only one of Chem 163L, 167L, and 177L may count toward graduation.

CHEM 177N: Laboratory in General Chemistry I
(0-3) Cr. 1. F.
Prereq: Credit or enrollment for credit in CHEM 177. For chemistry and biochemistry majors
Laboratory to accompany CHEM 177. CHEM 177N must be taken with CHEM 177. Only one of Chem 163L, CHEM 167L, and CHEM 177N may count toward graduation.

CHEM 178: General Chemistry II
(3-0) Cr. 3. F.S.SS.
Prereq: CHEM 177, CHEM 177L
Continuation of 177. Recommended for physical or biological science majors, chemical engineering majors, and all others intending to take 300-level chemistry courses.

CHEM 201: Advanced General Chemistry
(5-0) Cr. 5. F.
Prereq: Co-enrollment in MATH 165 or credit, one year of high school chemistry, and one year high school physics or advanced chemistry. Co-enrollment in CHEM 201L.
A one-semester course in general chemistry designed to give students an in-depth, broad-based view of modern chemistry, and, in part, to facilitate participation in independent undergraduate research. Topics include stoichiometry, atomic and molecular structure, chemical bonding, kinetics, chemical equilibria, and thermodynamics. Discussion of current trends in various chemical disciplines, which may be given by guest experts in chemistry, biochemistry, and chemical engineering, will help the student appreciate the scope of the chemical sciences and how research is carried out. Only one of Chem 163, 167, 177, or 201 may count toward graduation.

CHIN 101: Elementary Mandarin Chinese I
(4-0) Cr. 4. F.
Introduction to spoken and written colloquial Mandarin through pinyin and simplified characters.

CHIN 201: Intermediate Mandarin Chinese I
(4-0) Cr. 4. F.
Prereq: CHIN 102
Development of speaking, writing, reading, and listening skills. Review and expansion of grammar skills, intensification of character acquisition. Meets International Perspectives Requirement.

CJ ST 240: Introduction to the U.S. Criminal Justice System
(3-0) Cr. 3. F.
Provides systematic overview of law, police organization and behavior, prosecution and defense, sentencing, the judiciary, community corrections, penology, and capital punishment. The course demonstrates the role of discretion in all of these agencies as well as the sociological influences of age, race, gender, and social class on criminal justice system processes.

CJ ST 241: Youth and Crime
(Cross-listed with SOC). (3-0) Cr. 3. F.
An examination of delinquency that focuses on the relationship between youth as victims and as offenders, social and etiological features of delinquency, the role of the criminal justice system, delinquents' rights, and traditional and alternative ways of dealing with juvenile crime.

CL ST 201: Technical Terminologies in the Professions
(3-0) Cr. 3. F.S.
Essential vocabulary and concepts in English that are derived from Latin and Ancient Greek. Formation and usage of technical terminology. Cultural influence of the classical languages. Analysis of technical writing.

CL ST 273: Greek and Roman Mythology
(3-0) Cr. 3. F.SS.
Survey of the legends, myths of the classical world with emphasis on the principal gods, and heroes, and their relation to ancient social, psychological, and religious practices; some attention may be given to important modern theories.
Meets International Perspectives Requirement.

COM S 101: Orientation
Cr. R. F.S.
Introduction to the procedures and policies of Iowa State University and the Department of Computer Science, test-outs, honorary societies, etc. Issues relevant to student adjustment to college life will also be discussed. Offered on a satisfactory-fail basis only.

COM S 103: Computer Applications
Cr. 4. F.S.SS.
Introduction to computer literacy and applications. Applications: Windows, Internet browser/HTML, word processing, spreadsheets, database management and presentation software. Literacy: history of computing, structure of computers, telecommunications, computer ethics, computer crime, and history of programming languages. No prior computer experience necessary. Offered online only. Attendance at an orientation session the first week of class is required. Only one of COM S 103 and COM S 113 may count toward graduation.

COM S 104: Introduction to Programming
(1.5-1) Cr. 2. F.S.
Offered first 8 weeks and last 8 weeks. Use of personal computer and workstation operating systems and beginning programming. Project-oriented approach to computer operation and programming, including use of tools to aid in programming. Topics from computer history, using basic Windows and Unix tools, program structure, expression, variables, decision and logic, and iteration. No prior computer experience necessary.

COM S 107: Applied Computer Programming
(3-0) Cr. 3. F.S.
Introduction to computer programming for non-majors using a language such as the Visual Basic language. Basics of good programming and algorithm development. Graphical user interfaces.

COM S 207: Fundamentals of Computer Programming
(Cross-listed with MIS). (3-1) Cr. 3. F.S.
Prereq: MATH 150 or placement into MATH 140/MATH 141/MATH 142 or higher
An introduction to computer programming using an object-oriented programming language. Emphasis on the basics of good programming techniques and style. Extensive practice in designing, implementing, and debugging small programs. Use of abstract data types. Interactive and file I/O. Exceptions/error-handling. This course is not designed for computer science, software engineering, and computer engineering majors. Credit may not be applied toward graduation for both Com S 207/MIS 207 and Com S 227.

COM S 227: Introduction to Object-oriented Programming
(3-2) Cr. 4. F.S.
Prereq: Placement into MATH 143, 165, or higher; recommended: a previous high school or college course in programming or equivalent experience.
Introduction to object-oriented design and programming techniques. Symbolic and numerical computation, recursion and iteration, modularity procedural and data abstraction, and specifications and subtyping. Object-oriented techniques including encapsulation, inheritance and polymorphism. Imperative programming. Emphasis on principles of programming and object-oriented design through extensive practice in design, writing, running, debugging, and reasoning. Course intended for Com S majors. Credit may not be applied toward graduation for both Com S 207 and 227.

COM S 228: Introduction to Data Structures
(3-1) Cr. 3. F.S.
Prereq: Minimum of C- in 227, credit or enrollment in MATH 165
An object-oriented approach to data structures and algorithms. Object-oriented analysis, design, and programming, with emphasis on data abstraction, inheritance and subtype polymorphism. Abstract data type specification and correctness. Collections and associated algorithms, such as stacks, queues, lists, trees. Searching and sorting algorithms. Graphs. Data on secondary storage. Analysis of algoritms. Emphasis on object-oriented design, writing and documenting medium-sized programs. This course is designed for majors.

COMST 101: Introduction to Communication Studies
(3-0) Cr. 3.
An introduction to communication theory, the development and functions of communication, and a survey of verbal, nonverbal, interpersonal, small group, organizational, and intercultural communication.

CPR E 131: Introduction to Computer Security Literacy
(Cross-listed with INFAS). (1-0) Cr. 1.
Basic concepts of practical computer and Internet security: passwords, firewalls, antivirus software, malware, social networking, surfing the Internet, phishing, and wireless networks. This class is intended for students with little or no background in information technology or security. Basic knowledge of word processing required. Offered on a satisfactory-fail basis only.

CPR E 185: Introduction to Computer Engineering and Problem Solving I
(2-2) Cr. 3.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Introduction to Computer Engineering. Project based examples from computer engineering. Individual interactive skills for small and large groups. Computer-based projects. Solving engineering problems and presenting solutions through technical reports. Solution of engineering problems using a programming language.

DANCE 270: Dance Appreciation
(3-0) Cr. 3. F.S.SS.
Introduction to the many forms and functions of dance in world cultures. Develop abilities to distinguish and analyze various dance styles. No dance experience required.
Meets International Perspectives Requirement.

DES 230: Design Thinking
(3-0) Cr. 3. F.S.
Introduction to the phenomenon of design thinking as it appears in various design fields, including methodologies of reasoning and problem solving; patterns of creativity and individual style; and the interaction of art, science, and technology.

DSN S 102: Design Studio I
(1-6) Cr. 4.
A core design studio course exploring the interaction of two-and three-dimensional design. Emphasis on fundamental skills and ideas shared across design disciplines. Investigation of creative process, visual order and materials, and development of critical thinking through studio projects and lectures. Includes study of precedents, contemporary design practices and disciplines in their cultural contexts.

DSN S 131: Design Representation
(1-6) Cr. 4.
An introduction to methods of visual thinking and drawing through studio experiences and lectures. All design fields utilize visual communication and drawing. Focus on the use of drawing as a method for creative problem solving, design development and visual communication. Explore, from observation and imagination, the use of fast sketching and in-depth drawing, using various scales, mediums and processes.

DSN S 183: Design Cultures
(3-0) Cr. 3.
A broad-based exploration of the dynamic relationship between design and culture, employing case study method to investigate particular examples of cultural production in contemporary society. Design processes and design works are presented as culturally, economically, environmentally, historically, ideologically, politically, and socially grounded events and artifacts.

DSN S 232: Digital Design Communications
(3-0) Cr. 3.
Introductory investigations of various digital design media to develop multi-dimensional problem solving, digital communication skills and perceptual sensitivity. Open to all university majors.

E E 185: Introduction to Electrical Engineering and Problem-Solving I
(2-2) Cr. 3. F.S.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Project based examples from electrical engineering. Systematic thinking process for engineering problem solving. Group problem solving. Mathematical, conceptual and computer based projects. Solving engineering problems and presenting solutions through technical reports and oral presentations. Solutions of engineering problems using computation tools and basic programming.

ECON 101: Principles of Microeconomics
(3-0) Cr. 3. F.S.SS.
Resource allocation, opportunity cost, comparative and absolute advantage. Supply and demand. Marginal analysis. Theories of production and consumption, pricing, and the market system. Perfect and imperfect competition and strategic behavior. Factor markets. Present discounted value.

ECON 101L: Laboratory in Principles of Microeconomics
(0-2) Cr. 1. F.
Prereq: Concurrent enrollment in the appropriate section of ECON 101
Discussion of material typically covered in Econ 101. Application of economic principles to real world problems. Economic principles and basic business management concepts applied to decision-making in agribusiness operations.

ECON 102: Principles of Macroeconomics
(3-0) Cr. 3. F.S.SS.
Prereq: ECON 101 recommended
Measurement of macro variables and general macro identities. Classical models of full employment. Production and growth. Savings and investment. Employment and unemployment. Money, inflation, and price levels. Operation of the U.S. banking system. Fiscal and monetary policy. Elements of international finance.

ECON 235: Introduction to Agricultural Markets
(3-0) Cr. 3. F.S.
Prereq: ECON 101
Basic concepts and economics principles related to markets for agricultural inputs and products. Overview of current marketing problems faced by farms and agribusinesses, farm and retail price behavior, structure of markets, food marketing channels, food quality and food safety, and the role of agriculture in the general economy. The implications of consumer preferences at the farm level. Introduction to hedging, futures, and other risk management tools.

ENGL 099L: Strategies for Nonnative Speakers of English: Strategies for Listening
Cr. 0. F.S.
Prereq: Recommendation of English Department; placement in sections L and R is determined by examination; section S is open to all interested international students. Available P/NP to graduate students at their department's option

ENGL 099R: Strategies for Nonnative Speakers of English: Strategies for Reading
Cr. 0. F.S.
Prereq: Recommendation of English Department; placement in sections L and R is determined by examination; section S is open to all interested international students. Available P/NP to graduate students at their department's option

ENGL 101B: English for Native Speakers of Other Languages: Academic English
(3-0) Cr. 3. F.S.
Prereq: Recommendation of English Department; placement in various sections is determined by examination. (See English Requirement for International Students in Index.)
For undergraduates: Completion of ENGL 101 requirement prepares students for ENGL 150. For graduates: Completion of ENGL 101 satisfies the English requirement of the Graduate College. ENGL 101 courses are limited to students who are nonnative speakers of English. Credit from ENGL 101 does not count toward graduation.

ENGL 101C: English for Native Speakers of Other Languages: Academic English II--Undergraduates
(3-0) Cr. 3. F.S.
Prereq: Recommendation of English Department; placement in various sections is determined by examination. (See English Requirement for International Students in Index.)
For undergraduates: Completion of ENGL 101 requirement prepares students for ENGL 150. For graduates: Completion of ENGL 101 satisfies the English requirement of the Graduate College. ENGL 101 courses are limited to students who are nonnative speakers of English. Credit from ENGL 101 does not count toward graduation.

ENGL 150: Critical Thinking and Communication
(3-0) Cr. 3. F.S.SS.
Prereq: Concurrent enrollment in LIB 160 is recommended.
Application of critical reading and thinking abilities to topics of civic and cultural importance. Introduction of basic oral, visual, and electronic communication principles to support writing development. Initiation of communication portfolio.

ENGL 201: Introduction to Literature
(3-0) Cr. 3.
Prereq: Credit in or exemption from 150
Study of selected examples of drama, poetry, short fiction, and the novel drawn from both British and American literature. Recommended for nonmajors.

ENGL 214: Introduction to Technical Communication
Cr. 3. F.
Prereq: ENGL 150
A broad introduction to the culture of professional work as a technical communicator, with particular emphasis on principles and best practices for developing and managing technical information and digital media. Examination of user-centered design, the history of the discipline, cross-cultural communication, and the ethics of communicating complex information to lay audiences. Study and practice of team-based collaboration, project management, and technical editing.

ENGL 225: Survey of British Literature to 1800
(3-0) Cr. 3.
Prereq: ENGL 250
Representative works of British literature from the origins to 1800 in historical, cultural, and literary contexts. Will include multiple genres.

ENGL 226: Survey of British Literature since 1800
(3-0) Cr. 3.
Prereq: ENGL 250
Representative works from 1800 to the present in historical, cultural, and literary contexts. Will include multiple genres and may include texts that reflect and/or critique the impact and legacy of the British empire on its former colonies, i.e., postcolonial literature.

ENGL 237: Survey of Film History
(3-0) Cr. 3. F.
Prereq: Credit in or exemption from 150
A survey of the history of film, both U.S. and international, from the beginnings in the late nineteenth century to the present.

ENGL 240: Introduction to American Indian Literature
(Cross-listed with AM IN). (3-0) Cr. 3. F.
Prereq: Credit in or exemption from ENGL 150
Appreciation of oral and written forms of American Indian literatures. Tropes and techniques in oral, visual and written texts. Focus on the role of American Indians in interdisciplinary approaches to modern social and environmental issues as expressed in literary works.
Meets U.S. Diversity Requirement

ENGL 250: Written, Oral, Visual, and Electronic Composition
(3-0) Cr. 3. F.S.SS.
Prereq: ENGL 150 or exemption from ENGL 150; sophomore classification or exemption from ENGL 150; credit for or concurrent enrollment in LIB 160
Analyzing, composing, and reflecting on written, oral, visual, and electronic (WOVE) discourse within academic, civic, and cultural contexts. Emphasis on supporting a claim and using primary and secondary sources. Continued development of communication portfolio.

ENGL 275: Analysis of Popular Culture Texts
(Cross-listed with SP CM). (3-0) Cr. 3. F.S.
Prereq: Credit in or equivalent of 250
Analysis of how information and entertainment forms persuade and manipulate audiences. Study of several forms that may include newspapers, speeches, television, film, advertising, fiction, and magazines. Special attention to verbal and visual devices.

ENGR 160: Engineering Problems with Computer Applications Laboratory
(2-2) Cr. 3. F.S.SS.
Prereq: MATH 143 or satisfactory scores on mathematics placement examinations; credit or enrollment in MATH 165
Solving engineering problems and presenting solutions through technical reports. Significant figures. Use of SI units. Graphing and curve-fitting. Flowcharting. Introduction to mechanics, statistics and engineering economics. Use of spreadsheet programs to solve and present engineering problems. Solution of engineering problems using computer programming languages. (The honors section includes application of programming to mobile robotics).

ENT 201: Introduction to Insects
(1-0) Cr. 1. F.S.SS.
5 weeks. Classroom section spring only. World Wide Web section of course offered summer and fall semesters. Biological and ecological aspects of insects.

ENT 211: Insects and Society
(2-0) Cr. 2. F.S.
Prereq: ENT 201
11 weeks. Classroom section spring only. World Wide Web section offered fall semester. The importance of insects in human well-being. Insect-human interactions. Primarily for nonscience and nonagriculture majors.

ENV S 101: Environmental Geology: Earth in Crisis
(Cross-listed with GEOL). (3-0) Cr. 3. F.S.
An introduction to geologic processes and the consequences of human activity from local to global scales. Discussion of human population growth, resource depletion, pollution and waste disposal, global warming and ozone depletion, desertification, and geologic hazards such as earthquakes, landslides, flooding, and volcanism.

ENV S 120: Introduction to Renewable Resources
(Cross-listed with AGRON, NREM). (3-0) Cr. 3. F.S.
Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management.

ENV S 173: Environmental Biology
(Cross-listed with BIOL). (3-0) Cr. 3. F.S.
An introduction to the structure and function of natural systems at scales from the individual to the biosphere and the complex interactions between humans and their environment. Discussions of human population growth, biodiversity, sustainability, resource use, and pollution. Does not satisfy biology major requirements.

ENV S 201: Introduction to Environmental Issues
(Cross-listed with BIOL, ENSCI). (2-0) Cr. 2. F.
Discussion of current and emerging environmental issues such as human population growth, energy use, loss of biodiversity, water resources, and climate change.

FRNCH 101: Elementary French I
(4-0) Cr. 4. F.SS.
Beginning level development of reading, writing, listening comprehension, and speaking in French, within the context of French culture.

FRNCH 201: Intermediate French I
(4-0) Cr. 4. F.
Prereq: FRNCH 102
Intermediate level development of reading, writing, listening comprehension, and speaking in French within the context of French culture.
Meets International Perspectives Requirement.

FS HN 101: Food and the Consumer
(3-0) Cr. 3. F.S.
Prereq: High school biology and chemistry or 3 credits each of biology and chemistry
The food system from point of harvest to the consumption of the food by the consumer. Properties of food constituents. Protection of food against deterioration and microbial contamination. Introduction of foods into the marketplace. Processes for making various foods. Government regulations. Use of food additives. Current and controversial topics. Electronic communication from web emphasized for class reports, notes and assignments.

FS HN 110: Professional and Educational Preparation
(1-0) Cr. 1. F.S.
Introduction to professional and educational development within the food science and human nutrition disciplines. Focus is on university and career acclimation as well as enhancement of communication skills. Offered on a satisfactory-fail basis only.

FS HN 167: Introduction to Human Nutrition
(3-0) Cr. 3. F.S.SS.
Prereq: High school biology or 3 credits of biology
Understanding and implementing present day knowledge of nutrition. The role of nutrition in the health and well being of the individual and family.

GEOL 100: The Earth
(3-0) Cr. 3. F.S.SS.
How does the earth work, what is it made of, and how does it change through time? Plate tectonics, Earth materials, landforms, structures, climate, and natural resources. Emphasis on the observations and hypotheses used to interpret earth system processes. Students may also enroll in Geol 100L.

GEOL 100L: The Earth: Laboratory
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in GEOL 100
Students will gain understanding of how Earth processes affect their lives and how they affect the Earth, and of the complex nature of the Earth and its processes. They will gain a deep knowledge of the methods used to understand the time scales and rates of Earth processes also through an applied research experience on groundwater and surface water.

GEOL 101: Environmental Geology: Earth in Crisis
(Cross-listed with ENV S). (3-0) Cr. 3. F.S.
An introduction to geologic processes and the consequences of human activity from local to global scales. Discussion of human population growth, resource depletion, pollution and waste disposal, global warming and ozone depletion, desertification, and geologic hazards such as earthquakes, landslides, flooding, and volcanism.

GEOL 105: Gems and Gemstones
(2-0) Cr. 1. F.
Offered in second half of the semester. Introduction to gems and gemstones, physical and optical properties of gems and gemstones, explanation of where gems come from and how they are found, how to distinguish between synthetic and naturally occurring gems, how the value of gems are determined, and the history of famous gems.

GEOL 108: Introduction to Oceanography
(Cross-listed with ENV S). (3-0) Cr. 3. F.
Introduction to study of the oceans. Ocean exploration. Waves and currents. Shape, structure, and origin of the ocean basins. Sedimentary record of oceanic life. Composition of seawater and its significance for life. Ocean circulation and its influence on climate. Life of the oceans, including coral reefs. Use and misuse of ocean resources. Anthropogenic impacts on the oceanic environment.

GEOL 111: Geological Disasters
(Cross-listed with ENV S). (1-0) Cr. 1. F.S.SS.
Introduction to the catastrophic geologic processes that disrupt ecosystems and human activity. Includes a discussion on the role of plate tectonics, the hydrologic cycle, and humans as the driving forces behind selected case studies on volcanic eruptions, earthquakes, tsunamis, landslides, and floods. Summer - online only.

GEOL 201: Geology for Engineers and Environmental Scientists
(2-2) Cr. 3. F.
Introduction to Earth materials and processes with emphasis on engineering and environmental applications.

GER 101: Elementary German I
(4-0) Cr. 4. F.SS.
Beginning level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. For beginning-level learners who have little or no prior exposure to German.

GER 201: Intermediate German I
(4-0) Cr. 4. F.
Prereq: GER 102
Intermediate level development of reading, writing, listening comprehension, and speaking in German within the context of German culture. Intensive review of basic grammar covered in the first-year German class (or equivalent high school courses) while exploring cultural topics and themes.
Meets International Perspectives Requirement.

GREEK 101: Elementary Ancient and New Testament Greek I
(5-0) Cr. 5. F.
Grammar and vocabulary of ancient Greek, within the context of Greek culture; reading knowledge through texts adapted from classical and New Testament works.

H S 105: First Aid and Emergency Care
(1-2) Cr. 2. F.S.SS.
Discussion and application of the basic techniques of utilizing bloodborne pathogen safety measures, administering first aid and cardiopulmonary resuscitation. ARC layperson certification available.

H S 110: Personal and Consumer Health
(3-0) Cr. 3. F.S.
Physical, mental, emotional and social aspects of health as a basis for understanding and promoting health, and preventing poor health conditions. Study of personal responsibility on the long-term benefits of maintaining a high level of wellness and health. Identification and mitigation of negative lifestyle habits.

H SCI 110: Orientation and Human Sciences Career Exploration
(2-0) Cr. 2. F.S.
Orientation and adjustment to the university and college; review of policies and procedures; academic resources; and course selection and planning. Comprehensive approach to career development; intensive self-analysis; and in-depth examination of majors in Human Sciences. Required for all students declared as an Undecided major in the College of Human Sciences.

H SCI 150: Dialogues on Diversity
(1-0) Cr. 1. F.S.
An exploration of diversity within the context of the Iowa State University community through understanding human relations issues.
Meets U.S. Diversity Requirement

HD FS 102: Individual and Family Development, Health, and Well-being
(3-0) Cr. 3. F.S.SS.
Overview of life-span developmental tasks (physical, cognitive, language, social, emotional) examined from various theoretical perspectives. Discussion of topics related to family diversity, individual/family health and well-being and reciprocal relationships as affected by external factors.

HD FS 183: Personal Finance in Early Adulthood
(1-0) Cr. 1. F.S.SS.
Introduction to basic concepts and budgeting practices for management of resources and prevention of financial problems commonly associated with college, including credit and student loans. Offered on a satisfactory-fail basis only.

HD FS 223: Child Development and Health
(3-0) Cr. 3. F.S.
Typical and atypical development of children prenatal through middle childhood. Examination of healthy development and potential impact of health issues in children. Discussion of influence of the family and society on development.

HD FS 239: Consumer Issues
(3-0) Cr. 3. F.S.
Introduction to factors affecting consumer decisions of individuals and families, including housing, healthcare, and personal finances. Emphasis on accessibility and affordability, community contexts for families; and consumer protection, legislation and regulation, and consumer fraud.
Meets U.S. Diversity Requirement

HD FS 240: Literature for Children

(3-0) Cr. 3. F.S.

Evaluation of literature for children, including an emphasis on diversity and inclusion; cultural competence. Roles of literature in the overall development of children. Literature selection and use in the home and educational settings.

Meets U.S. Diversity Requirement

HD FS 276: Human Sexuality

(3-0) Cr. 3. F.S.SS.

Behavioral, biological, and psychological aspects of human sexuality within the social context of family, culture, and society. Role of sexuality in human development. Critical analysis of media and research. Communication and decision-making skills relating to sexuality issues and relationships.

Meets U.S. Diversity Requirement

HIST 201: Introduction to Western Civilization I

(3-0) Cr. 3. F.

Western civilization from ancient Mediterranean world to 1500. Social and cultural developments; economic and political ideas and institutions; problems of historical change and continuity.

Meets International Perspectives Requirement.

HIST 207: Chinese Civilization

(3-0) Cr. 3.

Origins, development, decline and transformation of China from earliest times to 1911.

Meets International Perspectives Requirement.

HIST 221: Survey of United States History I

(3-0) Cr. 3-5. F.

Colonial foundations: revolution, confederation, and constitution; nationalism and democracy; sectional disunity, Civil War, and reunion.

HIST 225: Introduction to Asian American Studies

(3-0) Cr. 3.

An interdisciplinary and chronological examination of Asian American immigration experiences from the early 19th century to the 21st century. Focus on how these immigration histories are accompanied by changing racial constructions. Discussion of racial stereotyping, the model minority myth, identity development, and efforts for social justice.

Meets U.S. Diversity Requirement

HIST 280: Introduction to History of Science I

(3-0) Cr. 3.

Ideas of nature from ancient Greece to the seventeenth-century scientific revolution.

Meets International Perspectives Requirement.

HORT 121: Home Horticulture

(2-0) Cr. 2. F.S.

Growing plants in and around the home including requirements for growing house plants; plant propagation; designing and maintaining flower, fruit, and vegetable gardens; lawn, tree, and shrub maintenance.

HORT 122: Hands-On Home Horticulture

(1-0) Cr. 1. F.S.

Demonstration and activities that illustrate principles of growing plants for the home garden. Topics include floral and landscape design, plant identification, propagation, selection, and management for indoor and outdoor gardens.

HSP M 101: Introduction to the Hospitality Industry

(3-0) Cr. 3. F.S.SS.

Introduction to the foodservice, lodging, and tourism components of the hospitality industry. Background information, current issues, and future challenges in various segments of the industry.

I E 148: Information Engineering

(2-2) Cr. 3. F.S.

Prereq: Credit or enrollment in MATH 143

Development of information solutions for engineering problems. Fundamentals of the software development process. Engineering computations and the human/computer interface. Data models and database development. Program connectivity and network applications.

JL MC 101: Mass Media and Society

(3-0) Cr. 3. F.S.SS.

Communication theory models and their application to the mass media; the mass communication process; organization, characteristics and responsibilities of the mass media; media literacy process.

JL MC 110: Orientation to Journalism and Communication

(1-0) Cr. 1. F.S.Alt. SS., offered irregularly.

Orientation to professional and pre-professional opportunities, writing for the mass media and curriculum requirements in the Greenlee School. Basic media writing preparation. Offered on a satisfactory-fail basis only.

KIN 252: Disciplines and Professions in Kinesiology and Health

(1-0) Cr. 1. F.S.

Overview of the various disciplines and professions that comprise the field of Kinesiology (the study of human movement) and help students determine the career option that best fits their interests.

KIN 253: Orientation and Learning Community in Kinesiology and Health
(1-0) Cr. 1. F.S.
Prereq: Concurrent enrollment or credit in KIN 252
Overview of ISU policies and procedures, academic advising operations, degree requirements, program of study planning, and campus resources. Students will have out-of-class activities and work with faculty, staff and mentors to explore careers in Kinesiology and complete assignments related to identification & development of their skills and interests. Department of Kinesiology students only. Offered on a satisfactory-fail basis only.

LAS 101: Orientation for Open Option and Preprofessional Students
(1-0) Cr. 1. F.
Introduction to all undergraduate colleges. Provides information about university resources and services, assists with a successful academic transition to the university, and helps initiate the process of identifying academic major(s) and eventual career paths. Required of all first-year students in Open Option and Preprofessional Programs. Offered on a satisfactory-fail basis only.

LATIN 101: Elementary Latin I
(4-0) Cr. 4. F.
Grammar and vocabulary of classical Latin, within the context of Roman culture; reading knowledge through texts adapted from classical authors.

LD ST 122: Leading with Purpose
(1-0) Cr. 1. F.S.
Designed for emerging student leaders, this course will provide students with basic leadership skills covering strengths identification, personal skills development, goal achievement, values-based behaviors, and mission statement development.

LD ST 270: Campus Leadership Development
(3-0) Cr. 3. F.S.SS.
Theory and practice of effective leadership in a campus context. Study of effective leadership models and leadership in complex systems. Expectation of engagement in campus activities. Assessed service-learning component.

LIB 160: Information Literacy
(1-0) Cr. 1. F.S.SS.
Prereq: For students whose native language is not English: Completion of ENGL 101 requirement.
Eight-week course required for undergraduate degree. Provides a solid understanding of information literacy and the research process with emphases on finding, evaluating, and using scholarly information; the ethical and legal framework related to information use; and utilization of library discovery tools. To be taken as early as possible in the student's undergraduate career. See course descriptions of ENGL 150 and ENGL 250 for requirements related to LIB 160. Offered on a satisfactory-fail basis only.

LING 119: Introduction to World Languages
(Cross-listed with WLC). (3-0) Cr. 3.
Study of language diversity and the personal, social and political effects of diversity. Language families, attitudes toward language and language use, language and culture, multilingualism, foreign language learning, written codes, official languages, and language policy.
Meets International Perspectives Requirement.

LING 120: Computers and Language
(Cross-listed with ENGL). (3-0) Cr. 3.
Introduction to the use of linguistic knowledge in computer applications today and the basic computational techniques used in such applications. The development of these techniques throughout the history of computational linguistics. How the study of language has contributed to the advancement of technology and how certain computational problems have influenced the way linguists study language.

M E 160: Mechanical Engineering Problem Solving with Computer Applications
(2-2) Cr. 3. F.S.
Prereq: M E majors only. MATH 142 or MATH 143 or MATH 145; credit or enrollment in MATH 165.
Introduction to the field of Mechanical Engineering through problem-solving in a range of topics including statics, mechanics of materials and thermo-fluids. Techniques to professionally present and communicate solutions. Use of MATLAB computer programming to aid problem solving, including curve fitting and graphing. Only one of M E 160, ENGR 160, Aer E 160, C E 160, CPR E 185, E E 185, S E 185 and I E 148 may count towards graduation.

M E 170: Engineering Graphics and Introductory Design

(2-2) Cr. 3. F.S.

Prereq: Satisfactory scores on mathematics placement assessments; credit or enrollment in MATH 142 or MATH 143 or MATH 145

Integration of fundamental graphics, computer modeling, and engineering design. Applications of multiview drawings and dimensioning. Techniques for visualizing, analyzing, and communicating 3-D geometries. Application of the design process including written and oral reports. Freehand and computer methods.

M S 101: Introduction to Military Science

(1-0) Cr. 1. F.

Prereq: Concurrent enrollment in M S 101L required

Examines the role of a Cadet in the Army Reserve Officer Training Corps and a Lieutenant in the United States Army. The course explores a military culture whose ultimate success is determined by the character and proficiency of its' leaders. Instruction introduces students to the cultural heritage and history of the U.S. Army. Students will begin to understand the structure of the U.S. Army and how it functions as an organization and institution. The curriculum promotes the development of students' communication skills to enhance their ability to transmit ideas. The class examines how the Army's cultural values drive the development of leadership in the Officer Corps. Hands-on activities enable students to gain insight on the skills and abilities required of cadets and officers interacting with civilians and soldiers.

M S 101L: Basic Leadership Laboratory I

(0-2) Cr. 1. F.

Prereq: Concurrent enrollment in M S 101 required

Uses basic military training, missions and scenarios to provide a hands-on method of developing confidence and leadership skills. Students observe and participate in the rotation through various levels of leadership positions at the platoon and squad level within the Army command structure. This concept provides a constant learning environment as they learn to communicate effectively and work as a team while assigned to positions at various levels within the organization. Marching, rifle firing, and tactical patrolling; students gain confidence through rappelling and construction/use of rope bridges; and increase professional knowledge in areas such as first aid, water survival, personal physical fitness, and land navigation. Teaching locations include the ISU Armory, Camp Dodge (National Guard Facility), Pammel Woods (ISU campus), and ISU fitness centers. Full participation in all events will be determined based on students' physical and medical eligibility.

M S 150: Army Physical Readiness

(0-3) Cr. 1. Repeatable. F.S.

This lab is designed to use basic military skills and instruction to develop confidence, leadership, and physical fitness. The team approach is utilized in the instruction and application of Army physical fitness requirements. Students will learn various Army physical fitness techniques as well as how to conduct physical fitness sessions. Teaching locations include Lied Recreation Center, Beyer Hall, State Gym as well as around campus. Full participation in all events will be determined based on students physical and medical eligibility.

MATH 010: High School Algebra

(4-0) Cr. 0. F.S.

For students who do not have adequate facility with topics from high school algebra or do not meet the algebra admission requirement. The course is divided into tracks of one- and two-semester lengths. For most students a diagnostic exam will determine which track must be taken. Students will receive a grade in MATH 25 or MATH 30 respectively depending on the level of material covered. Satisfactory completion of MATH 30 is recommended for students planning to take MATH 140, MATH 143, MATH 145, MATH 150, or MATH 151, while MATH 25 is sufficient for MATH 104, MATH 105, MATH 195, STAT 101 or STAT 105. Students must complete MATH 30 to remove a deficiency in the algebra admission requirement. Topics include signed numbers, polynomials, rational and radical expressions, exponential and logarithmic expressions, and equations. Offered on a satisfactory-fail basis only.

MATH 104: Introduction to Probability

(3-0) Cr. 3. F.S.SS.

Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry

Permutations, combinations, probability, expected value, and applications. Either MATH 104 or MATH 150 may be counted toward graduation, but not both.

MATH 105: Introduction to Mathematical Ideas

(3-0) Cr. 3. F.S.SS.

Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry.

Introduction to contemporary mathematics with an emphasis on use of mathematics to solve real world problems. Typical topics are the mathematics of voting, methods of fair division and apportionment, and elementary game theory.

MATH 106: Discovering Mathematics

(3-0) Cr. 3. F.S.

Inquiry-based approach to mathematics, emphasizing the art, history, and beauty of the subject. Typical topics are mathematics from art, music, puzzles, patterns, and reasoning.

MATH 140: College Algebra
(3-1) Cr. 3. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry; or MATH 30.
Coordinate geometry, quadratic and polynomial equations, functions, graphing, rational functions, exponential and logarithmic functions, inverse functions, quadratic inequalities, systems of linear equations. Prepares students for MATH 160. Students in the College of Liberal Arts and Sciences may not count MATH 140 toward the General Education Requirements.

MATH 143: Preparation for Calculus
(4-0) Cr. 4. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry; or MATH 140.
Preparation for MATH 160, MATH 165, and MATH 181. Functions, graphing, basic trigonometry, logarithms, exponentials. Emphasis on co-variational reasoning. Students in the College of Liberal Arts and Sciences may not count MATH 143 toward General Education Requirements. Only one of MATH 143 and MATH 145 may count toward graduation.

MATH 145: Applied Trigonometry
(3-0) Cr. 3. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry; or minimum of C- in MATH 140.
Mathematical ideas regarding the conception of space. General trigonometry, with an emphasis on the calculation of lengths, areas, and angles. The Law of Sines and the Law of Cosines. Polar, cylindrical, and spherical coordinate systems. Conic sections and quadric surfaces. Students in the College of Liberal Arts and Sciences may not count MATH 145 toward the General Education Requirements. Only one of MATH 143 and MATH 145 may count toward graduation.

MATH 150: Discrete Mathematics for Business and Social Sciences
(2-1) Cr. 3. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry
Linear equations and inequalities, matrix algebra, linear programming, discrete probability. Either MATH 104 or MATH 150 may be counted toward graduation, but not both.

MATH 151: Calculus for Business and Social Sciences
(2-1) Cr. 3. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry
Differential calculus, applications to max-min problems, integral calculus and applications. Will not serve as prerequisite for MATH 265 or MATH 266. Only one of MATH 151, MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 160: Survey of Calculus
(4-0) Cr. 4. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of geometry; or MATH 143; or MATH 140
Analytic geometry, derivatives and integrals of elementary functions, simple differential equations, and applications. Will not serve as a prerequisite for MATH 265 or MATH 266. Only one of MATH 151, MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 165: Calculus I
(4-0) Cr. 4. F.S.SS.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of geometry, 1 semester of trigonometry; or MATH 143
Differential calculus, applications of the derivative, introduction to integral calculus. Only one of MATH 151 or MATH 160 or the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 166: Calculus II
(4-0) Cr. 4. F.S.SS.
Prereq: Minimum of C- in MATH 165 or high math placement scores
Integral calculus, applications of the integral, infinite series, parametric curves and polar coordinates. Only one of MATH 151, MATH 160, the sequence MATH 165-MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 181: Calculus and Mathematical Modeling for the Life Sciences I
(4-0) Cr. 4. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years of high school algebra, 1 year of high school geometry, 1 semester of trigonometry; or MATH 143
Exponential and logarithm functions, difference equations, derivatives, and applications of the derivative. Examples taken from biology. Only one of MATH 151, MATH 160, the sequence MATH 165- MATH 166, or the sequence MATH 181-MATH 182 may be counted towards graduation.

MATH 195: Mathematics for Elementary Education I
(2-2) Cr. 3. F.S.
Prereq: Satisfactory performance on placement assessment, 2 years high school algebra, 1 year of high school geometry, enrollment in elementary education or early childhood education
Whole number operations through analysis of properties, theoretical and hands-on models, mathematical analysis of elementary students' thinking; standard and non-standard algorithms; structure of the decimal system; linear measurement; two- and three-dimensional geometric shapes and spatial sense; number theory; algebra as it relates to elementary curricula/teaching profession. Students in the College of Liberal Arts and Sciences may not count MATH 195 toward General Education Requirements.

MATH 265: Calculus III
(4-0) Cr. 4. F.S.SS.
Prereq: Minimum of C- in MATH 166 or MATH 166H
Analytic geometry and vectors, differential calculus of functions of several variables, multiple integrals, vector calculus.

MATH 267: Elementary Differential Equations and Laplace Transforms
(4-0) Cr. 4. F.S.SS.
Prereq: Minimum of C- in MATH 166 or MATH 166H
Same as MATH 266 but also including Laplace transforms and series solutions to ordinary differential equations.

MICRO 101: Microbial World
(3-0) Cr. 3. F.
Prereq: High school biology or equivalent
Introduction to the importance of viruses, bacteria, fungi, archaea and parasites both to humans and to the biosphere. Topics include past and present microbial impact on humans and society, ecology and diversity of microbes, biotechnology and microbial impact on the biosphere.

MICRO 201: Introduction to Microbiology
(2-0) Cr. 2. F.S.
Prereq: One semester of college-level biology
Selected topics in microbiology with emphasis on the relationship of microorganisms to human and animal health, agricultural technology, and the environment. With written petition to the chair of the supervisory committee, students who obtain a grade of B or better may substitute 201 for Micro 302 in advanced courses.

MTEOR 107: Severe and Hazardous Weather
(2-0) Cr. 1. F.
Understanding of atmospheric processes that play a role in creating severe and hazardous weather. Focus on thunderstorms, tornadoes, hurricanes, floods, blizzards, ice storms, and temperature extremes. Impacts on lives and property.

MTEOR 206: Introduction to Weather and Climate
(Cross-listed with AGRON). (3-0) Cr. 3. F.S.
Basic concepts in weather and climate, including atmospheric measurements, radiation, stability, precipitation, winds, fronts, forecasting, and severe weather. Applied topics include global warming, ozone depletion, world climates and weather safety.

MUSIC 101: Fundamentals of Music
(1-2) Cr. 2. F.S.
Prereq: Ability to read elementary musical notation
Notation, recognition, execution and analysis of scales, intervals, triads, and rhythm; key signatures; time signatures; transposition. Open to non-majors only.

MUSIC 102: Introduction to Music Listening
(3-0) Cr. 3. F.S.SS.
Expansion of the music listening experiences for the general student through greater awareness of differences in techniques of listening, performance media, and materials of the art. The course focuses on the elements of music: rhythm, melody, harmony, form, and style, and how these elements are used in musics of different cultures and time periods. Ability to read or perform music not required.
Meets International Perspectives Requirement.

MUSIC 111: Wind Ensemble
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Emphasis on significant extended compositions for wind and percussion instruments. Performances include formal concerts on campus and the annual tour.

MUSIC 112: Concert Band
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Open to all students who have performed on a wind or percussion instrument in high school band or orchestra
Repertoire includes the broad spectrum of band music. Two concerts are presented each semester.

MUSIC 113: Jazz Ensemble
(0-2) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Designed to explore various styles and trends in contemporary jazz.

MUSIC 114A: Marching and Pep Bands: Marching Band
(0-5) Cr. 1. Repeatable. F.
Membership determined by audition and band application. Auditions held for woodwind, brass, percussion, flag, and twirler positions. Presentation of pre-game and half time shows at each home football game; additional performances are also scheduled on and off campus. Audition information is listed on the band website (www.music.iastate.edu/org/marching). Students may not be concurrently enrolled in MUSIC 114A and 114C.

MUSIC 115: Symphonic Band
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Stresses high quality wind literature. Performances include formal concerts on campus.

MUSIC 118: Applied Music: Non-majors
(0.5-0) Cr. 1-2. Repeatable. F.S.
Prereq: Audition, permission of instructor
Applied music for the general student.

MUSIC 141: Lyrica Women's Choir
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all female students by audition
Large chorus; emphasis on fundamental vocal and choral skills, wide variety of literature. Campus concerts each semester.

MUSIC 151A: Oratorio Chorus: Cantamus Women's Choir
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Advanced skills required, high quality literature. Campus concerts each semester, some concerts in conjunction with orchestras. Men's and women's choirs separately and in combination.

MUSIC 151B: Oratorio Chorus: Statesmen Men's Choir
(0-3) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Advanced skills required, high quality literature. Campus concerts each semester, some concerts in conjunction with orchestras. Men's and women's choirs separately and in combination.

MUSIC 161: Iowa State Singers
(0-5) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Concert choir specializing in performance of advanced music literature, Renaissance through contemporary. Campus concerts, annual spring tour.

MUSIC 181: Symphony Orchestra
(0-4) Cr. 1. Repeatable. F.S.
Prereq: Open to all students by audition
Reading, preparation, and performance of standard repertoire. Five or six concerts annually plus occasional off-campus appearances.

N S 111: Introduction to Naval Science
(3-0) Cr. 3. F.
Introduction to the organization, regulations, and capabilities of the US Navy, with emphasis on mission and principal warfare components.

NREM 110: Orientation in Natural Resource Ecology and Management
Cr. 1. F.
Orientation to the University and to the Department of Natural Resource Ecology and Management. Discussion of departmental learning outcomes, strategies for academic success and academic planning. Offered on a satisfactory-fail basis only.

NREM 120: Introduction to Renewable Resources
(Cross-listed with AGRON, ENV S). (3-0) Cr. 3. F.S.
Overview of soil, water, plants, and animals as renewable natural resources in an ecosystem context. History and organization of resource management. Concepts of integrated resource management.

PHIL 201: Introduction to Philosophy
(3-0) Cr. 3. F.S.SS.
It has been rumored that the unexamined life is not worth living. Philosophy is an attempt to begin examining life by considering such questions as: What makes us human? What is the world ultimately like? How should we relate to other people? Is there a god? How can we know anything about these questions? Understanding questions of this kind and proposed answers to them is what this course is all about.

PHIL 206: Introduction to Logic and Scientific Reasoning
(3-0) Cr. 3. F.S.SS.
Basic principles of critical reasoning and argument evaluation. A consideration of basic forms of argumentation in science and everyday life. Application to contemporary issues and controversies.

PHIL 207: Introduction to Symbolic Logic
(Cross-listed with LING). (3-0) Cr. 3. S.
Introduction to fundamental logical concepts and logical symbolism. Development of natural deduction through first order predicate logic with identity. Applications to arguments in ordinary English and to philosophical issues. Linguistics majors should take LING/PHIL 207 as early as possible.

PHIL 230: Moral Theory and Practice
(3-0) Cr. 3. F.S.SS.
Investigation of moral issues in the context of major ethical theories of value and obligation; e.g., punishment, abortion, economic justice, job discrimination, world hunger, and sexual morality. Emphasis on critical reasoning and argument analysis.

PHIL 235: Ethical Issues in A Diverse Society
(3-0) Cr. 3. S.
This course will examine a range of arguments on diversity issues. Topics will include: the social status of women, the moral status of sexuality and homosexuality, the nature and role of racism in contemporary society, the relationship between biology, gender roles and social status, and various proposals for change from a variety of political perspectives.
Meets U.S. Diversity Requirement

PHYS 101: Physics for the Nonscientist
(3-0) Cr. 3. F.S.
Survey of the principal areas of both classical and modern physics. Emphasis on the nature of the physical universe and the application of physical principles to life in the modern world. Not suitable to meet a general physics requirement for natural science majors.

PHYS 111: General Physics
(4-2) Cr. 5. F.S.SS.
Prereq: 1 1/2 years of high school algebra, 1 year of geometry, 1 semester of trigonometry
General background in physical concepts, principles, and methods for those who do not plan advanced study in physics or engineering. Mechanics, fluids, heat and thermodynamics, vibrations, waves, sound.

PHYS 112: General Physics
(4-2) Cr. 5. F.S.SS.
Prereq: PHYS 111
General background in physical concepts, principles, and methods for those who do not plan advanced study in physics or engineering. Electricity and magnetism, ray and wave optics, topics in modern physics.

PHYS 115: Physics for the Life Sciences
(4-0) Cr. 4. F.S.
Prereq: high school: 1 1/2 yr. algebra, 1 yr. geometry, 1 semester trigonometry
Emphasis on basic physics principles applied to biological problems. Topics include mechanics, fluids, thermodynamics, heat, light, sound, electricity and magnetism. A coordinated laboratory, Physics 115 laboratory is available.

PHYS 198: Physics of Music
(2-2) Cr. 3. F.
Introductory level course on sound for nonphysics majors. Properties of pure tones and harmonics; human perception of sound; room acoustics; scales; production, and analysis of musical by voice, string, woodwind, brass, and percussion instruments. Not suitable to meet a general physics requirement for natural science majors

PHYS 221: Introduction to Classical Physics I
(4.5-1) Cr. 5. F.S.SS.
Prereq: Proficiency in algebra, trigonometry, vector manipulation, and topics covered in Math 165, and credit or enrollment in MATH 166.
For engineering and science majors. 3 hours of lecture each week plus 3 recitations and 1 laboratory every 2 weeks. Elementary mechanics including kinematics and dynamics of particles, work and energy, linear and angular momentum, conservation laws, rotational motion, oscillations, gravitation. Heat, thermodynamics, kinetic theory of gases; waves and sound.

PHYS 222: Introduction to Classical Physics II
(4-2) Cr. 5. F.S.SS.
Prereq: PHYS 221 OR PHYS 241, MATH 166
3 hours of lecture each week plus 1 recitation and 1 laboratory each week. Electric forces and fields. Electrical currents; DC circuits. Magnetic forces and fields: LR, LC, LCR circuits; Maxwell's equations; ray optics and image formation; wave optics; topics in modern physics.

POL S 215: Introduction to American Government
(3-0) Cr. 3. F.S.SS.
Fundamentals of American democracy; constitutionalism; federalism; rights and duties of citizens; executive, legislative, and judicial branches of government; elections, public opinion, interest groups, and political parties.

POL S 241: Introduction to Comparative Government and Politics
(3-0) Cr. 3. F.S.
Basic concepts and major theories; application to selected political systems, including non-western political systems.
Meets International Perspectives Requirement.

POL S 251: Introduction to International Politics
(3-0) Cr. 3. F.S.
Dynamics of interstate relations pertaining to nationalism, the nation state; peace and war; foreign policy making; the national interest; military capability and strategy; case studies of transnational issues, such as population, food, energy, and terrorism.
Meets International Perspectives Requirement.

PSYCH 101: Introduction to Psychology
(3-0) Cr. 3. F.S.SS.
Fundamental psychological concepts derived from the application of the scientific method to the study of behavior and mental processes. Applications of psychology.

PSYCH 102: Laboratory in Introductory Psychology
(0-2) Cr. 1. F.S.
Prereq: Credit or enrollment in PSYCH 101
Laboratory to accompany 101.

PSYCH 111: Orientation to Psychology
Cr. 0.5. F.S.
Program requirements and degree/career options. Required of psychology majors. Offered on a satisfactory-fail basis only.

PSYCH 131: Academic Learning Skills
(0-2) Cr. 1. F.S.
Evidence-based approach to learning and applying academic skills such as time management, note-taking, reading, test preparation, goal setting and motivation, and well-being. Hybrid course structured in a team-based learning format. Offered on a satisfactory-fail basis only.

PSYCH 230: Developmental Psychology
(3-0) Cr. 3. F.S.SS.
Life-span development of physical traits, cognition, intelligence, language, social and emotional behavior, personality, and adjustment.

PSYCH 250: Psychology of the Workplace
(3-0) Cr. 3.
Survey of theories and research methods of psychology applied to the workplace. Consideration of employee selection, training, performance evaluation, leadership, work groups, employee motivation, job attitudes and behaviors, organizational culture, organizational development, human factors, and job design from the scientist-practitioner approach.

PSYCH 280: Social Psychology
(3-0) Cr. 3. F.S.SS.
Individual human behavior in social contexts. Emphasis on social judgments and decisions, attitudes, perceptions of others, social influence, aggression, stereotypes, and helping.

RELIG 205: Introduction to World Religions
(3-0) Cr. 3. F.S.SS.
An introduction to the academic study of religions, including myths, beliefs, rituals, values, social forms. Examples chosen from oral cultures and major religions of the world.
Meets International Perspectives Requirement.

RELIG 210: Religion in America
(3-0) Cr. 3. F.S.SS.
Introductory study of the major beliefs, practices, and institutions of American Judaism, Catholicism, Protestantism, and Islam with emphasis on the diversity of religion in America, and attention to issues of gender, race, and class.
Meets U.S. Diversity Requirement

RELIG 220: Introduction to the Bible
(3-0) Cr. 3. F.S.
Basic overview of the contents of the Old and New Testament in light of their ancient socio-historical background, and with attention to a variety of interpretations and relevance to modern American society.

RELIG 280: Introduction to Catholicism
(3-0) Cr. 3. F.
An explanation of the beliefs, spirit, and practices of Roman Catholicism, including its understanding of God, sacramentality, the human person, and community, and its relationship to other forms of Christianity and other world religions.

RUS 101: Elementary Russian I
(4-0) Cr. 4. F.
Introduction to the Russian language, grammar and syntax. Practice in the four basic skills (listening, speaking, reading, and writing) within the context of Russian culture.

RUS 201: Intermediate Russian I
(4-0) Cr. 4. F.
Prereq: RUS 102
Thorough review of grammar and growth of vocabulary. Selected readings. Continued use of the four basic skills.
Meets International Perspectives Requirement.

S E 101: Software Engineering Orientation
Cr. R.
Introduction to the procedures, policies, and resources of Iowa State University and the department of Computer Science and Electrical and Computer Engineering. Information on engineering and computer-based professions.

SOC 115: Orientation to Sociology
(1-0) Cr. 1. F.S.
Orientation to sociology. A familiarization with University and LAS College requirements and procedures. Occupational tracks and career options open to sociology; introduction to career planning. Recommended during first semester of freshman year, or as soon as possible after transfer into the department. Offered on a satisfactory-fail basis only.

SOC 134: Introduction to Sociology
(3-0) Cr. 3. F.S.SS.
Social interaction and group behavior with emphasis on the scientific study of contemporary U.S. society, including issues relating to socialization, inequality, and changing rural and urban communities. Analysis of relationships among the institutions of family, religion, political participation, work, and leisure.

SOC 219: Sociology of Intimate Relationships
(3-0) Cr. 3. F.S.SS.
Prereq: SOC 134
Analysis of intimate relationships among couples using a sociological perspective. Attention is given to singlehood; dating and courtship; sexuality; mate selection, cohabitation, and marriage. Relationship quality, communication, conflict and dissolution of these types of relationship will also be explored.

SOC 235: Social Problems and American Values
(3-0) Cr. 3. F.S.
Prereq: SOC 134
Sociological concepts, theories and methods to analyze the causes and consequences of social problems. Social problems discussed may include crime, substance abuse, income inequalities, discrimination, poverty, race relations, health care, family issues, and the environment. How American culture and values shape societal conditions, public discourse and policy.
Meets U.S. Diversity Requirement

SOC 241: Youth and Crime
(Cross-listed with CJ ST). (3-0) Cr. 3. F.
An examination of delinquency that focuses on the relationship between youth as victims and as offenders, social and etiological features of delinquency, the role of the criminal justice system, delinquents' rights, and traditional and alternative ways of dealing with juvenile crime.

SP CM 110: Listening
(3-0) Cr. 3. F.S.
Theory, principles, and competency development in comprehensive, therapeutic, critical, consumer, and appreciative listening. The impact of listening in relationships and partnerships.

SP CM 212: Fundamentals of Public Speaking
(3-0) Cr. 3. F.S.SS.
Theory and practice of basic speech communication principles applied to public speaking. Practice in the preparation and delivery of extemporaneous speeches.

SP CM 216: America Speaks: Great Speakers and Speeches in US History
Cr. 3.
Survey of great speeches examined within their political and cultural contexts. Analysis of the rhetorical strategies of diverse speakers with an emphasis on texts from social movements in the United States.
Meets U.S. Diversity Requirement

SP CM 275: Analysis of Popular Culture Texts
(Cross-listed with ENGL). (3-0) Cr. 3. F.S.
Prereq: Credit in or equivalent of 250
Analysis of how information and entertainment forms persuade and manipulate audiences. Study of several forms that may include newspapers, speeches, television, film, advertising, fiction, and magazines. Special attention to verbal and visual devices.

SP ED 250: Education of the Exceptional Learner in a Diverse Society
(3-0) Cr. 3. F.S.
Prereq: C I 204
An overview of students with diverse learning needs, including students with disabilities, English Learners, students who are at risk, and gifted learners. Emphasis is on early identification; educational programming and implications; and legal foundations.
Meets U.S. Diversity Requirement

SPAN 101: Elementary Spanish I
(4-0) Cr. 4. F.SS.
A communicative approach to grammar and vocabulary within the context of Hispanic culture. For students whose native language is not Spanish.

SPAN 201: Intermediate Spanish I
(4-0) Cr. 4. F.
Prereq: SPAN 102 or placement by departmental exam
Intensive review of basic grammar and conversation. For students whose native language is not Spanish. Practice in oral and written communication. Development of fluency with idiomatic expressions. Selected readings on culture and literature.
Meets International Perspectives Requirement.

SPAN 297: Intensive Intermediate Spanish
(4-0) Cr. 4. F.S.
Prereq: 4 years of high school Spanish, two years of Spanish at a community college, Spanish 201, or equivalent by placement
Bridge course between 200- and 300-level Spanish courses that focuses on application of advanced grammatical concepts within the context of Hispanic culture. Accelerated review of SPAN 201 and SPAN 202 designed for students who want to continue at the 300 level. Taught in Spanish for students whose native language is not Spanish.
Meets International Perspectives Requirement.

STAT 101: Principles of Statistics
(3-2) Cr. 4. F.S.SS.
Prereq: 1 1/2 years of high school algebra
Statistical concepts in modern society; descriptive statistics and graphical displays of data; the normal distribution; data collection (sampling and designing experiments); elementary probability; elements of statistical inference; estimation and hypothesis testing; linear regression and correlation; contingency tables. Credit for only one of the following courses may be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226.

STAT 104: Introduction to Statistics
(2-2) Cr. 3. F.S.SS.
Prereq: 1 1/2 years of high school algebra
Statistical concepts and their use in science; collecting, organizing and drawing conclusions from data; elementary probability; binomial and normal distributions; regression; estimation and hypothesis testing. For students in the agricultural and biological sciences. Credit for only one of the following courses may be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226.

STAT 105: Introduction to Statistics for Engineers
(3-0) Cr. 3. F.S.
Prereq: MATH 165 (or MATH 165H)
Statistical concepts with emphasis on engineering applications. Data collection; descriptive statistics; probability distributions and their properties; elements of statistical inference; regression; statistical quality control charts; use of statistical software; team project involving data collection, description and analysis. Credit for only one of the following courses may be applied toward graduation: STAT 101, STAT 104, STAT 105, STAT 201, or STAT 226. Credit for both STAT 105 and STAT 305 may not be applied for graduation.

THTRE 106: Introduction to the Performing Arts
(3-0) Cr. 3. F.S.SS.
An audience oriented, broad-based, team-taught survey of the performing arts which emphasizes theatre and includes segments on television, radio, film, dance, and music.

THTRE 110: Theatre and Society
(3-0) Cr. 3. F.S.
An introduction to Theatre focusing on its relationship with society throughout history.

THTRE 251: Acting I
(3-0) Cr. 3. F.S.
Theory and practice in fundamentals of acting.

TSM 115: Solving Technology Problems
(2-2) Cr. 3. F.S.
Prereq: Credit or enrollment for credit in MATH 140 or higher
Solving technology problems and presenting solutions through data analysis and technical report writing. Problem solving cycle, unit conversion, unit factor method, SI units, significant digits, graphing, curve fitting and computer programming. Use of modern hardware and software tools for applied data-driven problem solving.

TSM 116: Introduction to Design in Technology
(2-2) Cr. 3. F.S.
Use of parametric solid modeling software to create three dimensional solid models and document parts and assemblies. Includes national and international standards for documentation, design projects, and teamwork. Rapid prototyping design creation, 3D printing, assemblies, rendering, and detailing technical drawings.

U ST 104: Personal Career Development
(2-0) Cr. 2. F.S.
Comprehensive approach to personal career development providing students with the skills and structure to make informed choices about their major and career path. Self-exploration of interests, skills, values, and personality as related to the world of work using a variety of techniques; exploration of majors and occupations; model for major and career decision-making and career goal implementation; exposure to effective job search and interviewing skills and resources.

US LS 211: Introduction to U.S. Latino/a Studies
(3-0) Cr. 3. F.S.
History and current lives of the Latino/a peoples in the United States, including Mexican, Cuban, Puerto Rican, Dominican, and South and Central Americans, as well as information specific to Iowa Latino/as, will be covered. Through readings, class discussions, writing assignments, and guest speakers, students will acquire accurate information and a solid understanding of the US Latino/a population and cultural perspectives. Elements of Latino/a culture to be covered include historical, sociological, educational, psychological, economic, and political facets.
Meets U.S. Diversity Requirement

W S 160: Gender Justice
(2-0) Cr. 1. F.S.
Half semester course. Examines the socialization process in the United States and how our perspectives are formed. An introduction to patriarchy, sexism, and ally development are explored. Skills to enhance communication and understanding among women and men will be developed. Offered on a satisfactory-fail basis only.
Meets U.S. Diversity Requirement

W S 201: Introduction to Women's Studies
(3-0) Cr. 3.
Introduction to the interdisciplinary field of Women's Studies. Contemporary status of women in the U.S. and worldwide from social, economic, historical, political, philosophical and literary perspectives. Analysis of intersection of gender, race, class, and sexuality. Subject matter includes work, health, sexuality, and violence. Foundation for the other courses in the program.
Meets U.S. Diversity Requirement

WLC 278: Introduction to Global Film
(3-0) Cr. 3. F.
Introduction to the cinema of non-English speaking regions and cultures of the world through representative subtitled films, lectures, and readings. Topics vary according to faculty interest. Emphasis on selected national cinemas and film as a mode of cultural expression as well as on diverse cultural contexts of cinema.
Meets International Perspectives Requirement.

The following experimental courses (courses that are new and not yet published in the catalog) are also available:

AGRON 106X. Global Agriculture in a Changing World. (3-0) Cr. 3. F. Understanding climate and its effects on global distribution of food and water resources. The nature of climate and its variability in space and time. Use of satellites and related technology to monitor agricultural production, water availability and climate. Influence of climate and climate change on drought famine and other disruptions of essential resources.

C R P 251X. Fundamentals of Geographic Information Systems. (3-0) Cr. 3. F. Fundamentals of the concepts, models, functions and operations of Geographic Information Systems (GIS). Principals of spatial problems, spatial questions and hypotheses and their solutions based on spatial data, GIS tools and techniques. Integration of concepts and applications through lectures and facilitated labs. Applications from a variety of areas including design; physical, social, and human science; engineering; agriculture; business and medicine, landscape architecture, architecture, urban planing, geology, forestry, biology, and ecology.

ENT 214X. Insects in Forensic Science. (3-0) Cr. 3. F. Introduction to the use of insects as evidence in court and how they can assist in solving crimes. Topics covered include basic insect biology, systematics, behavior, with emphasis on applications of forensic entomology.

ENT 220X. Introduction to Forensic Science. (3-0) Cr. 3 F. Study of fundamental forensic science techniques and procedures covering types of physical, chemical, and biological evidence and how this information is used in the legal system. Assessment of crime scenes and various forensic specialties will be introduced.

IND D 101X. Everyday Creativity. (3-0) Cr. 3. F. Conceptual and contextual foundation for understanding the creative impulse and the processes of creative work, drawing examples from multiple cultures, disciplines, and historical periods. Students will recognize the inherent creativity in themselves and others, identify characteristics of a creative person that relate to themselves, develop creative problem solving skills using the basic elements of the creative process, examine qualities of a creative environment in real world settings, and evaluate ideas from critical perspectives.

Credits

The academic value of each course is stated in semester credits. Each credit is normally earned by attending one (50-minute) hour of lecture or recitation per week for the entire semester, or by attending a laboratory or studio period of two or three hours per week. As a guideline, undergraduate students typically will be expected to spend two hours in preparation outside of class for each lecture or recitation hour; additional outside work may be required for laboratory or studio classes.

Contact Hours

Each course states the number of semester credits assigned to the course, preceded in parentheses by the number of hours in class (contact hours) expected of the student. The first of the two contact-hour numbers indicates the number of lecture or recitation class hours per week for the semester. The second is the number of laboratory or studio hours required per week. Laboratory and studio hours may include some time devoted to lectures and recitations. For example, COM S 227 Introduction to Object-oriented Programming is listed as (3-2) Cr. 4. In that case, the course is 4 semester credits, 3 hours of lecture and two hours of laboratory each week.

Semester Offering

The expected term a course is to be offered is indicated by the abbreviations F (Fall) S (Spring) SS (Summer). The notations are for planning purposes and *do not* guarantee a course will be offered in a particular term. Always check the Schedule of Classes (http://classes.iastate.edu) for availability and specific offering times.

GRADUATE MAJORS

Ph.D. Programs

Aerospace Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=2)
Agricultural and Biosystems Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=5)
Agricultural Economics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=3)
Agricultural Education (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=4)
Agricultural Meteorology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=7)
Analytical Chemistry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=9)
Animal Breeding and Genetics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=10)
Animal Physiology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=11)
Animal Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=12)
Apparel, Merchandising, and Design (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=14)
Applied Linguistics and Technology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=15)
Applied Mathematics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=16)
Applied Physics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=17)
Astrophysics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=19)
Biochemistry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=20)
Bioinformatics and Computational Biology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=21)
Biomedical Sciences (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=22)
Biophysics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=23)
Biorenewable Resources and Technology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=24)
Business and Technology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=26)
Chemical Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=27)
Chemistry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=28)
Civil Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=29)
Computer Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=31)
Computer Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=32)
Condensed Matter Physics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=33)
Crop Production and Physiology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=35)
Earth Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=37)
Ecology and Evolutionary Biology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=38)
Economics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=39)
Education (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=40)
Electrical Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=41)
Engineering Mechanics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=43)
Entomology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=45)
Environmental Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=46)
Fisheries Biology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=49)
Food Science and Technology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=50)
Forestry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=51)
Genetics and Genomics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=52)
Geology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=53)
Gerontology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=118)
High Energy Physics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=55)
Horticulture (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=58)
Hospitality Management (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=59)
Human Computer Interaction (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=60)
Human Development and Family Studies (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=61)

Immunobiology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=62)
Industrial and Agricultural Technology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=63)
Industrial Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=65)
Inorganic Chemistry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=68)
Kinesiology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=73)
Materials Science and Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=75)
Mathematics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=76)
Meat Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=77)
Mechanical Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=78)
Meteorology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=79)
Microbiology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=80)
Molecular, Cellular and Developmental Biology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=81)
Neuroscience (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=82)
Nuclear Physics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=83)
Nutritional Sciences (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=84)
Organic Chemistry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=85)
Physical Chemistry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=86)
Physics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=87)
Plant Biology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=88)
Plant Breeding (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=89)
Plant Pathology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=90)
Psychology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=93)
Rhetoric and Professional Communication (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=96)
Rural Sociology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=97)
Rural, Agricultural, Technological and Environmental History (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=6)
Sociology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=101)
Soil Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=102)
Statistics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=103)
Sustainable Agriculture
Toxicology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=108)
Veterinary Microbiology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=112)
Veterinary Pathology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=113)
Wildlife Ecology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=115)
Wind Energy Science, Engineering, and Policy (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=116)

Masters Programs

A complete list of Graduate level programs is available at http://www.grad-college.iastate.edu/academics/programs/masters.php.

Accounting (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=1)
Aerospace Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=2)
Agricultural and Biosystems Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=5)
Agricultural Economics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=3)
Agricultural Education (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=4)
Agricultural Meteorology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=7)
Agronomy (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=8)
Analytical Chemistry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=9)
Animal Breeding and Genetics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=10)
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Animal Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=12)
Anthropology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=13)

Apparel, Merchandising, and Design (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=14)
Applied Mathematics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=16)
Applied Physics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=17)
Architecture (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=18)
Astrophysics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=19)
Biochemistry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=20)
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Biorenewable Resources and Technology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=24)
Business Administration (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=25)
Business Analytics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=119)
Chemical Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=27)
Chemistry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=28)
Civil Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=29)
Community and Regional Planning (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=30)
Computer Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=31)
Computer Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=32)
Condensed Matter Physics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=33)
Creative Writing and Environment (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=34)
Crop Production and Physiology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=35)
Diet and Exercise (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=36)
Earth Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=37)
Ecology and Evolutionary Biology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=38)
Economics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=39)
Education (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=40)
Electrical Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=41)
Energy Systems Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=117)
Engineering Management (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=42)
Engineering Mechanics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=43)
English (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=44)
Entomology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=45)
Environmental Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=46)
Family and Consumer Sciences (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=47)
Finance (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=48)
Fisheries Biology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=49)
Food Science and Technology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=50)
Forestry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=51)
Genetics and Genomics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=52)
Geology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=53)
Gerontology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=118)
Graphic Design (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=54)
High Energy Physics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=55)
History (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=56)
Horticulture (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=58)
Hospitality Management (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=59)
Human Computer Interaction (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=60)
Human Development and Family Studies (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=61)

Immunobiology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=62)
Industrial and Agricultural Technology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=63)
Industrial and Manufacturing Systems Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=65)
Industrial Design (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=64)
Information Assurance (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=66)
Information Systems (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=67)
Inorganic Chemistry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=68)
Integrated Visual Arts (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=69)
Interdisciplinary Graduate Studies (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=70)
Interior Design (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=71)
Journalism and Mass Communication (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=72)
Kinesiology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=73)
Landscape Architecture (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=74)
Materials Science and Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=75)
Mathematics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=76)
Meat Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=77)
Mechanical Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=78)
Meteorology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=79)
Microbiology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=80)
Molecular, Cellular and Developmental Biology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=81)
Neuroscience (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=82)
Nuclear Physics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=83)
Nutritional Sciences (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=84)
Operations Research (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=120)
Organic Chemistry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=85)
Physical Chemistry (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=86)
Physics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=87)
Plant Biology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=88)
Plant Breeding (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=89)
Plant Pathology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=90)
Political Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=91)
Psychology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=93)
Rhetoric, Composition, and Professional Communication (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=95)
Rural Sociology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=97)
School Mathematics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=98)
Science Education (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=99)
Seed Technology and Business (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=100)
Sociology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=101)
Soil Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=102)
Statistics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=103)
Sustainable Agriculture
Sustainable Environments (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=105)
Systems Engineering (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=106)
Teaching English as a Second Language/Applied Linguistics (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=107)
Toxicology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=108)
Transportation (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=109)
Urban Design (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=110)

Veterinary Clinical Science (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=111)
Veterinary Microbiology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=112)
Veterinary Pathology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=113)
Veterinary Preventive Medicine (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=114)
Wildlife Ecology (http://www.grad-college.iastate.edu/academics/programs/apresults.php?id=115)

Certificates

A complete list of Graduate level programs is available at http://www.grad-college.iastate.edu/academics/programs/cert.php.

Advanced Manufacturing (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=1)
Agronomy (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=50)
Applied Research Methods in the Human Sciences (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=2)
Biorenewable Resources and Technology (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=3)
Business Analytics (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=51)
Community College Leadership (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=4)
Community College Teaching (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=5)
Computational Fluid Dynamics (being discontinued) (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=6)
Computer Networking (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=7)
Construction Management (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=8)
Developmental and Family Sciences Advanced Research Design and Methods (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=9)
Dietetics Internship (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=10)
Education for Social Justice (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=40)
Embedded Systems (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=13)
Energy Systems Engineering (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=14)
Entrepreneurship and Innovation (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=15) Environmental Engineering (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=16)
Environmental Systems (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=17)
Family Financial Planning (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=18)
Family Well-Being in Diverse Society (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=19)
Financial and Housing Counseling (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=20)
Food Safety and Defense (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=21)
Forensic Sciences (Catalog information)
Forensic Sciences (Graduate College web site) (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=22)
Geographic Information Systems (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=23)
Gerontology (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=24)
Graduate Student Teaching (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=25)
Human Computer Interaction (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=26)
Infant and Early Childhood Mental Health (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=27)
Information Assurance (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=28)
Instructional Design (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=29)
Lifespan Development (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=30)
Literacy Coaching Certificate (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=31) Power Systems Engineering (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=34)
Principal Licensure (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=35)
Public Management and Policy (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=36)
Quantitative Psychology (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=37)
Seed Business Management (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=38)
Seed Science and Technology (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=39)
Software Systems (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=41)

Special Education (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=42)
Student Affairs (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=43)
Superintendent Licensure (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=44)
Systems Engineering (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=45)
Teaching English as a Second Language/Teaching English as a Foreign Language (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=46)
Veterinary Preventive Medicine (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=47)
Youth Development Specialist (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=48)
Youth Program Management and Evaluation (http://www.grad-college.iastate.edu/academics/programs/acresults.php?id=49)

Graduate Minors

Students may request a minor in any program (http://www.grad-college.iastate.edu/academics/programs/approgram.php) approved to grant a graduate degree and in programs approved to offer only a minor. For more information about minor only programs, click their respective links below:

Applied Scientific Computing (http://asc.aere.iastate.edu)
Biorenewable Chemicals (http://www.cbirc.iastate.edu/education/university/biorenewable-chemicals-graduate-minor) | see catalog information
French (http://catalog.iastate.edu/collegeofliberalartsandsciences/worldlanguagesandcultures)
German (http://catalog.iastate.edu/collegeofliberalartsandsciences/worldlanguagesandcultures)
Latin (http://catalog.iastate.edu/collegeofliberalartsandsciences/worldlanguagesandcultures)
Linguistics (https://apling.engl.iastate.edu)
Philosophy (http://www.philrs.iastate.edu/philosophy/major-in-philosophy)
Russian (http://catalog.iastate.edu/collegeofliberalartsandsciences/worldlanguagesandcultures)
Spanish (http://catalog.iastate.edu/collegeofliberalartsandsciences/worldlanguagesandcultures)
Speech Communication (http://www.engl.iastate.edu/graduate-students)
Technology and Social Change (http://catalog.iastate.edu/interdisciplinaryprograms/minor/technologyandsocialchange)
Women's Studies (https://womensstudies.las.iastate.edu/about/degrees)

INFORMATION ABOUT COURSES

A-Z Courses

Course Numbers

The courses in each department are numbered from 1 to 699, according to the following groups:

- 1-99 Courses not carrying credit toward a degree (zero credit).
- 100-299 Courses primarily for freshman and sophomore students.
- 300-499 Courses primarily for junior and senior students.
- 500-599 Courses primarily for graduate students, but open to qualified undergraduates.
- 600-699 Courses for graduate students.

Off-campus courses-Residential Credit

Iowa State University faculty teach distance learning courses online, by video conferencing, streaming media, and CD/DVD. Courses are the same as those offered on campus, carry residential credit, and are taught by Iowa State faculty. Credit earned becomes a part of the academic record at Iowa State University and may be used to meet degree requirements the same as credit earned on campus.

Priority Enrollment

High demand for courses in certain areas has necessitated enrollment management for some courses. When enrollment priority is established for a course, first consideration is given to students whose curriculum/major explicitly requires the course.

Special Course Fees

Courses for which special course fees are assessed are designated in the Schedule of Classes. Special course fees may be assessed for such extraordinary costs as materials fees (which may include consumable materials or equipment replacement), field trip expenses, developmental Math fees, and camp fees. In some cases, special course fee amounts vary from term to term. Additional information on camp fees and the developmental Math fee may be found in the fees and expenses section.

Independent Study

Most departments offer opportunities for independent study through a 490 course listing. Usually a minimum of 6 to 10 credits of coursework in the department is required before independent study is permitted. Students who are interested in this kind of experience in a particular department should check the catalog to determine the department's prerequisites to register for 490. 490H sections are reserved for students in the University Honors Program.

Students should check with the department about procedures, in addition to meeting the prerequisites, for registering for 490. A written plan of study is prepared in advance with a faculty member who has agreed to supervise the student's work, to evaluate progress and the final product, and to assign a grade. Initiation of the plan of study should occur prior to the semester in which enrollment is desired. Both the student and the instructor should agree on the number of credits for which the student will enroll, the amount and kind of work he or she will do for that credit, and the system by which she or he will be graded (A-F or S/F). Students should not expect to register for or add 490 credit without an instructor's permission. Some colleges and/or departments have limits on the number of credits of 490 that may be applied toward graduation.

Credits and Contact Hours

The academic value of each course is stated in semester credits. Each credit is normally earned by attending one (50-minute) hour of lecture or recitation per week for the entire 16-week semester, or by attending a laboratory or studio period of two or three hours per week. As a guideline, undergraduate students typically will be expected to spend two hours in preparation outside of class for each lecture or recitation hour; additional outside work may be required for laboratory or studio classes. The Office of the Registrar will maintain a table of faculty-approved credit-contact hour equivalencies for the types of instruction (e.g. lecture, studio, internships, research courses) offered by the institution.

Courses offered for less than a full semester (e.g. summer terms or compressed formats) will fulfill the same contact hour requirements as full-semester courses having the same credit hours. For example, a student enrolled in a one-credit course offered in an 8-week (half-semester) format should expect two hours of lecture and four hours of out of class preparation per week. Similarly, a course offered in hybrid, online, or distance education format is expected to meet the same contact hour requirement, and offer equivalent student-faculty/student-student interaction and class preparation time, as the same course taught in a traditional format.

Each course states the number of semester credits assigned to the course, preceded in parentheses by the number of hours in class (contact hours) expected of the student. The first of the two contact-hour numbers indicates the number of lecture or recitation class hours per week for the semester. The second is the number of laboratory or studio hours required per week. Laboratory and studio hours may include some time devoted to lectures and recitations. For example, COM S 227 Introduction to Object-oriented Programming is listed as (3-2) Cr. 4. In that case, the course is 4 semester credits, 3 hours of lecture and two hours of laboratory each week.

The term “Cr. arr.” means that the amount of credit is arranged in advance between the student and the instructor. The credit to be earned depends on the amount of work expected of the student, in accordance with the

policy that some combination of teacher-student contact and outside work by the student involving at least three hours per week for the semester is required for each credit.

The term "Cr. R." means that the course is required in a certain curriculum or as cognate to one or more other courses. It is also used for cooperative education courses and for some optional inspection trips, study tours, and professional development courses for which numerical credit is not granted. An R credit course does not carry numerical credit toward a student's degree, but it does apply toward the degree. The R credit course is generally listed on the degree program as a requirement for a specific curriculum/major that must be completed prior to graduation. R credit courses may be graded using the A-F grading scale or the satisfactory/fail grading scale. All R credit courses are assigned a numerical value for purposes of enrollment certification. Requests by students to drop an R credit course will be processed as an administrative drop during period 2 and thus will not be counted against the student's drop limit and will not appear on the student's transcript. (See Schedule Changes.)

Credit Involving a Paid Activity

Students may obtain credit for an activity, either on- or off-campus, for which they are also paid, provided the activity is academically relevant. This policy does not apply to registrations for R credit.

In order for an activity to be defined as academically relevant, prior arrangements for receiving credit must be made with a faculty member in an appropriate department.

The arrangements must include agreement on (1) the academic objectives which the activity is expected to achieve, and (2) the procedure by which the student's learning will be assessed.

Semester of Offering

Within each course description may be found one or more of the following letters: F. S. SS., indicating which term—fall, spring, summer session—of the academic year the course is offered. "Alt." is the abbreviation for alternate. If there is sufficient demand, courses may be offered more frequently than announced. Insufficient demand or unforeseen staffing problems may result in the cancellation of announced offerings. Students are advised to refer to the Schedule of Classes or consult with departments for up-to-date course schedule information.

Course Prerequisite

A prerequisite indicates the specific academic background or general academic maturity considered necessary for the student to be ready to undertake the course. Prerequisites are usually stated in terms of specific courses, but equivalent preparation is usually acceptable. An instructor may, however, direct a student whose background does not meet the stated prerequisite, or its equivalent, to drop the course. Conversely, an instructor may waive the prerequisite for a course for which he or she is responsible. Thus, permission of the instructor is understood to be an alternate to the stated prerequisites in all courses.

It is university policy that the instructor shall inform- the students at the beginning of each course if students who have not met the prerequisite requirements must drop the course. Course prerequisites are listed in the Schedule of Classes as well as in the Courses and Programs section of this publication.

Cross-listed Courses

A course, including its complete description, may be listed in two or more departments. The participating department or departments are noted in parentheses. Credit for the course may be obtained through any of the cross-listed departments.

Dual-listed Courses

Dual-listed courses permit undergraduate and graduate students to be in the same class while receiving credit for either undergraduate or graduate level work.

Credit in the graduate course is not available to students who have received credit in the corresponding undergraduate course. Both graduates and undergraduates receive the same amount of credit for the course, but additional work is required of all graduate students taking the course under the graduate-level course number. This extra work may take the form of additional reading, projects, examinations, or other assignments as determined by the instructor. The instructor must be a member of the Graduate Faculty or a Graduate Lecturer. Each dual-listed course is designated in the catalog with the phrase "Dual-listed with," although the student's official transcript of credits, both graduate and undergraduate, does not identify dual-listed courses as such. There is a limit to the number of dual-listed course credits that may be used to meet the requirement for an advanced degree. (For information about procedures for requesting permission to offer dual-listed courses, faculty should consult the Graduate Faculty Handbook.)

IOWA STATE FACULTY

A

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Emeritus Professor of Greenlee School of Journalism and Communication. B.S., 1967, Iowa State; M.S., 1970, Ph.D., 1974, Wisconsin.

ABEL, CRAIG
Affiliate Professor of Entomology. B.S., 1987, M.S., 1993, Ph.D., 1998, Iowa State.

ABELSON, ABRAHAM G.
Emeritus Professor of School of Education. B.A., 1964, M.Ed., 1970, Pennsylvania State; Ph.D., 1976, Michigan.

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Emeritus Associate Professor of Civil, Construction and Environmental Engineering. B.S., 1966, M.S., 1968, Ph.D., 1983, Wisconsin.

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Emeritus Professor of English. B.A., 1953, Cornell; M.A., 1976, Iowa State; Ph.D., 1981, Illinois.

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Lecturer in Psychology. M.S., 1996, Buenos Aires National; Ph.D., 2001, rer.nat. Konstanz (Germany).

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Assistant Professor of Food Science and Human Nutrition. B.S., 1999, Cordoba (Argentina); Ph.D., 2006, Buenos Aires (Argentina).

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Professor of Agricultural Education and Studies; Associate Dean of the College of Agriculture and Life Sciences. B.A., 1975, Wilmington; M.Ed., 1980, M.S., 1980, California (Davis); Ph.D., 1989, Oregon State.

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Professor of Veterinary Pathology; Professor of Veterinary Clinical Sciences. D.V.M., 1986, Ph.D., 1990, Iowa State.

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Lecturer in Kinesiology. B.S., 1983, New York; M.A., 1990, California (Los Angeles).

ADAMS, DEAN
Professor of Ecology, Evolution and Organismal Biology; Professor of Statistics. B.A., 1992, Franklin and Marshall College; M.Sc., 1994, Louisiana; Ph.D., 1999, New York (Stony Brook).

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Emeritus Professor of Biomedical Sciences; University Professor. A.B., 1960, California (Davis); M.A., 1967, Chico State; Ph.D., 1970, California (Davis).

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Assistant Professor of Natural Resource Ecology and Management. B.S., 1999, Duke; Ph.D., 2010, Princeton.

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Professor of Computer Science. B.Tech., 1993, Jawaharlal Nehru Technological; M.S., 1995, Indian Institute of Technology; Ph.D., 2001, New York (Buffalo).

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Professor of Veterinary Diagnostic and Production Animal Medicine; Professor of Veterinary Microbiology and Preventive Medicine. B.A., 1978, Nebraska (Omaha); D.V.M., 1984, M.S., 1986, Ph.D., 1990, Iowa State.

ZIMMERMAN, ZORA DEVRNJA
Emeritus Professor of English. B.A., 1967, Ph.D., 1974, New York (Buffalo).

ZMOLEK, WILLIAM G.
Emeritus Professor of Animal Science. B.S., 1944, M.S., 1951, Iowa State.

ZUNKEL, KAREN A.
Lecturer in School of Education. B.S., 1983, Iowa State; M.S., 1989, Oklahoma; Ph.D., 2002, Iowa State.

ZYTOWSKI, DONALD G.
Emeritus Professor of Psychology. A.B., 1952, Harris; M.S., 1957, Ed.D., 1965, Washington (St. Louis).

PLAN OF STUDY - SOAR IN 4

Four Year Graduation Guarantee

Iowa State University's Soar in 4: Four-Year Graduation Guarantee provides the opportunity for students to take a proactive approach towards completing their undergraduate degree in four years (or eight semesters). Through careful planning with their academic advisers, students can complement their undergraduate degree with experiences such as study abroad, internship, and service learning. By graduating in four years, students can reduce their tuition costs and accelerate their entry into the job market or advanced education compared to students who take more than eight semesters to graduate. The program encourages students to work collaboratively with their academic adviser to make strategic academic decisions about which courses to take each semester.

Students wanting to graduate in four years under the Soar in 4: Four-Year Graduation Guarantee are expected to:

- Keep in close contact with their Iowa State academic adviser, who will guide students' academic decisions and keep students up-to-date with university policies and procedures.
- Take required courses at the times they are available.
- Maintain student registration at ISU during off-campus experiences.
- Register for classes promptly and monitor academic progress on a regular basis by reviewing the degree audit and with his/her adviser.

Iowa State University will provide the academic advising services and degree-audit mechanisms to assist students in accurately monitoring progress toward graduation. ISU is also responsible for providing class space in the courses required for the student's respective major in order to complete a bachelor's degree within eight consecutive semesters.

Additional information about the Four-Year Graduation Guarantee can be found at:

http://www.provost.iastate.edu/academic-programs/soarin4

Four-year (eight-semester) templates for ISU programs of study

Iowa State University offers over 100 majors in six undergraduate colleges. All but two programs, architecture and landscape architecture, may be completed in four years. ISU's bachelor degree programs require from 120 to 144 credits; therefore, students must average between 15 and 18 credits per semester. To assist students in creating their own personal four-year academic plans, eight-semester templates are provided for all programs of studies covered by the Soar in 4 program.

- Agricultural and Life Sciences Education, B.S - communications option
- Agricultural and Life Sciences Education, B.S - teacher certification option
- Agricultural Biochemistry, B.S. - option 1
- Agricultural Biochemistry, B.S. - option 2
- Agricultural Business, B.S.
- Agricultural Studies, B.S.
- Agricultural Systems Technology, B.S. - Agricultural and biosystems management option
- Agricultural Systems Technology, B.S. - machine systems option
- Agriculture and Society, B.S.
- Agronomy, B.S.
- Animal Ecology, B.S. - fisheries and aquatic sciences
- Animal Ecology, B.S. - interpretation of natural resources option
- Animal Ecology, B.S. - Pre-vet & wildlife care option
- Animal Ecology, B.S. - wildlife option
- Animal Science, B.S
- Animal Science, B.S. - pre-veterinary medicine
- Biology, B.S.
- Culinary Science, B.S.
- Dairy Science, B.S. - general
- Dairy Science, B.S. - pre-veterinary medicine option
- Diet and Exercise, B.S./M.S.
- Dietetics, B.S.
- Environmental Science, B.S.
- Food Science, B.S. - Food Science and industry option
- Food Science, B.S. - Food Science and technology option
- Forestry, B.S. - forest ecosystem management option
- Genetics, B.S.
- Global Resource Systems, B.S.
- Horticulture, B.S. - horticulture food crop production and management option
- Horticulture, B.S. - landscape design, installation, and management
- Horticulture, B.S. - public horticulture option
- Horticulture, B.S. - science option
- Horticulture, B.S. - turfgrass management option
- Horticulture, B.S. ornamental plant production and garden center and management option
- Industrial Technology, B.S. - manufacturing option
- Industrial Technology, B.S. - occupational safety option
- Microbiology, B.S.
- Nutritional Science, B.S. - nutritional and wellness option
- Nutritional Science, B.S. - pre-health professional & research option

- Accounting, B.S.
- Business Economics, B.S.
- Entrepreneurship, B.S.
- Finance, B.S.
- Management, B.S.
- Management Information Systems, B.S.
- Marketing, B.S.
- Supply Chain Management, B.S.

- Architecture, B.Arch.
- Art and Design, B.A., Art and Culture Concentration
- Art and Design, B.A., Visual Culture Studies Concentration
- Community and Regional Planning. B.S.
- Graphic Design, B.F.A.
- Industrial Design
- Integrated Studio Arts. B.F.A.
- Interdisciplinary Design
- Interior Design, B.F.A.
- Landscape Architecture, B.L.A.

- Aerospace Engineering, B.S.
- Agricultural Engineering, B.S. - ag power and machinery option
- Agricultural Engineering, B.S. - animal production systems engineering option
- Agricultural Engineering, B.S. - land and water resources engineering option
- Biological Systems Engineering, B.S. - bioenvironmental engr option
- Biological Systems Engineering, B.S. - biorenewable resources engr option
- Biological Systems Engineering, B.S. - Pre-prof. and pre-graduate Option
- Biological Systems Engineering, B.S. Food Engineering Option
- Chemical Engineering, B.S.
- Civil Engineering, B.S. - environmental specialization
- Civil Engineering, B.S. -GENERAL Program
- Computer Engineering, B.S.
- Construction Engineering, B.S. building emphasis
- Construction Engineering, B.S. electrical emphasis
- Construction Engineering, B.S. heavy/highway emphasis
- Construction Engineering, B.S. mechanical emphasis
- Electrical Engineering, B.S.
- Industrial Engineering, B.S.
- Materials Engineering, B.S.
- Mechanical Engineering, B.S.
- Software Engineering, B.S.

- Apparel Merchandising, Design B.S. - creative and technical design option
- Apparel Merchandising, Design B.S. - merchandising option
- Apparel Merchandising, Design B.S. - product development option
- Athletic Training, B.S.
- Child, Adult, and Family Services, B.S.-adult and family program option
- Child, Adult, and Family Services, B.S.-child program option
- Child, Adult, and Family Services, B.S.-youth program option
- Culinary Science, B.S.
- Diet and Exercise, B.S./M.S.
- Dietetics, B.S.
- Early Childhood Education, B.S.
- Elementary Education, B.S.
- Event Management, B.S.
- Family and Consumer Sciences Education and Studies, B.S.-communications option
- Family and Consumer Sciences Education and Studies, B.S.-professional studies option
- Financial Counseling and Planning, B.S.-family financial studies emphasis
- Financial Counseling and Planning, B.S.-financial counseling emphasis
- Financial Counseling and Planning, B.S.-financial planning emphasis
- Food Science, B.S - food science & industry option
- Hospitality Management, B.S.
- Kinesiology and Health, B.S. - athletic training
- Kinesiology and Health, B.S. - community/public health
- Kinesiology and Health, B.S. - exercise science
- Kinesiology and Health, B.S. - physical education for teacher education
- Kinesiology and Health, B.S. - pre-health - pre-chiropractic
- Kinesiology and Health, B.S. - Pre-health - pre-medicine
- Kinesiology and Health, B.S. - pre-health - pre-physical therapy
- Kinesiology and Health, B.S. - pre-health - pre-physician assistant
- Nutritional Science, B.S. - Nutrition & wellness option
- Nutritional Science, B.S. - Pre-health professional & research option

- Advertising, B.A.
- Anthropology, B.A., B.S.
- Biochemistry, B.S.
- Bioinformatics and Computational Biology B.S.

- Biological/Pre-Medical Illustration, B.A.
- Biology, B.S.
- Biophysics, B.S.
- Chemistry, B.A.
- Chemistry, B.S.
- Communication Studies, B.A.
- Computer Science, B.S.
- Criminology and Criminal Justice Interdisciplinary Studies
- Earth Science, B.A.
- Earth Science, B.S.
- Economics, B.S.
- English, B.A. - English Education
- English, B.A., B.S.
- Environmental Science, B.S
- Genetics, B.S.
- Geology, B.S. - Env-Geol/Hydro Option
- Geology, B.S.- Traditional Option
- History, B.S.
- History, B.A.
- Journalism and Mass Communication, B.A., B.S.
- Linguistics, B.A.
- Mathematics, B.S. (5-12 certification)
- Mathematics, B.S.
- Meteorology, B.S. - plan 1
- Meteorology, B.S. - plan 2
- Music, B.A.
- Music, B.Mus. - Instrumental: K-12 Certification
- Music, B.Mus. - organ
- Music, B.Mus. - piano
- Music, B.Mus. - strings
- Music, B.Mus. - vocal: K-12 certification
- Music, B.Mus. - voice
- Music, B.Mus. - wind or percussion instrument
- Music, B.Mus.-composition
- Performing Arts, B.A.
- Philosophy, B.A.
- Physics, B.S
- Political Science, B.A.
- Psychology, B.A.
- Psychology, B.S
- Public Relations, B.S.
- Religious Studies, B.A.
- Sociology, B.A., B.S.
- Software Engineering, B.S.
- Speech Communication, B.A.
- Statistics, B.S.
- Technical Communication, B.S.
- Women's Studies, B.A., B.S. (1)
- World Languages and Cultures B.A-French/German/Spanish

PREPROFESSIONAL STUDY

Requirements for admission to most professional academic programs can be met by study at Iowa State University. These requirements may be met in the course of obtaining a bachelor's degree from Iowa State or at a level below that of a degree, depending on the intended field of study. The specific courses taken in a preprofessional program will depend primarily upon the admission requirements of the professional schools to which a student wants to apply. In some programs requiring three years of preprofessional work, a student may, by careful planning, complete requirements for the bachelor's degree upon transferring to Iowa State up to 32 semester credits of professional coursework. Generally these credits will be counted as electives, but a maximum of 24 may be used as major credits in interdisciplinary studies and a smaller number as major credits in appropriate departments.

Students who have not declared a major upon entry should enter as preprofessional students, i.e., premedical, prelaw, PHP (preprofessional health programs), or GENPV (General Undergraduate Studies Pre Vet), until they choose a major or transfer to a professional school. All students, whether they have selected a major or not, are encouraged to identify their interest in a professional career by designating it on their application.

Information about preprofessional program admissions requirements and career opportunities in human health or law may be obtained in the Liberal Arts and Sciences Advising Center. Information about veterinary medicine admissions requirements and career opportunities may be obtained from the coordinator of the preveterinary program in the Office of the Dean of the College of Veterinary Medicine.

Clinical Laboratory Science/Medical Technology

Clinical laboratory scientists, still commonly referred to as medical technologists, are important members of health-care teams. They perform the chemical, microscopic, radio-assay, and microbiological tests that are necessary in disease diagnosis, and they type and cross-match blood samples to facilitate blood transfusions. They usually work under the supervision of a physician in a hospital or clinic laboratory, but may also be employed by a pharmaceutical company or by manufacturers of analytical instruments. The professional training requires 12 months in a hospital-based CLS/MT program following at least 3 years of college study that emphasizes chemistry and the biological sciences. Students may earn a bachelor's degree in specific ISU majors, by completing the admissions requirements of the CLS/MT program and most of the degree requirements in 3 years on campus, then spending their fourth year in one of the hospital programs that are affiliated with Iowa State University. Before beginning the off-campus studies, students must earn at least 88 credits; the 32 most recent credits must have been earned in residence at ISU. A maximum of 32 semester credits earned in pro-fessional CLS/MT school can be used to partially fulfill the requirements for the bachelor's degree. Students who complete all degree requirements in residence at the university may apply to any school of medical technology for which the admission requirements have been met.

Dentistry

Dentists diagnose, treat, and try to prevent diseases and injuries of the teeth, jaws, and mouth. Usually a general practitioner will have spent 3 or 4 years taking preprofessional courses at the undergraduate level and 4 years in dental school earning the degree of doctor of dental surgery (D.D.S.) or doctor of dental medicine (D.M.D.). Learning a specialty requires at least 2 more years. The courses necessary for admission to most dental schools include English, biology, general and organic chemistry, and physics. Students may earn a degree in any major that Iowa State University offers as they meet the admission requirements; they should choose their major to reflect their own interests and abilities. Highly qualified students may be accepted into dental school after 3 years of preprofessional study without earning a baccalaureate degree..

Health Information Management

Health information managers serve as supervisors of medical records departments in hospitals, clinics, nursing homes, and other healthcare institutions. Certified registered record administrators (R.R.A.) must have completed a program leading to a bachelor's degree in medical record administration. Most professional programs are 2 years in length and follow 2 years of college study in chemistry, biology, the humanities, social sciences, languages, and philosophy. Students may take the preprofessional courses at Iowa State University and then transfer to a university offering the professional program or they may earn a bachelor's degree at Iowa State University before entering a health information management program.

Hospital and Health Administration

Administrators of health care organizations manage and guide the varied activities in hospitals, clinics, nursing homes, and mental health facilities. The professional requirement may be for a master's degree or a bachelor's degree, depending upon the size of the institution and whether an upper or middle entry-level position is desired. Students at Iowa State may take general education courses for two or more years and then transfer to a university offering a bachelor's degree in health administration, or they may spend four years earning a bachelor's degree in any department before entering a master's degree program at the University of Iowa or other university. Courses required for admission to master's degree programs in hospital and health administration vary, but may include introductory accounting, management, statistics, and economics.

Human Medicine

Physicians study, diagnoses, and treat illness and injury. They may work in offices, clinics, hospitals, or laboratories, in private practice or for government or industry. Their professional training usually consists of 4 years of study in a college of medicine to earn the doctor of medicine (M.D.) degree, and then 3 or more years in hospital residency learning a specialty such as family medicine, pediatrics, surgery, obstetrics, or psychiatry. A degree of doctor of osteopathy (D.O.) is awarded to those students who complete 4 years in a college of osteopathic medicine before their residency. All medical schools recommend a broad preprofessional education that includes courses in biology, chemistry, physics, mathematics, English, the social sciences, arts and humanities. The degree of a premedical student can be from any college and in any curriculum or major offered by the university. The major should reflect the student's interests and provide appropriate preparation for an alternative career.

Law

An attorney offers assistance, often where a third-party neutral arbiter is required to resolve conflicts. Many attorneys work in private practice, but others secure positions in the public sector, e.g., federal or state governmental agencies. A minimum of three years from an American Bar Approved (ABA) law school is required to earn a Doctor of Jurisprudence (J.D) degree. A bachelor's degree is required for admission to all accredited law schools. A student planning to enter law school may pursue an undergraduate degree in any discipline. The choice of the bachelor's degree should reflect a student's passion and personal interests and not be perceived as being the best degree to help them be admitted into law school. Appropriate courses should be completed that will enhance a student's development of critical thinking skills, including analytical written and oral skills. An understanding of business, social sciences, and humanities is necessary to comprehend the pluralistic society within and outside of the United States. These courses should include accounting, management, political science, psychology, criminal justice, economics, philosophy, English literature, and history. The completion of these courses will provide students with a knowledge base and skill sets that will assist them with their preparation for law school. Courses in mathematics and statistics are also helpful in developing analytical skills. Advanced writing courses and speech communication courses will also serve students well. The College of Liberal Arts and Sciences participates in a 3+3 program with the Law Schools at Drake University and at the University of Iowa. Visit the Liberal Arts and Sciences Student Academic Services office for details.

Library and Information Science

Librarians and information science specialists select, organize, preserve and promote information resources as well as advocate and teach information literacy skills. Professional opportunities include work for libraries in academic institutions, public education, city and county municipalities, medical facilities, government agencies, and corporate settings. They also have work opportunities in the publishing and information technology professions. Master's degree programs in library and information science provide the professional preparation. Iowa State students may earn a bachelor's degree in any department before entering a professional master's degree program. They may choose majors that reflect their interests and provide a foundation for working in the library and information science field.

Occupational Therapy

Occupational therapists provide purposeful activities to help those who have been disabled by physical illness or injury, birth defects, emotional disorder, aging, drug abuse, or other problems to learn to cope with everyday living. Therapists treat patients in hospitals, school systems, and rehabilitation centers. Students may complete a bachelor's degree in any major at Iowa State University, and then enter a master's or doctoral degree program at another university.

Optometry

Optometrists examine, diagnose, treat and manage diseases of the visual system, the eye and associated structures. Treatment may include corrective glasses or contacts, vision therapy and therapeutic drugs. Optometrists usually set up their own offices or work in group practice. Professional study requires 4 years in a school or college of optometry and leads to the doctor of optometry (O.D.) degree. All optometry schools require at least 90 semester credits of preprofessional courses, including biology, chemistry, physics, mathematics, and English. Certain optometry schools require a bachelor's degree. Students wishing to earn the bachelor's degree from Iowa State University may choose any major and take the courses required for graduation with that major as they take the courses required for admission to a professional optometry program.

Pharmacy

Pharmacists prepare and dispense therapeutic drugs; educate health care professionals, patients and the general public about the appropriate use of drugs; conduct pharmaceutical research and work in industrial settings which involve the manufacture, marketing and advertising of pharmaceutical. Students may complete prepharmacy courses at Iowa State University. Many schools do not require a bachelor's degree for admission, however most students complete at least 3 years of college before admission to pharmacy schools. Upon admission, the student will then transfer to a Pharm. D. program of study which will entail four years of study.

Physical Therapy

Physical therapists work with people who have been disabled by injury, illness, or birth defects. They assist in evaluating the physical problems and administer therapeutic agents such as massage and exercise,

heat, baths, ultrasonics, and electricity; they work in hospitals, clinics, nursing homes, schools, rehabilitation centers, and private practice. Usually, students earn a bachelor's degree at ISU before entering professional school to earn a doctoral degree. The bachelor's degree from ISU may be earned in any department, provided that the physical therapy prerequisites are completed. Courses required for admission to a professional program include biology, chemistry, physics, psychology, mathematics, and statistics.

Physician Assistant

A physician assistant provides medical services under the supervision of a licensed physician. PAs conduct physical examinations, order and interpret laboratory tests, make diagnostic and treatment decisions, and are allowed to prescribe medication in most states. Certification as a physician assistant requires at least 2 years in a professional program at the master's degree level. Applicants must have had health-care experience with direct patient contact experience. Students must have earned a bachelor's degree before entering a PA program. The degree can be in any area but the student must complete the pre-requisite courses for the PA program. These usually include courses in biology, chemistry, psychology, and statistics.

Podiatry

Podiatrists diagnose, and treat diseases and disorders of the human foot and ankle. They treat patients in private and group practice, hospitals, and, increasingly, in industrial and sports-related positions. Professional training requires 4 years in a college of podiatric medicine and leads to the degree of doctor of podiatric medicine (D.P.M.). This is usually followed by 1 to 3 years in a hospital residency. All podiatric colleges require at least 3 years of preprofessional study, including courses in biology, general and organic chemistry, physics, and English. Most entrants have a bachelor's degree, which may be in any major. A few students may complete the admission requirements and most of the bachelor's degree requirements in 3 years. If so, a maximum of 32 semester credits may be transferred to Iowa State University from the first year in an accredited podiatric college in order to complete the requirements for the bachelor's degree.

Theology or Religious Studies

The professional education of a student of religion can follow one of two paths. The path to a profession as a pastor, priest, rabbi or other leadership position in a religious tradition usually requires 3 years in a program leading to the master of divinity (M.Div.) offered at a school of divinity or of theology. The path to a profession as a teacher of religious studies at the college level requires 4-7 years in a program leading to the Ph.D. at a graduate school of Religious Studies. Both seminaries and graduate schools require a bachelor's degree for admission.
The American Association of Theological Schools recommends the following areas of study as the best preparation for theological studies: English language and literature; history, including non-Western culture; philosophy; natural sciences, social sciences, especially psychology, sociology and anthropology; the fine arts; Biblical and modern languages; and religion, both Western and Eastern. Although students in a variety of major fields may qualify for admission to a theological school, interested persons are advised to review their proposed programs with a representative of the Religious Studies Program in the Department of Philosophy and Religious Studies.

Veterinary Medicine

About 75% of all veterinarians are engaged in private practice. In a mixed practice, they diagnose and treat health problems among a variety of animals. Others specialize in one species (e.g., feline, pet bird) and still others specialize in a specific discipline within veterinary medicine (e.g., cardiology, ophthalmology). Veterinarians may also choose public and corporate practice (e.g., public health, education, research, food safety, industry, laboratory animal medicine, aquatic animal medicine, poultry medicine, and military veterinary medicine).

The professional program requires four years at a college of veterinary medicine and leads to the doctor of veterinary medicine degree (D.V.M.). Admission to a veterinary college involves at least two years of preprofessional college education. Candidates must take courses in biology, chemistry, genetics, physics, English, humanities, social sciences, speech, anatomy and physiology, and biochemistry. (For Iowa State University see Veterinary Medicine, Admission Requirements; for most recent information, consult the College of Veterinary Medicine Web site: www.vetmed.iastate.edu (http://www.vetmed.iastate.edu).)

Students may pursue their preveterinary preparation in any college at Iowa State University. A major (preveterinary medicine is not a major) should be selected that is allied to each student's vocational interests in veterinary medicine or that otherwise offers vocational satisfaction in the event that plans for entry into the College of Veterinary Medicine change. Students are encouraged to pursue a bachelor's degree; the most effective progress toward a bachelor's degree is made when a major is selected upon entry and no change occurs before graduation. However, students who have not even considered a career other than veterinary medicine may need some time to explore possibilities before selection of a major.

To assist students who have indicated interest in the preveterinary program for the College of Veterinary Medicine and are undecided about a major, an advising category is available known as GENPV (General Undergraduate Studies Pre Vet). Orientation and advising services for these students are designed to help students fulfill preveterinary course requirements, to introduce available majors and careers allied to veterinary medicine, and to introduce career options in veterinary medicine. GENPV students must select a major by the end of their second semester. Some Iowa State University majors allow, by careful

planning, the opportunity for a student to earn the bachelor's degree by combining credits from three years of preprofessional study and one year of professional study in the College of Veterinary Medicine.

STUDENT FINANCIAL AID

The Office of Student Financial Aid helps families afford Iowa State University. Scholarships, grants, loans, and part-time employment opportunities are available to assist students and families in meeting college expenses. For more information see:

http://www.financialaid.iastate.edu

STUDENT HOUSING AND DINING

Department of Residence (DOR)

The university provides housing for almost 13,000 students in university owned on-campus residence halls and on-campus apartments, as well as university operated off-campus apartments. Housing is available for undergraduate and graduate students; single students and families.

ISU Dining

With five dining centers, 11 cafes, three markets, four restaurants (including a food court) and vending, a fresh meal or snack is right around the corner! On a student meal plan? You can use it at any ISU Dining location.

QuestionS?

Questions concerning DOR on-campus housing or ISU Dining should be directed to the Administrative Services Office by e-mail to: housing@iastate.edu and dining@iastate.edu.

STUDENT LIFE

Memorial Union- Activities and Services

The Memorial Union is an historic building that is regarded as the heart of campus life and the center of informal education at Iowa State University.

515-296-6848; www.mu.iastate.edu (http://www.mu.iastate.edu)

Arts, Entertainment, Recreation:

- CyBowl & Billiards: bowling, billiards, video arcade, table tennis
- Maintenance Shop: live music, comedy, open mic
- Student Union Board: weekly films, comedy, music, diverse programs, special events, much more
- Art exhibits and art-for-rent
- Workspace: art and crafts classes for fun, studios for work in wood, photo, pottery; button maker
- Big screen TVs; pianos to play
- Lectures

Student Organizations

- Student organization offices and meeting space; recognition process.

Dining & Shopping

- Food Court & MU Market & Café
- University Book Store

Study Spots

- Multicultural Center
- Browsing Library & Computer Lab; Chapel;
- Lounges: Main, West, Pride, Commons & more

Services

- Meeting rooms, catering
- Parking ramp
- Copy Center
- Soults Family Visitor Center
- ATMs, Mshop Ticket Office, Lockers (in the MCC)
- U.S. Post Office – full service
- Student Legal Service

Distinctive Feature

- Gold Star Hall, an active memorial to Iowa State service personnel lost in the nation's conflicts

Student Activities Center

Director of Student Activities, Asst. Director - Memorial Union
George Micalone

Coordinator for Leadership and Service
Ashley Dorris

Coordinator for Art Programs
Letitia Kenemer

Coordinator for Entertainment Programs
Jim Brockpahler

Coordinator for Student Organizations
John Taylor

COORDINATOR FOR STUDENT ORGANIZATION Resources
Tim Reuter

CYBOWL & BILLIARDS Recreation Center Manager
Doug Swanson

SAC Secretary
Brigitte Milhous

The Student Activities Center (SAC) in the Memorial Union is committed to helping students learn inside and outside the classroom by offering countless ways to get involved at Iowa State through leadership, service, arts, entertainment and recreation activities.

The Student Activities Center includes: the Workspace (arts studio), the Maintenance Shop (entertainment venue), CyBowl & Billiards (recreation center/ bowling alley), Cyclone Cinema, leadership and service programs, art galleries in the MU, and management of the recognition of over 850 campus and student organizations. For a complete list of recognized organizations visit www.stuorg.iastate.edu.

The staff provides assistance to student and campus organization leaders, members and advisers on an individual or group basis. This office produces Newsline, an online newsletter distributed twice a month to officers and advisers of recognized student and campus organizations. Available on the SAC website are resources for student and campus organizations including the event authorization process, publicity and promotion ideas, constitution writing guidelines, and officer transition information. The Student Activities Center is home to the Leadership and Service Center which provides hands on support for students interested in leadership and service opportunities and student organization officers looking to better their clubs. In addition the SAC offers a 3-credit course called Leadership ISU, where students learn leadership skills through a series of activities and seminars, as well as many other leadership conferences and retreats. Reservations for the Lynn Fuhrer Lodge are managed by this office as well.

The Student Activities Center just launched the Co-Curricular Transcript (CCT), an online system to help students manage their experiences, achievements and involvement while as an Iowa State student. Faculty and staff can add verified entries while students can add their own self-managed entries as well. Entries are added to one of the following

categories: Campus Involvement, Community Service, Honors and Awards, Internships and Study Abroad, Leadership Experience, On Campus Employment, Publications, Recreational Activities, Research, and Seminars and Workshops. From there students can create customized and comprehensive transcripts to use when applying for jobs, internships, scholarships, graduate school or leadership opportunities.

Annual SAC events include: ClubFest & Spring ClubFest (organization involvement fair), WelcomeFest (Ames and ISU opportunity fair), Iowa State Leadership Experience (one-day leadership conference), and Winterfest (celebration of all things winter). Student Activities Center staff advise key student organizations including: Student Union Board, ISU AfterDark, Dance Marathon, Freshmen Council, CyServe Council, and WinterFest.

More information is available at the Student Activities Center, located in the East Student Office Space in the Memorial Union (across from Panda Express); online at www.sac.iastate.edu; or by calling (515) 294-8081.

Lectures

www.lectures.iastate.edu/ (http://www.lectures.iastate.edu)

Throughout the academic year, the Committee on Lectures brings to the campus a number of speakers eminent in national and international affairs, the sciences, and the arts. In addition to giving formal lectures, a number of these speakers meet with students informally for meals and discussions. Through these lectures and discussions the students are given a well-rounded presentation on a range of subjects including popular culture, educational and economic philosophy, the arts, and technological and scientific development. Past speakers include evolutionary biologist Richard Dawkins and physicist Michio Kaku; activist Gloria Steinem; writers Margaret Atwood and Cheryl Strayed; and former Secretary of State Madeleine Albright.

The World Affairs Series is an annual series of speakers on a topic of international interest. The National Affairs Series invites speakers on a topic of national concern. The Committee on Lectures also sponsors or co-sponsors dramatic and film events.

Students are encouraged to contact the lectures program office and become involved in the planning of these events.

Honor Societies

Honor societies at Iowa State University provide opportunities for students who excel in the classroom and want to network with others in their major. Members of these honor societies are eligible for transcript recognition through the Office of the Registrar. The complete list of honor societies can be found on the student organization website at www.stuorg.iastate.edu (https://www.stuorg.iastate.edu/orgtype/12)

STUDENT RECORDS

Student Records

Iowa State University maintains various records concerning students, to document their academic progress as well as to record their interactions with university staff and officials. In order that their right to privacy be preserved and to conform with federal law, the university has established certain policies to govern the handling of student records. All policies conform with FERPA, the Family Educational Rights and Privacy Act (also known as the Buckley Amendment).

Student Addresses

Students have the responsibility to notify the Office of the Registrar each time their information changes. Student information changes can be made in person to the Office of the Registrar, 214 Enrollment Services Center, or via AccessPlus (https://accessplus.iastate.edu/frontdoor/login.jsp). Complete this form online using Acrobat Reader 6.0 or later, then print (remember to sign it) and submit to the Office of the Registrar, 214 Enrollment Services Center; by FAX (515)294-1088. ISU employees (graduate assistant or student worker), MUST also report an address change correction directly to the Office of Human Resource Services (http://www.hrs.iastate.edu/main/homepage.shtml), 3810 Beardshear Hall.

When Records May Be Withheld

The appropriate university official may request that a student's record not be released if that student is delinquent in an account with the university or an affiliated organization. The effect of this action is that a transcript will not be released and registration will be withheld.

The appropriate official may also request that records be withheld in instances when official disciplinary action has been taken against a student. Authorization for these actions is supported by The Iowa Code and The Iowa Administrative Code.

In order for such an action to be rescinded, the Office of the Registrar must receive written authorization from the official who originally requested the action, indicating that the student has met the obligation. Further information about this policy can be obtained from the Office of the Registrar.

Review and Challenge of Records

A student may challenge the accuracy of handling of records maintained by the university on grounds that the records are inaccurate, misleading, or otherwise violate the privacy or other rights of the student. The university has established the following procedures to provide an opportunity for the student to correct or delete inaccurate records, or to insert into the record a written explanation of the content. Students who question their records should discuss the issue first with the individual staff person who established or maintains the records. Presumably most issues can be resolved at this level. If a satisfactory resolution cannot be reached, the student should submit the question to the head of the department in which the record is maintained.

The department head will discuss the issue with the staff person and the student challenging the record. If resolution cannot be reached after meeting with the department head, the student may submit the question to the dean or director to whom the department head is responsible. The dean or director will investigate, and will respond in writing.

If the record has not been reconciled through these measures, the student may direct a written request to the president of the university. The president will convene an Ad Hoc Hearing Panel of Access and Confidentiality of Educational Records, composed of two faculty members, two students, and one administrator, appointed by the president for a period of one year, with the president or a designee serving as nonvoting chairperson. The student shall be given an opportunity to present to the panel evidence relevant to the issues raised, and the panel will issue a written response.

Posting Grades and Test Scores

Instructors who wish to inform students of their performance may post grades and test scores on a secure course web site as long as individual students may only access their own grades. The test scores or course grades of students may not be posted in any public location (World Wide Web or hard copy posting) unless the instructor posts the information using a code for each student that is known only by the instructor and the student.

Release of Grades

Students who choose to release their grades to parents or other trusted third parties may do so using the AccessPlus third party system. Reports of a student's grades are not routinely sent to the student's parents. Parents of students under 18 years of age may obtain grades by writing to the Office of the Registrar. The grades of other students will be sent to their parents only with written permission of the student, or by establishing dependency as outlined in item 9 under Confidential Information.

ISUCard and Identification Number

Each student is assigned a random university identification number on entry to the university. This number appears on the ISUCard that is provided to each student at the time of first registration. The ISUCard, may be required for some services and/or activities. At the time the ISUCard is issued each student also selects a university password, which is required for electronic access to personal student information.

Loss of an ISUCard should be reported immediately to the ISUCard Office, where the lost card will be invalidated and replaced for a charge. Disciplinary sanctions may be imposed for improper use of the ID card or attempts to obtain, by fraudulent means, any form of identification.

Social Security Number

Social security numbers are collected from prospective and current students, for administrative coordination and record identification purposes only. Although procedures have been established by the registrar for assignment of an alternative number upon request, students who wish to be employed on campus, desire to claim federal educational tax benefits, or are applying to receive financial aid, are required by law to provide their social security numbers for administrative use. The social security number is a confidential record and is maintained as such by the university in accordance with the Family Educational Rights and Privacy Act.

Policy on Student Names

Iowa Regent universities have a common policy regarding student names and name changes. The name on the student record should be the student's complete and legal name. In evaluating and processing all name change requests, the university reserves the right to require adequate and appropriate documentation as warranted.

Information Disclosure

Iowa State University is required by law to make available to enrolled students, prospective students, and their parents certain information about the university. The information disclosure policy is available at www.iastate.edu/~disclosure (http://www.public.iastate.edu/%7Edisclosure). Students without electronic access can obtain the information from the Office of the Registrar, 214 Enrollment Services Center, 515-294-1840 or from the Office of Admissions, 100 Enrollment Services Center, 515-294-5836. A paper copy of the information will be provided upon request.

Public Information

Certain information concerning students is considered to be open to the public upon inquiry. This public information is of two types: **directory information** and **other information** not included in the ISU Directory.

ISU directory information includes student name, local address, telephone number, campus e-mail address, college, curriculum, year in school, and enrollment status.

Other public information includes mailing address, date and place of birth, home town, dates of attendance at Iowa State, expected date of graduation, names of advisers, awards and academic honors, Iowa State degree(s) and date(s) awarded, previous educational institutions attended, degrees received, dates of attendance, full- or part-time status, participation in officially recognized activities and sports, and weight and height of members of athletic teams.

Public information will be released by the registrar to anyone upon inquiry, unless students have requested that their information not be released. Students can withhold public information through the Address Change link on Access Plus (https://accessplus.iastate.edu/frontdoor/login.jsp).

Confidential Information

With the exception of the information noted above, all student records are considered to be confidential and are open only to school officials. A school official is a person employed by the university in administrative, supervisory, academic or research, or support staff position (including law enforcement unit personnel and health staff); a person or company with whom the university has contracted; or a student serving on an official committee, such as a disciplinary or grievance committee, or assisting another school official in performing his or her tasks. A school official has a legitimate educational interest if the official needs to review an education record in order to fulfill his or her professional responsibility. Iowa State University's notification of rights under FERPA can be found at http://www.registrar.iastate.edu/policies.

The following policies govern access to student records:

1. Each type of student record is the responsibility of a designated school official, and only that person or the dean or director to whom that person reports has authority to release the record. The following is a list of the responsible officials:

    a. Academic records: registrar
    b. Admissions records: director of admissions
    c. Financial aid records: director of student financial aid
    d. Business records: university controller
    e. Traffic and security records: director, ISU Department of Public Safety
    f. Medical records: director, Thielen Student Health Center
    g. Counseling records and test scores: director, Student Counseling Service
    h. Actions of Academic Standards Committees: college deans
    i. Disciplinary records: dean of students
    j. Residence hall records: director of residence
    k. Placement records: college placement officers
    l. Evaluations for admission to ISU graduate or professional programs: deans or department chairs
    m. Special academic programs: faculty member in charge of the program and the dean of the college

2. The designated official may release records to other school officials who have a legitimate need for the information. A list of those persons

who normally have access to each type of student record is available in 214 Enrollment Services Center.

3. All student records are reviewed periodically. Information concerning the frequency of review and expurgation of specific records is available in 214 Enrollment Services Center.

4. Students have the right to review upon request any records that pertain directly to them, and may obtain a copy of the record for a fee. This provision does not apply to records to which the student has waived his or her right to review, nor does it apply to medical and counseling records.

5. A student may waive the right to review a specific record by submitting in writing a statement to this effect to the official responsible for that record.

6. A file containing copies of records pertinent to advising is maintained on each student for use by the student's adviser. This file may be maintained in hard copy or electronic format. Ordinarily this file is kept in the possession of the adviser, but for convenience it may be stored elsewhere such as in the dean's office or department office. When the student changes majors, or changes advisers within the same major, the file is transferred to the new adviser. Under the university's student records policy, the student is considered to have the right of access to this file.

7. Medical and counseling records shall be released at the written request of the student to medical or psychological professionals outside the university or to university officials.

8. University personnel who have access to student records in the course of carrying out their university responsibilities shall not be permitted to release the record to persons outside the university, unless authorized in writing by the student or unless one of the exceptions stated earlier is involved.

9. Confidential information may be released by students to their parents or other trusted third parties through the AccessPlus third party system. Confidential information may also be released by obtaining the student's written consent or by having the parent establish the student's dependency as defined by the Internal Revenue Code of 1954, section 152, by furnishing a certified copy of the parent's most recent federal income tax return.

10.The officials responsible for custody of student records will maintain records of requests and disclosures of personally identifiable nonpublic information. The records of requests, whether granted or not, shall include the person or agency requesting the information and the purpose of the release. These records of requests and disclosures will be available to the student on request. Records of requests and disclosures are not necessary for requests made by the student, by school officials in carrying out their official responsibilities, by persons employed by agencies and offices conducting audits and accreditations of university programs, or any of the other exceptions listed previously.

For the purposes of FERPA, Iowa State University defines directory information to include both ISU directory information and other public information as defined above.

It is the policy of the university to respect the privacy of students; therefore, only lists containing names of students and their directory information will be made available to members of the public who request address lists. This directory information will be provided for the cost of producing the information as provided by the university's public records policies. Directory information is available using the online phonebook (http://info.iastate.edu).

Disclosures Permitted by FERPA

Iowa State University retains the discretion to disclose both directory and confidential information as indicated in Section 4 (http://www.registrar.iastate.edu/policies) of Iowa State University's Notification of Rights Under FERPA. Specifically, the university may disclose to the public or to specific individuals, directory or confidential information for reasons of safety if the disclosure meets the criteria under Section 4 (http://www.registrar.iastate.edu/policies).

REGISTRATION

Registration/Enrollment

In order to register for classes students must first accept their offer of admission by the university. Registration and the payment of assessed fees are required of all who attend classes. Enrollment is not complete until fees are paid, including room and board fees for those living in residence halls.

Registration is a process by which students become officially enrolled in classes for a given term. The process involves consultation between the student and the student's academic adviser. All undergraduate students are assigned an academic adviser based on their major/curriculum. A new adviser assignment is made when a student changes majors/curricula.

Students who attend classes must complete registration and pay their assessed fees. Registration is not complete until all fees are paid, including board and room fees for those living in residence halls.

Disabled students who need assistance with any phase of registration should contact the Student Disability Resources office.

Validating Enrollment

To validate their enrollment in each course at the beginning of the semester, students must attend the first or second meeting (first meeting if the class meets only once a week). Students who add a course after the term begins must attend the next class meeting. The instructor has the option to offer a registered place in the course to another student when a registered student fails to attend and has not obtained prior approval of the instructor. Students who do not validate their enrollment must drop the course or they will receive an F grade.

Enrollment Status

Enrollment status is defined for certification purposes as either full-time or half-time.

Full-time status, fall or spring semester
Undergraduates: 12 credits
Graduates: 9 credits

Three-quarters status, fall or spring semester
Undergraduates: 9 credits
Graduates: 7 credits

Half-time status, fall or spring semester
Undergraduates: 6 credits
Graduates: 5 credits

Summer status

Summer status depends on the number of weeks a student is enrolled. Always contact the Office of the Registrar to verify a student's status for a summer session.

With the exception of enrollment certification for veterans' benefits, credit hours are rounded up to the next whole number. For example, credit load of 11.5 credits is rounded up to 12 credits. Contact the Office of the Registrar for more information.

Registration Responsibilities

The registration process includes advising, enrollment in courses, and schedule changes. In addition to the student, this process may involves the student's adviser; the student services staff of the student's college; and the dean of the college. Each is responsible for knowing and following the academic policies and procedures.

Student

- knowing and adhering to university policies and procedures that apply to registration and schedule changes
- checking the accuracy of his/her schedule on AccessPlus, including schedule adjustments (i.e., adds, drops, section changes)
- knowing the degree requirements of his or her major and/or curriculum
- planning course schedules to meet those requirements; and monitoring the accuracy of the degree audit.

Adviser

- consulting with advisees during the advising/registration period
- providing information about student's major and curriculum requirements
- providing guidance in the student's course selection
- assisting in monitoring the degree audit for accuracy
- notifying the college student services office with corrections to the degree audit.

College Student Services Staff

- assisting new and reentering students with the registration process
- resolving unusual scheduling problems
- updating the degree audit or solving problems concerning the degree audit.

Dean

- making decisions with respect to requests for deviations from university policies, deadlines, etc.

Students and staff should check with the college office to find out who is authorized to grant approvals or exceptions on behalf of the dean.

Class Schedule Planner

The Class Schedule Planner is an application that allows students to plan their schedules using courses displayed in the Schedule of Classes. Students can select courses and/or sections they want to take for a particular term, as well as block out unavailable class days and times. Based on those selections, Class Schedule Planner can return all possible schedules to the student in a color coded grid format.

Though it is a Web-based application, the Class Schedule Planner does not require authentication (no user ID, PIN, or password). Therefore, it is essential that students understand this is a planner and as such, it does not register them in courses and cannot be used to complete their registration. The application requires that the user have Java on their computer. The first screen of the Planner provides information about how to use the planner and simple instructions for downloading the Java application. A useful Help link also has been provided. The Class Schedule Planner is available at http://planner.iastate.edu.

Using AccessPlus Registration

Students enter the system via AccessPlus by using university ID and password. A registration access number (RAN) also is needed, if required by their college.

The registration system provides messages after each entry indicating whether each request has been processed. Students also may review their current schedules at any time during registration. Students are held accountable for all changes made to their schedules.

All students are encouraged to register for courses through the AccessPlus registration system. However, students who are unable to use the system may register in person by processing their signed Registration Worksheet in the Registrar's Student Scheduling Office, 10 Enrollment Services Center.

Registration System Abuse

Using the AccessPlus registration system is a privilege, which may be revoked if abuse is detected. Abuse includes, but is not limited to, creating and using an automated program to search for course openings and/or enrolling in a section with the intent of reserving space in that particular section for another student. The Office of the Registrar, college office, and/or advisers have the right to determine abuse and revoke privileges for any type of registration system abuse.

Registration Process

To register for classes, students need the following materials and information:

- Registration Worksheet, available for download at www.registrar.iastate.edu/forms/ (http://www.registrar.iastate.edu/forms).
- A RAN (registration access number) if required by their college.
- Course information from the Online Schedule of Classes at http://classes.iastate.edu/.
- Other departmental information applicable to their curriculum, available from their adviser.

Students are expected to do the following in the advising and registration process:

1. Meet with their adviser, who will provide the following:

a. degree audit
b. guidance in course selection
c. Registration Authorization form, with RAN, if applicable.

2. Choose specific sections of each course. Students are responsible for choosing their course sections. In most cases advisers will not be involved in selecting meeting times.

3. Review their registration start date/time information and any registration hold information on AccessPlus (https://accessplus.iastate.edu/frontdoor/login.jsp), under Current Information. Students in those colleges which require a four-digit registration access number (RAN) should meet with their adviser in advance of their start date, to obtain their Registration Authorization Card on which the RAN is printed.

4. Register for courses using the AccessPlus (https://accessplus.iastate.edu/frontdoor/login.jsp) registration system.

Making Schedule Changes

Students may make most schedule changes through the first five days of class using the AccessPlus (https://accessplus.iastate.edu/frontdoor/login.jsp) registration system.

Procedures for schedule changes vary by the time period of the semester. The effective date of a schedule change is the date when the change is entered into the registration system.

Schedule change periods for full term courses are as follows:

Period 1 ends on the fifth day of classes in the fall and spring semesters. Schedule changes during period 1 are free and do not require adviser signatures. Instructor or departmental approval may be required for adds or section changes for some courses during period 1. Course drops during this period do not count toward a student's ISU course drop limit, and will not appear on a student's permanent record. Schedule changes during period 1 may be processed through the AccessPlus registration system or by presenting a Schedule Change form to the Registrar's Student Scheduling Office, 10 Enrollment Services Center.

Period 2 ends the Friday of week 10 in the fall and spring semesters. During this period, schedule changes require signatures of adviser and

instructor and are processed on a Schedule Change form. A schedule change fee is assessed for adds, drops, and section changes during this period. Course drops after period 1 count toward a student's ISU drop limit and appear as an X on the permanent record. A section change does not require a drop.

Drops and other schedule changes that are judged to be beyond the student's control may be processed as administrative actions if approved by the college dean. There is no schedule change fee for administrative schedule changes. Administrative drops do not count toward a student's ISU drop limit and do not appear as an X on the permanent record. The effective date of an administrative action is the date it is approved by the college dean or authorized representative.

Period 3 is anytime after period 2. Schedule changes during this period are permitted only for extenuating circumstances, may require a written statement of support from the instructor and the student, and must be approved by the dean of the student's college or authorized representative.

Half-Semester and Partial Term Courses

Specific deadlines for adding and dropping half-semester courses are published in the university calendar. Prorated adjustments to add and drop deadlines are made for other partial term courses. To find out specific deadlines for partial term courses, contact the Registrar's Student Scheduling Office, 10 Enrollment Services Center, 294-2331.

R-Credit Courses (required courses)

Processing a scheduling change for a required course is usually considered administrative. There is no fee for administrative schedule changes. Administrative drops do not count toward a student's ISU drop limit and do not appear as an X on the permanent record. To make a Period 3 R-credit drop administrative requires approval of the college dean.

Dates and Deadlines

Dates for registration are published in the university calendar (http://www.event.iastate.edu) (choose the Academic calendar link), and at www.registrar.iastate.edu/calendar/ (http://www.registrar.iastate.edu/calendar).

Students are assigned a registration start date and time, which is the first day and time they can use the registration system. Registration start dates are assigned based on projected year in school classification (computed by combining total credits, current term credits, and current term test out credits). Then specific start dates within projected year in school are established by using the sum of total credits and current term test out credits.

Students may choose to delay their registration until a later date; however, courses will begin to fill on the first day of registration. Any delay in registration may reduce course selection options. A list of start dates by classification is available at http://www.registrar.iastate.edu/calendar/registration-start-dates.

Continuing students register for the following term during the middle of the current term. For example, registration for spring term begins the middle of fall term; registration for summer session is completed during the previous spring at the same time as registration for fall semester.

A late registration fee is assessed for registration initiated on or after the first day of classes for fall and spring terms. This fee is not charged for the summer term. If registration is not initiated by the end of the fifth day of classes, students must obtain written permission from their advisers, the instructors for the courses they plan to take, as well as approval from the dean of the college in which they are registered. During the summer session, these approvals must be obtained in order to register after the third day of classes.

Students may not enroll in courses with time conflicts without the approval of the instructors concerned.

Students who participate in off-campus experiences for which they receive Iowa State University credit must register for that credit during the term when the experience is taking place, whether or not they are taking courses on campus during that time.

Withdrawal of Admission to the University

New undergraduate students who wish to withdraw their admission to the university prior to the first day of classes must initiate their withdrawal by completing the Admissions Office's Application Change Form: https://www.admissions.iastate.edu/forms/change_application.php.

Cancellation/Withdrawal - Currently Enrolled Students

Students who decide not to attend classes before the date class work begins must cancel their registration (http://www.registrar.iastate.edu/students/cancel-withdraw) to avoid tuition and fees assessment. Students who decide not to attend classes beginning the first day of class or later must withdraw from the university (http://www.registrar.iastate.edu/students/withdrawal).

Course Information

Prerequisite. A prerequisite indicates the specific academic background or general academic maturity considered necessary by the faculty for the student to be ready for maximum success in the course. For more information, see Information About Courses (http://catalog.iastate.edu/informationaboutcourses), Course Prerequisite.

Permission Required courses/sections. To register for these sections, students must obtain authorization on a Request for Schedule Change or Restriction Waiver form and process the approved form in the Registrar's Student Scheduling Office, 10 Enrollment Services Center.

Restricted courses/sections. Some courses or sections are restricted to students who meet specified criteria including curriculum/major, college, and/or year in school. In addition, some sections may be restricted to new students to ensure that sufficient spaces are available when new students register during summer orientation. A department may waive a restriction for a student who has extenuating circumstances. The student must obtain the authorization from the department on a Request for Schedule Change or Restriction Waiver form. The form is processed in the Registrar's Student Scheduling Office, 10 Enrollment Services Center.

Classrooms are listed for each course in the Online Schedule of Classes at http://classes.iastate.edu/ and on the student's class schedule on AccessPlus, beginning approximately 3 weeks prior to the start of the term.

Cancelled courses/sections. In some cases, courses or sections may be cancelled due to low enrollment or departmental staffing considerations. Students who are registered for a cancelled course or section will be notified by the Office of the Registrar, the department, and/or on their AccessPlus schedule.

Textbook information. A link to textbook information, including the ISBN and retail price for assigned textbooks, is available from the Schedule of Classes. Textbook information for Iowa State University courses is posted as close to the start of registration as possible. Students may purchase textbooks from any source they choose.

Credit Limits

For fall and spring semesters, the credit limit is 18 credits for undergraduates and 15 credits for graduate students. For summer session, the limits are 12 credits for undergraduates and 10 credits for graduate students. A student may be required to drop credits before adding another course. In some cases, the college dean may approve a higher or lower credit limit for individual students. Students may request a change in their credit limit by contacting their adviser. Advisers should notify the student's college student services office if the credit limit needs to be changed.

Registration Holds

Students with holds on their registration will not have access to registration until the initiating offices have released the holds. Those who attempt to register before the holds have been released will receive a message indicating which offices have placed holds on their registration. Prior to their registration, students may check for holds on AccessPlus.

Drop Limit

Students are limited in the number of courses they may drop during their academic career. (This refers to drops processed after the fifth day of classes of each semester.) Students who entered Iowa State University as freshmen are allowed to drop a maximum of five courses during their undergraduate career. If they entered at a level above freshman classification or in the College of Veterinary Medicine, they are allowed to drop a maximum of four courses. Courses dropped during their first term at Iowa State are not included in this limit, nor does the summer count as a first term for this purpose. Students who enroll at Iowa State University as undergraduates after receiving a bachelor's degree are permitted four drops.

Exceptions to the drop limit may be made for courses that must be dropped for reasons beyond the student's control. These exceptions are granted only by the dean or other authorized person in the student's college.

The number of drops students have left is indicated on their grade report (available on AccessPlus) each term. Students are responsible for not exceeding their limit. At the instructor's discretion, students who attempt to drop a course beyond the limit without special permission by the dean of the student's college will continue to be enrolled in the course and will receive a grade at the end of the term.

Auditing

To audit a course means to enroll in the course without receiving credit for the course. The instructor of the course approves the audit request.

Students are assessed tuition and fees as though they are taking the course for credit, but the audited course does not count in determining full-time student status. However, an audited course does count towards the maximum allowable credits per semester. Audited courses do not apply toward V.A. benefits.

Graduate students: An audited course counts as one credit in the graduate student's allowable course load; however, tuition and fees will be assessed for the full number of credits for the course. See Graduate College.

Changing status to audit: Changing a course from credit to audit requires dropping the course for credit and adding it as an audit on a schedule change request form. After day 5 of the semester, the drop will count toward the total allowable ISU drops. The drop appears on the student's permanent record and a schedule change fee will be assessed to the student's university bill.

Rights and privileges: Once enrolled in an audited course, auditors have the same rights and privileges as any student taking the course for credit. Their names appear on the class list with a notation that they are auditing the course. Audited courses do not appear on the student's permanent

record except by special request from the student. A request form can be downloaded from the Office of the
Registrar web site at www.registrar.iastate.edu/forms (http://www.registrar.iastate.edu/forms).

Audit Deadlines and Required Signatures

In addition to the deadlines provided below, note that instructors must approve all audits.

• Full semester courses:

Adding an audit–day 10 deadline:
–Through day 5 of classes: instructor approval required.

–Day 6-10: instructor, adviser approval required.
–After day 10: only with extenuating circumstances, instructor, adviser, college approval required.

Changing status, from credit to audit–day 10 deadline:
–Through day 5 of classes: instructor approval required.
–Day 6-10: instructor, adviser, college approval required.
–After day 10: only with extenuating circumstances, instructor, adviser, college approval required.

Changing status from audit to credit–day 5 deadline:
–Through day 5 of classes: instructor approval required.
–After day 5: instructor, adviser, college approval required.

• Partial semester or summer courses:
Deadlines are determined based on the length of the course. For deadlines concerning partial term or summer courses, contact the Student Scheduling Office, 515-294-2331.

Reinstatement

The procedures delineated in this section apply to students who were dismissed from Iowa State for academic reasons. Students who left Iowa State in good academic standing and who are seeking reentry should see Index, Reentry for more information.

1. Reinstatement is not automatic. Students who have been dismissed for academic reasons should contact the dean's office in the college they wish to enter for instructions specific to that college.
   The college Academic Standards Committee reviews each petition and other relevant information, and reinstatement is based upon that review. As part of the petition process, students must submit a plan for academic success that identifies the causes of their poor academic performance and demonstrates that they have taken actions to avoid or eliminate these causes.
2. Students can only be reinstated after at least one academic semester has elapsed since they were academically dismissed. The summer session is not a semester for the purpose of being out of school one semester.
3. Students who have been dismissed from enrollment two or more times are not eligible for reinstatement until at least two academic semesters have elapsed since their last academic dismissal.
4. Students who were dismissed by one college and subsequently reinstated by another college cannot transfer back to the original college unless permission is granted by the Academic Standards Committee of the original college. This procedure applies regardless of the student's academic standing when the transfer is requested.
5. To be considered for reinstatement to the university, students must submit a petition to the Academic Standards Committee of the college in which they desire to enroll at least 45 days before the beginning of the semester. Students who have not been enrolled for a period of 12 or more months or who are international students must also file a reentry form prior to their return. For more information see the Reentry web site at http://www.registrar.iastate.edu/info/reentry.html. (Students dismissed for the second time and requesting reinstatement in the College of Liberal Arts and Sciences must submit their petition 70 days before the beginning of the semester.)
6. As a condition of reinstatement, students will reenter on academic probation and must accept whatever additional requirements are stipulated by the college Academic Standards Committee. Examples include full- or part-time status, specified credit hours, specific courses, specific GPAs, restriction on choice of major, and required counseling.

Student Appeal

Students may appeal a decision regarding their academic status if they believe that new information can be provided or extenuating circumstances exist that would alter the application of any rule in this section. The appeal should be made in writing to the Academic Standards Committee of the college in which the student is enrolled. The written appeal must include the reasons for the appeal and the evidence to substantiate these reasons.

The student should initiate the appeal process by contacting the secretary of the college Academic Standards Committee in the administrative office of her or his college immediately upon receipt of notification of the committee's action, and at least ten calendar days before the beginning of the semester. The secretary will then inform the student of the deadline for submission of the written appeal.

If the student is dissatisfied with the committee's action, he or she may submit an appeal in writing to the dean of her or his college within seven calendar days after they are notified of the committee's action. The dean must respond in writing within seven calendar days of receipt of the appeal.

If the issue is not resolved within the college, further appeals may be made in writing to the provost and subsequently to the president of the university. Appeals beyond the college level will, however, be considered only if based on one or both of the following contentions: (a) appropriate procedures were not followed at the college level; (b) academic rules were not applied correctly at the college level.

Academic Renewal

Students who are returning to Iowa State University to pursue an undergraduate degree after an extended absence may request permission to remove one or more of their complete academic terms from future degree and GPA considerations.

1. Eligibility. To be eligible for academic renewal consideration, students must meet these requirements:
   a. Students must not have enrolled at Iowa State University for five or more consecutive years.
   b. Students must not have graduated from Iowa State University.
   c. Students must currently be in good academic standing. (If the student was previously dismissed, he or she must be reinstated.)

2. Conditions. Academic renewal is based on the following conditions:
   a. All courses and credits that were taken during the chosen terms will be removed from consideration for GPA and degree requirements. Students may not combine courses from multiple terms to comprise the semester(s) or quarter(s) dropped. Degree requirements met during the dropped terms will ordinarily have to be repeated.
   b. Renewal may be applied only to academic terms completed prior to the students' extended absence.
   c. All courses and grades for the chosen terms will remain on the students' academic record.
   d. Designated repeats, drops and P/NP options will be reinstated for the terms dropped.
   e. Students who have used all of their drop options will be given one extra drop.
   f. Students may be granted only one academic renewal. To be eligible for a degree after academic renewal is granted, students must complete a minimum of 24 credit hours after re-enrolling at Iowa State University.

3. Procedures.
   a. Students should discuss their desire to pursue academic renewal with an adviser in the college they wish to enter.
   b. The student must complete the Academic Renewal Petition form available from www.registrar.iastate.edu/forms (http://www.registrar.iastate.edu/forms) .
   c. After the form is signed by the student and academic adviser, it is submitted to the Records area in the Office of the Registrar, 214 Enrollment Services Center.

Returning/Reentry to the University

U.S. students who have been absent from Iowa State University less than 12 months may be admitted as a returning student. If more than 12 months have elapsed since last enrolled, a U.S. student must apply for reentry to the university. All international students must apply for reentry regardless of the time away from the university.

Returning Students

U.S. undergraduate and U.S. non-degree undergraduate students planning to return to Iowa State University after an absence of less than 12 months do not complete a reentry form; however, international undergraduate and international non-degree undergraduate students planning to return to Iowa State University after an absence of less than 12 months must complete a reentry form.

Returning U.S. students and graduate students should contact the Office of the Registrar to have their records updated and registration access created. Students should contact their advisers or major professor to select courses and begin the registration process.

Returning students who want to change their curricula should follow the same procedure as in-school students. Students who were dropped from enrollment at Iowa State University must obtain reinstatement by the Academic Standards Committee of the college that initiated the drop. (See below for policies that apply to requests for reinstatement.)

Reentry Students

Undergraduate and nondegree undergraduate (special) students who plan to attend Iowa State University after an absence of twelve months or more must complete a reentry form. Forms are available from http://www.registrar.iastate.edu/forms/.

Students with a bachelor's degree who plan to take supporting graduate level coursework prior to applying for graduate degree admission should request a nondegree graduate admission application.

Students who have previously attended Iowa State University only as nondegree (special) students and who now seek to earn an undergraduate degree should request an undergraduate application.

International students must complete a reentry form. Forms are available from http://www.registrar.iastate.edu/forms/. Financial certification of ability to cover all educational and living expenses will be required.

The reentry form should be completed and returned to the Office of the Registrar, 10 Enrollment Services Center, well in advance of the term of reentry. Students who have attended another college or university since enrollment at Iowa State University must have an official transcript(s)

of all course work attempted sent to the Office of Admissions, 100 Enrollment Services Center.

Reentering students must also contact their departmental office/adviser to prepare a class schedule. Reentry must be approved prior to registration.

Iowa State University requests the information on the reentry form for the purpose of making a reentry decision. The university reserves the right not to approve reentry if the student fails to provide the required information.

Reentry Approval Process

Generally, a request to reenter Iowa State University will be approved within the Office of the Registrar. However, the Office of the Registrar will refer the reentry form to the college to which a student plans to return if the student: (a) desires to change curriculum; (b) has a previous Iowa State University cumulative grade point average below 2.00; (c) was dropped from the university for unsatisfactory academic progress or was not otherwise in good standing; or (d) since leaving Iowa State University, has completed additional college study with less than a 2.00 grade point average.

STUDENT SERVICES

Dean of Students Office

www.dso.iastate.edu (http://www.dso.iastate.edu)
1010 Student Services Building
(515) 294-1020

The Dean of Students Office(DSO) at Iowa State University uses an integrated approach to support student-centered learning through personal, community and academic development culminating in a transformative experience. Reporting through the Division of Student Affairs, the DSO provides numerous opportunities for students to engage in learning beyond the classroom. The fourteen departments that comprise the DSO collaborate to create and support a common community experience for Iowa State University students.

Start with us. We're here to help.

Dean of Students: Pamela Anthony, Ph.D.
Associate Dean of Students: Keith Robinder, Ph.D.

For more information see the individual DSO department web sites.

Academic Success Center

www.asc.dso.iastate.edu (http://www.asc.dso.iastate.edu)
1060 Hixson-Lied Student Success Center
(515) 294-6624

Greek Affairs

www.greek.iastate.edu (http://www.greek.iastate.edu)
0355 Memorial Union
(515) 294-1023

Hixson Opportunity Awards

www.hixson.dso.iastate.edu (http://www.hixson.dso.iastate.edu)
1080 Hixson-Lied Student Success Center
(515) 294-6479

Lesbian, Gay, Bisexual, and Transgender Student Services

www.lgbtss.dso.iastate.edu (http://www.lgbtss.dso.iastate.edu)
1064 Student Services Building
(515) 294-5433

Margaret Sloss Women's Center

www.mswc.dso.iastate.edu (http://www.mswc.dso.iastate.edu)
205 Sloss House
(515) 294-4154

Multicultural Student Affairs (MSA)

www.multicultural.dso.iastate.edu (http://www.multicultural.dso.iastate.edu)
2080 Student Services Building
(515) 294-6338

National Student Exchange (NSE)

www.nse.dso.iastate.edu (http://www.nse.dso.iastate.edu)
1080 Hixson-Lied Student Success Center
(515) 294-6479

Parents' Association (ISUPA)

www.dso.iastate.edu/pa (http://www.dso.iastate.edu/pa)
1010 Student Services Building
(515) 294-6054

Recreation Services

www.recservices.iastate.edu (http://www.recservices.iastate.edu)
1180 State Gymnasium
(515) 294-4980

Student Assistance and Outreach

www.studentassistance.dso.iastate.edu (http://www.studentassistance.dso.iastate.edu)
1010 Student Services Building
(515) 294-1020

Student Conduct

www.studentconduct.dso.iastate.edu (http://www.studentconduct.dso.iastate.edu)
1010 Student Services Building
(515) 294-1021

Student Disability Resources

www.sdr.dso.iastate.edu (http://www.sdr.dso.iastate.edu)
1076 Student Services Building
(515) 294-7220; TTY (515) 294-6635

Student Legal Services

www.studentlegal.dso.iastate.edu (http://www.studentlegal.dso.iastate.edu)
0367 Memorial Union
(515) 294-0978

Writing & Media Center

www.wmc.dso.iastate.edu (http://www.wmc.dso.iastate.edu)
300 Carver Hall
(515) 294-5411

Student Counseling Service

Assistant Vice President and Director of Counseling: Terry W. Mason, Ph.D.

The Student Counseling Service (SCS) assists students in enhancing their academic success and personal well-being with a staff of professional psychologists and counselors. Services are available to help students sort through their feelings, strengths, and options to develop new perspectives and coping skills.

Services include:

- One-on-one counseling for any issue of personal concern, such as depression, anxiety, stress management, relationship issues, identity issues, and other forms of personal challenge. Students may also receive therapeutic services to deal with more severe mental health issues.
- Couples counseling for ISU students and their partners during times of relationship difficulty.
- Eating disorders assessment and treatment for students concerned with eating or body image issues. Students receiving treatment for eating disorders might also work with physicians, nutritionists, and personal trainers as their needs require.
- Substance abuse assessments to help students determine the nature and extent of their alcohol or other drug use and the impact of this use on their well being. Counselors offer recommendations and referrals for any concerns identified through the assessment.
- Career counseling to assist students having difficulty choosing a major or making decisions about their future after college.
- Group counseling is offered to facilitate personal growth and social skills learning. A list of the current semester's groups is available on the SCS web site.
- A variety of outreach programs are also available.

Counseling services are offered at no cost to ISU students. However, a nominal fee for testing may be required. Nominal fees are also charged for uncancelled missed appointments. Counseling is strictly confidential. SCS staff will not release any information to anyone outside of the Student Counseling Service without the written permission of the client unless an imminent harm condition exists.

In addition to providing counseling and outreach services to students, SCS provides training and consultation to faculty and staff to assist them in addressing the psychological needs of students.

SCS hours are Monday through Friday 8 a.m. - 5 p.m. The Student Counseling Service phone number is 515-294-5056.

Student Support Services Program

www.dso.iastate.edu/sssp (http://www.dso.iastate.edu/sssp)
Director: Japannah Kellogg, M.S.
2010 Student Services Building
(515) 294-0210

Student Support Services Program (SSSP), a federally funded program, provides academic support to eligible students and is designed to increase the retention and graduation rates of low-income individuals who are first-generation college students or individuals with disabilities. The needs of the students who are accepted into SSSP are thoroughly assessed through testing and counseling. SSSP participants receive personal and career counseling, along with academic advice, tutoring, and assistance in receiving financial aid.

Participants in SSSP are encouraged to work with an SSSP student mentor to become acclimated to the ISU environment. These relationships also encourage participants to fully access ISU resources. Study skills improvement sessions and basic skills instruction are provided in the areas of math and writing. In addition, cultural enrichment (i.e. theatre, dance, and musical events) and educational activities (leadership conferences, graduate/professional, etc.) are planned. These services are provided free of charge to eligible students after they are accepted into the program.

International Students and Scholars

www.isso.iastate.edu (http://www.isso.iastate.edu)
Director: James Dorsett

The International Students and Scholars Office (ISSO) provides a welcoming and supportive environment for international students and scholars, Iowa State University, and the Ames community. ISSO staff members orient and advise international students and scholars on university procedures, community resources, U.S. immigration regulations, and nonacademic personal concerns. ISSO intercultural programs, such as the Culture Corps, Friendships International, and activities developed with the International Student Council and dozens of international student organizations, bring international students and Americans together for mutual learning. We welcome volunteers to join these and other programs to help us maximize the international experience of students and scholars to the successful completion of their academic objectives and enhance their personal growth.

Thielen Student Health Center

Thielen Student Health Center is a full-service medical clinic in Ames, Iowa, that specializes in students. The clinic is staffed with physicians,

advanced registered nurse practitioners and nurses. The medical team is available to care for your primary health care needs.

The clinic offers a full range of medical services including illness and injury care, women's health, allergy and travel care, immunizations, mental health care, laboratory and x-ray services, physical therapy and a full-service pharmacy. After hour service is available for urgent or emergency problems at McFarland Urgent Care Clinic or Mary Greeley Medical Center Emergency Room.

The Prevention Services department provides campus-wide leadership for a comprehensive approach to reduce health risks for students. In collaboration with our campus and community partners, they strive to foster a healthy campus environment and support the academic success of our students. Areas of focus include high-risk drinking and sexual and interpersonal violence.

The mission of the Thielen Student Health Center is to promote the optimal health of our university community by providing high quality, accessible, affordable and accountable health care that encompasses prevention, wellness and education and to support the academic success of the Iowa State University students while building healthy habits for a lifetime.

We provide an inclusive, non-judgmental environment for our diverse student body and are conveniently located on the corner of Sheldon Avenue and Union Drive, right across from State Gym.

Student Health receives no funding from the state of Iowa and relies on the health fee for approximately 50% of its operating budget. Please note that the health fee is not health insurance. All students are encouraged to maintain adequate health insurance coverage while enrolled at Iowa State University. Those taking 4 or fewer credits may still access services by paying the health fee. Spouses/domestic partners of students who opt to pay the health fee also have access to services.

Clinic hours:

Monday, 8 a.m.-6 p.m.; Tuesday, Thursday and Friday, 8 a.m.-5 p.m.; Wednesday, 9 a.m.-5 p.m.; Saturday, 9 a.m.-12 noon. Hours vary during breaks and summer session. Patients are seen by appointment. Please call 515-294-5801.

The University Library

http://www.lib.iastate.edu/
Dean of the Library Services: Beth McNeil
General Information (515) 294-3642

The University Library provides extensive research collections, services and information literacy instruction/information for all students. Facilities consist of the main Parks Library, the Veterinary Medical Library, Design Reading Room, and a remote library storage building.

The library's extensive collections include electronic and print resources that support research and study for all undergraduate and graduate programs. Nationally recognized collections support the basic and applied fields of biological and physical sciences. Library holdings include more than 2,930,438 volumes and approximately 110,455 current serial titles. The library has access to 457,967 electronic books.

The library's instruction program includes an undergraduate information literacy course as well as a wide variety of subject-based seminars on effective use of library resources for undergraduate and graduate students.

The library website provides access to local and web-based resources including electronic journals and books, local collections, online indexes, electronic course reserves and guides, and a broad range of subject research guides. Assistance in using this vast body of electronic resources is available at the Help Desk on the first floor, on the library website through the Ask Us! link, and through individually arranged appointments with subject librarians. The Digital Repository @ Iowa State provides free, public access to the research and scholarship of Iowa State's faculty, students and staff.

A limited number of semiprivate study rooms available for graduate students, intended for research and other scholarly activities that require extensive use of library material, are available. Parks Library has group study rooms, multi-media production studios, a presentation room and collaborative multi-media study areas. The library has over 232 public computers and a laptop checkout program for use within the library. Also located in Parks Library - ITS Solution Center, Online Learning Hub, and The Bookends Café.

Student Answer Center

http://www.registrar.iastate.edu/AnswerCenter/

Students who have questions but are not sure where to find an answer may contact the Student Answer Center located on the ground floor of Beardshear Hall. A staff member will answer campus-related questions on the spot or provide referrals to other university departments as needed. Information may include registration instruction, financial aid status, or classroom directions. Students can pick up forms, information brochures, campus maps, or use one of the computers to log on to AccessPlus or e-mail. Questions can be answered by email at answercenter@iastate.edu or by phone 515-294-4469.

Career Services Offices

Agriculture and Life Sciences: 15 Curtiss Hall
Business: 1320 Gerdin Business Building
Design: 297 College of Design

Engineering: 4th Floor Memorial Union
Graduate Business: 1360 Gerdin Business Building
Human Sciences: 131 MacKay Hall
Liberal Arts and Sciences: 131 Carver Hall
Veterinary Medicine: 2270A Veterinary Medicine Complex

Career Services is a coordinated network of career services offices offering a broad range of programs and services for undergraduate, professional, and graduate students, faculty, staff, alumni, and employers. These services include career exploration, career development, experiential learning, and professional career search assistance programs. The goal is to provide constituents with life-long skills to assist with career development and exploration.

Programs and services are offered including online registration, position listing and interview scheduling; résumé referral; coordination of co-op and internship programs; workshops and seminars on career exploration, résumé preparation, letter writing, job search techniques, interview skills, applying to graduate and professional schools, and adjusting to the first job.

Each year career services sponsors multiple career fairs, which bring to the ISU campus hundreds of employers. The career services offices also coordinate on-campus interview opportunities. Each college career services office serves as a point of entry for students, alumni, and employers to the entire ISU network of coordinated, decentralized career services.

In addition to the college-based career services offices, the Career Exploration Service provides a variety of services to students who are unsure about their major or future career path. Students can work one-on-one with a trained career counselor, use the many books and electronic resources in the Career Exploration Center, or enroll in UST 104, Personal Career Development.

Additional information on career services is available at http://www.career.iastate.edu/.

Child Care

Child Care Administration, a unit of Human Resource Services, supports Iowa State University families by linking them with programs and services that can help meet their child care needs. The university child care coordinator is available to assist families in accessing services available both on the campus and in the community.

Child care programs located on campus include:

- Center for Child Care Resources: Assistance in locating campus and community child care services, 100 University Village, Suite 1010, 515-294-8833 or 1-800-437-8599
- University Community Childcare, Family Resource Center, 100 University Village, 515-294-9838
- The Comfort Zone: Childcare for kids who don't feel so good, 100 University Village, 515-294-3333.
- Flex-Care: Part time care for children of ISU students, 100 University Village, 515-294-9838.
- University Child Care Center at Veterinary Medicine, 1700 Christensen Drive, 515-294-2273.
- ISU Child Development Laboratory School, Palmer HDFS Building, 515-294-3040.

For more information about child care options, contact the university child care coordinator at 515-294-8827.

Veterans Center

Jathan A. Chicoine
Veterans Services Coordinator
3578 Memorial Union

Phone: 515-294-9801
Email: jathan@iastate.edu

The Iowa State University Veterans Center provides a comfortable space for veterans and military personnel to connect and find support for issues related to enrolling at Iowa State University, and also assists with finding resources to help these individuals with adjusting to life as a student. In addition, the center provides assistance to faculty or staff with questions about military protocol. For example, when a veteran deploys, the Veterans Center can provide resources to help explain the process so that faculty and staff can meet the unique needs of students who may have obligations of military service.

Students receiving military educational benefits must work with a Veterans Administration certifying official in the Office of the Registrar in order to be certified for educational benefits. The Veterans Center is not directly involved in the certification process, but works closely as a team with V.A. certifying officials in order to provide the best support possible to veterans and their families attending ISU.

TUITION, FEES AND EXPENSES

Tuition

Tuition and fees are based on the number of credits in which a student is enrolled as of 5:00 p.m. on the 10th day of class. Maximum charges start at 12 credits for undergraduate and veterinary medicine students. Maximum charges start at 9 credits for graduate students.

Students who are not residents of Iowa pay a higher tuition rate each semester. Nondegree undergraduate students and noncollegiate students pay the same fees as undergraduates. Tuition and fees are assessed in accordance with regulations of the Board of Regents, State of Iowa. Information about these regulations are found in this catalog under Admissions and Registrar.

All tuition, fees, expenses, and policies are subject to change without notice by Iowa State University and the Board of Regents, State of Iowa. For the most current and complete information see http://www.registrar.iastate.edu/fees/

Residency Classification for Admission and Tuition Purposes

These criteria are contained in the Policy Manual, Board of Regents, State of Iowa and or the Iowa Administrative Code: Board of Regents, State of Iowa.

GENERAL INFORMATION

A. A person enrolling at one of the three state universities shall be classified as a resident or nonresident for admission, tuition, and fee purposes by the registrar or someone designated by the registrar. The decision shall be based upon information furnished by the student and other relevant information.

B. In determining resident or nonresident classification, the issue is essentially one of why the person is in the state of Iowa. If the person is in the state primarily for educational purposes, that person will be considered a nonresident. For example, it may be possible that an individual could qualify as a resident of Iowa for such purposes as voting, or holding an Iowa driver's license, and not meet the residency requirements as established by the Board of Regents, State of Iowa, for admission, tuition, and fee purposes.

C. The registrar, or designated person, is authorized to require written documents, affidavits, verifications, or other evidence deemed necessary to determine why a student is in Iowa. The burden of establishing that a student is in Iowa for other than educational purposes is upon the student. A student may be required to file any or all of the following:

1. A statement from the student describing employment and expected source of support

2. A statement from the student's employer

3. A statement from the student's parents verifying nonsupport and the fact that the student was not listed as a dependent on tax returns for the past year and will not be so listed in future years

4. A statement from the student’s spouse related to sources of family support, length of residence in Iowa, and reasons for being in the state of Iowa

5. Supporting statements from persons who might be familiar with the family situation

6. Iowa state income tax return.

D. Applications for resident classification for a given semester or session are due no later than the fifteenth class day of that semester or session. Applications received after the fifteenth class day of that semester or session will be considered for the next semester or session. Appeals of any nonresident classification decision resulting from applications for resident classifications are due no later than midterm of that semester or session. Change of classification from nonresident to resident will not be made retroactive beyond the term in which application for resident classification is made.

E. A student who gives incorrect or misleading information to evade payment of nonresident fees shall be subject to serious disciplinary action and must also pay the nonresident fees for each term previously attended.

F. Review committee. These regulations shall be administered by the registrar or someone designated by the registrar. The decision of the registrar or designated person may be appealed to a university review committee. The finding of the review committee may be appealed to the Board of Regents, State of Iowa.

GRADUATE ASSISTANTS

Students with graduate assistantships of 1/4-time or more are assessed Iowa resident tuition and fees. Nonresident students with graduate assistantships of 1/4-time or more retain their nonresidency classification, but are assessed resident tuition and fees as long as the graduate assistantship is continued.

The spouse of a 1/4-time or more graduate assistant who is a nonresident is eligible for resident tuition and fees during the period of the assistantship appointment. Iowa residency is not granted, but a waiver of nonresident tuition and fees is in effect. When the graduate assistantship ends, the tuition and fee waiver for the spouse is

terminated. (Board of Regents, State of Iowa, Minutes March 15, 1995, p. 801).

The graduate student must request the resident tuition assessment by midterm of the term in question. The benefit will not be granted retroactively.

GUIDELINES

The following guidelines are used in determining the resident classification of a student for admission, tuition, and fee purposes:

1. A financially dependent student whose parents move from Iowa after the student is enrolled remains a resident provided the student maintains continuous enrollment. A financially dependent student whose parents move from Iowa during the senior year of high school will be considered a resident provided the student has not established domicile in another state.

2. In deciding why a person is in the state of Iowa, the person's domicile will be considered. A person who comes to Iowa from another state and enrolls in any institution of postsecondary education for a full program or substantially a full program shall be presumed to have come to Iowa primarily for educational reasons rather than to establish a domicile in Iowa.

3. A student who was a former resident of Iowa may continue to be considered a resident provided absence from the state was for a period of less than 12 months and provided domicile is reestablished. If the absence from the state is for a period exceeding 12 months, a student may be considered a resident if evidence can be presented showing that the student has long-term ties to Iowa and reestablishes an Iowa domicile. A person or the dependent of a person whose domicile is permanently established in Iowa, who has been classified as a resident for admission, tuition, and fee purposes, may continue to be classified as a resident so long as domicile is maintained, even though circumstances may require extended absence of the person from the state. It is required that a person who claims Iowa domicile while living in another state or country will provide proof of the continual domicile as evidence that the person:

(1). Has not acquired domicile in another state;

(2). Has maintained a continuous voting record in Iowa; and

(3). Has filed regular Iowa resident income tax returns during absence from the state.

4. A student who moves to Iowa may be eligible for resident classification at the next registration following 12 consecutive months in the state provided the student is not enrolled as more than a half-time student (6 credits for an undergraduate or professional student, 5 credits for a graduate student) in any academic year term, is not enrolled for more than 4 credits in a summer term for any classification, and provides sufficient evidence of the establishment of an Iowa domicile.

5. A student who has been a continuous student and whose parents move to Iowa may become a resident at the beginning of the next term provided the student is dependent upon the parents for a majority of financial assistance.

6. A person who has been certified as a refugee or granted asylum by the appropriate agency of the United States, who enrolls as a student at a university governed by the Board of Regents, State of Iowa, may be accorded immediate resident status for admission, tuition, and fee purposes where the person:

(1). Comes directly to the state of Iowa from a refugee facility or port of debarkation, or

(2). Comes to the state of Iowa within a reasonable time and has not established domicile in another state.

Any refugee or individual granted asylum not meeting these standards will be presumed to be a nonresident for admission, tuition, and fee purposes and thus subject to the usual method of proof of establishment of Iowa residency.

7. An alien who has immigrant status establishes Iowa residency in the same manner as a United States citizen.

8. At the Regent institutions, American Indians who have origins in any of the original people of North America and who maintain a cultural identification through tribal affiliation or community recognition with one or more of the tribes or nations connected historically with the present state of Iowa, including the Iowa, Kickapoo, Menominee, Miami, Missouri, Ojibwa (Chippewa), Omaha, Otoe, Ottawa (Odawa), Potawatomi, Sac and Fox (Sauk, Meskwaki), Sioux, and Winnebago (Ho Chunk), will be assessed Iowa resident tuition and fees. (Board of Regents, State of Iowa, Minutes October 15-16, 1997, p. 299)

**Section B below is under revision. For current information, go to http://www.veterans.iastate.edu/for-students/in-statetuition

B. Additional guidelines are used in determining the resident classification of a veteran, qualified military person, and dependent children and spouses of a veteran or qualified military person for purposes of admission and undergraduate tuition and mandatory fees:

1. A person who is stationed on active duty at the Rock Island arsenal as a result of military orders, or the dependent child or spouse of such person, is entitled to resident status for purposes of undergraduate tuition and mandatory fees. However, if the arrival of the person under orders is subsequent to the beginning of the term in which the dependent child or spouse is first enrolled, nonresident fees will be charged in all cases for the dependent child or spouse until the beginning of the next

term in which the dependent child or spouse is enrolled. If the qualified military person is transferred, deployed, or restationed while the person's spouse or dependent child is enrolled in an institution of higher education under the control of the board of regents, the spouse or dependent child shall continue to be classified as a resident under this subparagraph until the close of the fiscal year in which the spouse or dependent child is enrolled.

2. A veteran who is domiciled or moves to the state of Iowa and who is eligible for benefits, or has exhausted benefits under the federal Post-9/11 Veterans Educational Assistance Act of 2008, is entitled to resident status for purposes of undergraduate tuition and mandatory fees. The dependent child or spouse of a veteran who meets these requirements is entitled to resident status for undergraduate tuition.
However, if the arrival of the veteran in Iowa is subsequent to the beginning of the term in which the dependent child or spouse is first enrolled, nonresident fees will be charged in all cases for the dependent child or spouse until the beginning of the next term in which the dependent child or spouse is enrolled.

3. A person who is moved into the state as the result of military or civil orders from the government for other than educational purposes, or the dependent child or spouse of such a person, is entitled to resident status. However, if the arrival of the person under orders is subsequent to the beginning of the term in which the dependent child or spouse is first enrolled, nonresident fees will be charged in all cases until the beginning of the next term in which the dependent child or spouse is enrolled. Legislation, effective July 1, 1977, requires that military personnel who claim residency in Iowa (home of record) will be required to file Iowa resident income tax returns.

FACTS

A. The following circumstances, although not necessarily conclusive, have probative value in support of a claim for resident classification:

1. Reside in Iowa for 12 consecutive months, and be primarily engaged in activities other than those of a full-time student, immediately prior to the beginning of the term for which resident classification is sought.
2. Reliance upon Iowa resources for financial support.
3. Domicile in Iowa of persons legally responsible for the student.
4. Former domicile in the state and maintenance of significant connections therein while absent.
5. Acceptance of an offer of permanent employment in Iowa.
6. Military orders, if for other than educational purposes.
7. Other facts indicating the student's domicile will be considered by the universities in classifying the student.

B. The following circumstances, standing alone, do not constitute sufficient evidence of domicile to affect classification of a student as a resident under these regulations:

1. Voting or registration for voting.
2. Employment in any position normally filled by a student.
3. The lease of living quarters.
4. Admission to a licensed practicing profession in Iowa.
5. Automobile registration.
6. Public records; for example, birth and marriage records, Iowa driver's license.
7. Continuous presence in Iowa during periods when not enrolled in school.
8. Ownership of property in Iowa, or the payment of Iowa taxes.

Fee Payment

The Accounts Receivable Office bills students for tuition, room, meal plan, and various other university charges. A statement of new charges is available on the first of each month on Access Plus and each student will receive an email message at that time at their Iowa State e-mail address telling them that their bill is available. It is the student's responsibility to ensure that the university has a correct e-mail address and to regularly check their Iowa State e-mail account. Students who do not receive a billing statement before the term begins or are unable to use AccessPlus to view their bill, should contact the Accounts Receivable Office to learn the amount of their account balance due. Failure to receive a billing statement or view their account on AccessPlus will not exempt students from late penalties or from having a hold placed on their registration. Payments for fall semester are due August 20. Payments for spring semester are due January 20. Payments for summer semester are due May 20.

Students may pay their university bill by direct debit through AccessPlus. They may also pay by mail by sending a check or money order (along with the bottom portion of the billing statement printed from AccessPlus) to Iowa State University, Treasurer's Office, 1220 Beardshear Hall, Ames, IA 50011-2044. Payments may also be made in person by taking the personal check or certified funds to the drop box that is located behind the Student Answer Center on the ground floor of Beardshear Hall.

Credit Type - Audits and zero credit courses: Assessed according to contact hours; maximum charge for zero credit courses is three credit hours.

Credit Type - Partial credits: (.5) assessed on the next larger whole number of credits, e.g., 6.5 credits is assessed as 7 credits.

Credit Type - R credit: Assessed for the minimum fee only if no other credits are taken.

Deferred Billing Plan (payment over three months): This $20 administrative charge (fall, spring, and summer) is assessed to those students who do not pay their full tuition, room and board charges on or before August 20 for fall semester, January 20 for spring semester, and May 20 for summer session. This permits students to spread payment over three installments. The administrative fee helps defray the extra IT and mailing costs involved in carrying and billing the charges over a longer period of time, as well as the extra personnel required in the Treasurer's Office to handle the traffic involved with three tuition payments per semester instead of one.

Employer Reimbursement Payment Option: Iowa State is proud to offer a deferment option which is beneficial to employees of companies that offer tuition reimbursement plans. With a completed benefit certification form (http://www.public.iastate.edu/~u-bill/forms/Employer%20Reimbursement%20Def%20Payment%20Agreement.pdf) you may defer all allowable charges to become due 30 days after grades are presented. The benefit certification form must be renewed each academic year, beginning with the summer semester. There is a $35 per semester fee for this deferment option.

For ISU Employees, you will need only complete the "Student" portion of the form. The Accounts Receivable Office will complete the "Employer" certification provided you have submitted the Employee Tuition Grant request through AccessPlus and have had it approved through the Human Resource Services Office.

For more information contact Jaye Anderson at (515) 294-9455 or jjander@iastate.edu.

Installment Payment Plan: This administrative charge is assessed to those who elect the Iowa State University Installment Plan. This plan will allow students to pay tuition, room, board, fees, and accounts receivable costs in twelve equal monthly installments. The $50 annual application fee will defray the extra IT and mailing costs associated with carrying the charges over a longer period of time, as well as the bank fees associated with the direct debit of payments.

Past Due Accounts: If students have past due accounts receivable charges prior to the beginning of classes, they may be dropped from enrollment if these past due charges are not paid by the Friday before the first day of class. Students that are subject to being dropped will be notified via their Iowa State e-mail account.

Refunds: Refunds are available for students who cancel or withdraw their registration within the appropriate time period. To cancel their registration, students must notify the Office of the Registrar before the first day of the semester to avoid tuition assessment. Beginning on the first day of the semester, it will be necessary for students to formally withdraw from the university to terminate their registration. More information about canceling registration and withdrawing from classes can be found at http://www.registrar.iastate.edu/registration/responsibilities.shtml.

Tuition adjustments for all students are made for withdrawals of registration according to the following schedule:

Withdrawal Date/Student Pays

Before first day of classes: 0%
During class days 1-5: 10%
During class days 6-10: 25%
During class days 11-15: 50%
During class days 16-20: 75%
After the twentieth day of classes: 100%

Students who wish to appeal tuition and fee assessment for withdrawals should contact the Scheduling & Fees area of the Office of the Registrar. Decisions of the Office of the Registrar will be based on the existence of extenuating circumstances beyond the control of the student.

Students who wish to appeal the decision of the Office of the Registrar must do so in writing within 10 calendar days after receiving the decision. Such appeals will then be reviewed by the Tuition Appeals Review Committee. Students who wish to appeal the decision of the Tuition Appeals Review Committee may make a request to do so in writing to the Office of the Provost.

Fee refund for students with a reduction in credits below full-time: 100 percent if change is made through the 10th day of classes. No adjustment is made after the 10th day of classes. Prorated adjustments in the tuition adjustment schedule are made for summer session courses, or any courses which are less than one semester in length (79 days).

Workshop and Short Courses Refunds: Students who drop workshops or short courses of one or two weeks on or before the first class meeting receive a 100% tuition adjustment for the course. No tuition adjustment will be made after the first day of classes. Students who drop three-week courses receive a 100% adjustment if they drop on or before the first day of classes, a 90% adjustment if they drop on the second day of classes, and no adjustment after the second day of classes.

UNDERGRADUATE MAJORS, MINORS, CERTIFICATES

- Accounting, B.S.
- Advertising, B.A.
- Aerospace Engineering, B.S.
- Agricultural and Life Sciences Education, B.S.
- Agricultural Biochemistry, B.S.
- Agricultural Business, B.S.
- Agricultural Engineering, B.S.
- Agricultural Studies, B.S.
- Agricultural Systems Technology, B.S.
- Agriculture and Life Sciences Education
- Agriculture and Society
- Agronomy, B.S.
- Animal Ecology, B.S.
- Animal Science, B.S.
- Anthropology, B.A., B.S.
- Apparel, Merchandising and Design B.S.
- Architecture, B.Arch.
- Art and Design, B.A.
- Athletic Training, B.S.
- Biochemistry, B.S.
- Bioinformatics and Computational Biology B.S.
- Biological Systems Engineering, B.S.
- Biological/Pre-Medical Illustration, B.A.
- Biology, B.S. (College of Agriculture and Life Sciences)
- Biology, B.S. (College of Liberal Arts and Sciences)
- Biophysics, B.S.
- Business Economics, B.S.
- Chemical Engineering, B.S.
- Chemistry, B.A., B.S.
- Child, Adult, and Family Services, B.S.
- Civil Engineering, B.S.
- Communication Studies, B.A.
- Community and Regional Planning, B.S.
- Computer Engineering, B.S.
- Computer Science, B.S.
- Construction Engineering, B.S.
- Criminal Justice Studies, B.A.
- Culinary Food Science, B.S. (College of Agriculture and Life Sciences)
- Culinary Food Science, B.S. (College of Human Sciences)
- Dairy Science, B.S.
- Diet and Exercise, B.S./M.S. (College of Agriculture and Life Sciences)
- Diet and Exercise, B.S./M.S. (College of Human Sciences)
- Dietetics, B.S. (College of Agriculture and Life Sciences)
- Dietetics, B.S. (College of Human Sciences)
- Early Childhood Education, B.S.
- Early Childcare Education and Programming, B.S.
- Earth Science, B.A., B.S.
- Economics, B.S.
- Electrical Engineering, B.S.
- Elementary Education, B.S.
- English, B.A., B.S.
- Entrepreneurship, B.S.
- Environmental Science, B.S. (College of Liberal Arts and Sciences)
- Environmental Science, B.S. (College of Agriculture and Life Sciences)
- Environmental Studies, B.A., B.S.
- Environmental Studies, B.S.
- Event Management, B.S.
- Family and Consumer Sciences Education and Studies
- Financial Counseling and Planning, B.S.
- Finance, B.S.
- Food Science, B.S. (College of Agriculture and Life Sciences)
- Food Science, B.S. (College of Human Sciences)
- Forestry, B.S.
- French, B.A (See World Languages and Cultures)
- Genetics, B.S. (College of Agriculture and Life Sciences)
- Genetics, B.S. (College of Liberal Arts and Sciences)
- Geology, B.S.
- German, B.A (See World Languages and Cultures)
- Global Resource Systems, B.S.
- Graphic Design, B.F.A.
- History, B.A., B.S.
- Horticulture, B.S.
- Hospitality Management, B.S.
- Industrial Design, B.I.D.
- Industrial Engineering, B.S.
- Industrial Technology, B.S.
- Integrated Studio Arts. B.F.A.
- Interdisciplinary Design
- Interdisciplinary Studies, B.A., B.S.
- Interior Design, B.F.A.
- International Agriculture, B.S.

- International Studies, B.A., B.S.
- Journalism and Mass Communication, B.A., B.S.
- Kinesiology and Health, B.S.
- Landscape Architecture, B.L.A.
- Liberal Studies, B.L.S.(a general studies degree)
- Linguistics, B.A.
- Management, B.S.
- Management Information Systems, B.S.
- Marketing, B.S.
- Materials Engineering, B.S.
- Mathematics, B.S.
- Mechanical Engineering, B.S.
- Meteorology, B.S.
- Microbiology, B.S.
- Music, B.A., B.Mus.
- Nutritional Science, B.S. (College of Agriculture and Life Sciences)
- Nutritional Science, B.S. (College of Human Sciences)
- Performing Arts, B.A.
- Philosophy, B.A.
- Physics, B.S.
- Political Science, B.A.
- Psychology, B.A., B.S.
- Public Relations, B.S.
- Religious Studies, B.A.
- Seed Science, B.S.*
- Sociology, B.A., B.S.
- Software Engineering, B.S.
- Spanish, B.A (See World Languages and Cultures)
- Speech Communication, B.A., B.S.
- Statistics, B.S.
- Supply Chain Management, B.S.
- Technical Communication, B.S.
- Veterinary Medicine, D.V.M.
- Women's Studies, B.A., B.S.
- World Languages and Cultures B.A.: French, German, Spanish

The following minors are available:

- Accounting
- Advertising
- African American Studies
- Agricultural Biochemistry
- Agricultural Business
- Agricultural Systems Technology
- Agronomy
- American Indian Studies
- Animal Ecology
- Animal Science
- Anthropology
- Apparel, Merchandising, and Design
- Astronomy
- Bioengineering
- Biology
- Biochemistry
- Bioinformatics and Computational Biology
- Biological Illustration
- Chemistry
- Child, Adult, and Family Services
- Chinese Studies
- Classical Studies
- Communication Studies
- Computer Science
- Criminal Justice Studies
- Critical Studies (http://www.design.iastate.edu/Programs/criticalstudies.php)
- Culinary Food Science
- Cyber Security
- Dance (http://www.kin.hs.iastate.edu/programs/dance/minor)
- Design Studies (http://www.design.iastate.edu/designstudies.php)
- Digital Media (http://www.design.iastate.edu/Programs/digitalmedia.php)
- Economics
- Education Services in Family and Consumer Sciences
- Emerging Global Diseases
- Energy Systems
- Engineering Sales
- English
- Entrepreneurial Studies
- Environmental Studies
- Event Management
- Exercise Science (http://www.kin.hs.iastate.edu/h/programs/minors/exercise-science)
- Family and Consumer Sciences Education
- Finance
- Financial Counseling and Planning
- Food and Society
- Food Safety

- Food Science
- Forestry
- French
- Genetics (AGLS)
- Genetics (LAS)
- Geology
- German
- Gerontology
- Health Promotion (http://www.kin.hs.iastate.edu/h/programs/minors/health-promotion)
- History
- Horticulture
- Hospitality Management
- Industrial Technology
- Insect Science
- International Agriculture
- International Studies
- Journalism and Mass Communication
- Kinesiology (http://www.kin.hs.iastate.edu/h/programs/minors/kinesiology)
- Learning and Leadership Sciences
- Leadership Studies
- Landscape Management
- Linguistics
- Management
- Marketing
- Mathematics
- Meat Science
- Meteorology
- Microbiology
- Military Studies
- Music
- Music Technology
- Nondestructive Evaluation
- Nutrition (http://www.fshn.hs.iastate.edu/undergraduate-programs/minors)
- Philosophy
- Physics
- Political Science
- Psychology
- Public Relations
- Religious Studies
- Russian Studies
- Sociology
- Spanish
- Speech Communication
- Statistics
- Supply Chain Management
- Sustainability
- Teaching English as a Second Language
- Technical Communication
- Technology and Social Change
- U.S. Latino/a Studies
- Wind Energy
- Women's Studies
- World Film Studies

Undergraduate Certificates

- Computing Applications
- Health Coach
- Latin American Studies
- Leadership Studies
- Occupational Safety

Preprofessional Study

Information about preprofessional program admissions requirements and career opportunities in human health or law may be obtained in the Liberal Arts and Sciences Advising Center. Information about veterinary medicine admissions requirements and career opportunities may be obtained from the coordinator of the preveterinary program in the Office of the Dean of the College of Veterinary Medicine.

Additional information is available in this catalog in the Preprofessional Study section.

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